

Explorations in Daoism

圖之汞抽

Medicine and alchemy in literature

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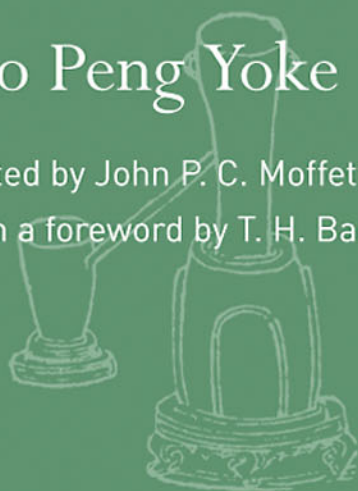
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Ho Peng Yoke

Edited by John P. C. Moffett and Cho Sungwu
with a foreword by T. H. Barrett



Explorations in Daoism

Explorations in Daoism brings together an extraordinary compendium of data on alchemical knowledge in China, describing the methods used for dating important alchemical texts in the Daoist Canon, and reconstructing and translating a number of alchemical texts that exist only in fragments scattered throughout the Canon, as well as in pharmacopoeia and other compendia. Such techniques, explained here for the first time, formed a vital part of the groundwork that went into writing the alchemical sections of Joseph Needham's *Science and Civilisation in China* series.

Written by a leading scholar in the field, the book provides a clear guide for students and scholars about the methods required for dating and reconstituting texts, while also looking beyond the Daoist Canon to demonstrate how Chinese pharmacopoeia contain much information on early chemistry. This book will appeal to those interested in Chinese alchemy, the history of science, Daoism and Chinese history.

Ho Peng Yoke has published widely on Chinese alchemy, astronomy, divination and mathematics. He occupied senior academic positions in Singapore, Malaysia, Australia and Hong Kong before becoming the Director of the Needham Research Institute in 1990. On his retirement at the end of 2001 he became its Emeritus Director. He is an academician of the Australian Academy of the Humanities, Academia Sinica and the International Euro-Asia Academy of Science.

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Joseph Needham's *Science and Civilisation in China* series began publication in the 1950s. At first it was seen as a piece of brilliant but isolated pioneering. However, at the beginning of the twenty-first century, it is clear that Needham's work has succeeded in creating a vibrant new intellectual field in the West. The books in this series cover topics relating broadly to the practice of science, technology and medicine in East Asia, including China, Japan, Korea and Vietnam. The emphasis is on traditional forms of knowledge and practice, but without excluding modern studies which connect their topics with their historical and cultural context.

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Medicine and alchemy in literature

Ho Peng Yoke

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**Dedicated to the memory of
Emeritus Professor Yabuuti Kiyosi 藪内 清 (1906–2000)**

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Foreword

T.H.Barrett

In his prefaces to this volume and to his earlier volume in this series, *Chinese Mathematical Astronomy*, Ho Peng Yoke gives in his typically modest fashion something of the autobiographical background to his researches into the type of material preserved in the Daoist Canon (*Daozang* 道藏) that may be used by historians of science, particularly for the study of Chinese alchemy. By his own account the collection of essays brought together here for the first time since their original appearance, frequently in publications now very difficult to find, represent no more than an ancillary effort contributing to the great compendium that is *Science and Civilisation in China (SCC)*. Yet to those of us who have read them with an eye to the context within which they were created they certainly amount to a quite extraordinary achievement in themselves. Most obviously the terminological data scattered throughout these pieces cumulatively provide not simply a conspectus on the technical language employed in alchemical texts, but a conspectus that can be interrogated on historical principles. These principles, giving due account of the appearance over time of new terms in sources that may be reliably placed in chronological order, are ones that all too few dictionaries of Classical Chinese of any sort tend to put into practice, even when dealing with the literary vocabulary that inevitably dominates their coverage of the language, and are obviously of great importance in tracing the history of science. We have therefore paid particular attention to making this information readily available by adding a specially prepared index to the volume, so that any vocabulary item relating to alchemical materials may be rapidly traced back to the sources concerned.

But second, these essays also show more generally the great strength of Chinese traditions of scholarship, in which the division into two cultures that has famously plagued British academic life in the twentieth century has been of significantly lesser account. Professor Ho has always been ready to bring together humanistic and scientific scholarship, and has in his less formal writings in Chinese made a point, for example, of commending the example of the greater integration of sciences and humanities in Japanese education by comparison with British academic life to anyone interested in grasping the full breadth of the Chinese heritage.¹ The most eloquent demonstration of the foolishness of following any other course is amply provided by the research republished here.

And third, and perhaps most significantly, the investigations detailed in the following pages themselves provide an education in research, as the essay chosen to head this volume makes explicit. Again, if we take the essays as a group, between them they exhibit many of the research techniques available in the Chinese humanities to all researchers, whether researchers specifically interested in the history of science or not. No appreciation of the scholarship involved, however, would be complete without some account of the very different academic environment that existed a generation ago, when *ab initio* research on what were then completely unknown sources was a much more

difficult proposition than it has become subsequently. We should not forget, for example, that *SCC* has itself become an important gateway to contemporary investigators, while the appearance of research guides such as those published by Endymion Wilkinson has brought together useful practical advice to the neophyte scholar allowing for a much quicker learning process.² The value of these essays remains even so extremely high, in that after the reprinting at the head of the volume of Professor Ho's piece that starts with some orientations in method, proportionately far more space is given over both in that essay and in the essays that follow to demonstrating how those techniques may be employed. Those wishing to employ the methods suggested are therefore given concrete examples of their application that they can take as models. And in any case, while specific aides to research may now be more abundant, the challenges remain much the same.

The reader should note, for example, Professor Ho's reference to the 'numerous problems' that he faced in piecing together often fragmentary early materials preserved only in later quotation, using a complex and often undefined terminology, stemming from authors who even when not sheltering behind pseudonyms were usually so obscure as to afford little clue as to the exact era in which they lived. In the face of these difficulties the essays collected here, as has long been recognised by his peers, bear witness to a remarkable advance in the understanding of this literature.³ Thanks to Professor Ho's work, scholars interested in the substances used in Chinese alchemy have been enabled to move beyond a reliance on traditional reference works such as the magisterial but late compendium of Li Shizhen 李時珍 (1518–93), the *Bencao gangmu* 本草綱目, to interrogate the traditions that lie behind it. That massive pharmacopoeia, which was already made available in a convenient typeset edition in 1930 to which an index (using the four corner system) was eventually added in a 1954 and subsequent reprints, is of course given its full due here, but as a starting point for further research, not as a final authority.

That further research, for its part, took Professor Ho away from materials that had been in the public domain for several centuries into a far more massive compendium, itself containing in places several compendia even larger than the *Bencao gangmu*, which even in its printed form had been so rare that its modern reprinting in the Republican period had much more of the effect of making a vast lost archive suddenly available—not least in the length of time it took scholars to gradually learn to find their way around and evaluate this sudden access of unfamiliar and indeed to the conventional scientist somewhat alien sources. The reasons why the alchemical literature treated here stems mainly from the Daoist Canon, the great collection of Daoist works compiled in the form in which we now use it in the Ming period, have now been considered at some length by those from Joseph Needham onwards interested in the interplay of the histories of science and religion in China, and the debate on this matter continues.⁴ Not all scholars working today would see a necessary connection between Chinese alchemical research and the Daoist tradition, but even so the fact remains that Daoists sustained institutions with substantial libraries that tended to preserve works on alchemy when other institutions such as Buddhist monasteries or clan schools with traditions of classical learning did not.⁵ The eventual waning of the alchemical tradition in China, which emerges as well from these essays as from the relevant volumes of *SCC*, also meant that the great bibliophiles of the Ming and Qing periods whose family wealth and dedication did so much to

preserve the surviving books of earlier ages tended not to assign a particularly high value to these materials. In the case of one of the works translated for the first time (provided later on), Dugu Tao's *Danfang jianyuan*, it was not a Chinese scholar but a Japanese physician who seems to have played a key role in copying one particular source earlier transmitted by Daoists.⁶

So we should note that during the decades when Professor Ho first ventured forth on his exploration of these sources expertise on the vast repository of Daoist materials, the Daoist Canon of the Ming period, was at a fairly rudimentary stage even amongst the tiny handful of scholars interested in the religion as such, several decades after its modern reprinting.⁷ As matters had turned out, the one Chinese scholar who had done more than anyone to work out how Daoist materials had been collected and transmitted in earlier times was another historian of alchemy, Chen Guofu 陳國符 (1914–2000). Unfortunately, although Chen was simultaneously pushing forward into investigations very similar to, and sometimes overlapping with, those contained in this volume, political conditions in China during the late 1960s and early 1970s precluded collaboration or even communication, so that both scholars were obliged to work quite independently. The outcome of Chen's researches too have been collected and published, and the lack of a single systematic index to his posthumously edited writings means that scholars will find the present volume much more convenient to use; anyone with more than a passing need to consult the sources investigated here would do well too to give careful consideration to Chen's work also.⁸ These two collections were not eventually composed in complete isolation from one another: in some of the later essays that follow here Professor Ho was able to refer to some of Chen Guofu's work in the form in which it was first published as, for example, with regard to the date or dates to be assigned to Qingxiazi 青霞子. At many points, moreover, both scholars use the same research techniques to pin down the date and value of alchemical sources, so that, for example, the preface by Chen Shengxi 陳生熙 to Chen's collected essays pays particular tribute also to the way in which he was able to draw on the traditional Chinese humanistic discipline of philology in the interests of scientific research.

In the case of Professor Ho's essays, however, we should note that the first step he advises is simply bibliographic: we need to be aware as to whether the title in which we are interested has been listed in any of the surviving catalogues of early libraries. Obscure as alchemical literature may have become, in its heyday it was very widely circulated and read: an alchemical work of July 855 is the very first book for which a print run—and a very respectable print run of several thousand copies at that—was ever recorded.⁹ Copies were therefore more than likely to end up in private and imperial collections, and where bibliographies of such collections survive they may well be listed there. Indeed, the publication of an excellent monograph indexing every single Daoist work listed in these early materials, together with a full explanation of the compilation of both the Daoist Canon and the bibliographies of the period, is now available to make the path first trodden by Professor Ho considerably easier.¹⁰ Within the Daoist Canon itself, too, the publication of research aids such as catalogues, concordances and especially indexes allowing one to locate titles listed or quoted within other texts has made searching a far less time consuming matter—though of course we still have far fewer research aids than would be ideal.¹¹

Some of these research aids may be of use in the biographical investigations that are recommended below for determining authorship; but it must be said that in searching for the means to locate the era within which a religious figure lived we are often at a disadvantage compared with those who distinguished themselves in secular life. The latter often show up in sources other than their published works complete with an outline of their official careers, naming the posts they held. If they give their current post (as so often) when they sign their names as authors, or even mention the post of a friend or other contemporary, then this can be used to date their writings quite precisely; at times even the recording of a post held by an unknown author can be sufficient to yield a rough historical date, in that we have a rather good record of the changes in official bureaucratic terminology.¹² The terms describing religious figures, however, do not relate to any comparable system and biographical writings concerning them tend to exhibit non-bureaucratic value, perhaps best described as hagiographic rather than biographic, that in the case of Daoists, let alone independent hermit alchemists, have scarcely been studied at all.¹³ One day, perhaps, we may achieve a more nuanced sense of the historical shifts in the conventions of nomenclature to be found in such writings, but if so this will at best allow us to distinguish dates of composition separated by slow shifts in fashion, not distinct spans of time in which different terminologies were decreed unambiguously by government action.

Somewhere in between in usefulness comes the study of geographical terms, for although the place names of Chinese administrative units were officially determined, unofficial usage can (as is pointed out later on) complicate the picture rather unhelpfully, though of course clues as to the geographical location of the author are themselves always worth looking for, as Professor Ho points out, and may well emerge from a close study of the biological or physical environment envisaged by the text. More precise evidence of dating may come from the grandiose titles emperors awarded themselves and their kin, which during the heyday of alchemical literature might be changed, like reign titles, more than once within the span of a single reign; other titles awarded by the emperor—for example, to divinities—also changed over time, though less rapidly.¹⁴ The study of the taboos observed by a text in avoiding the name of the reigning emperor and his ancestors can yield significant information, too, but again as Professor Ho points out the significance of taboos may bear more upon the transmission of a text than upon its date of origin. It is also worth noting that Dunhuang materials suggest that at the end of a long dynasty inertia may have kept invalidated conventions of this type in force, at least for a while.¹⁵

So once specific clues in a text have been checked, the researcher may settle for a more general indication of the date of a text based upon the nature of the language used. Within the Chinese tradition a scholar confronted with a text of doubtful provenance would often appeal to questions of linguistic style in an impressionistic way, appealing to a common sense view of language to distinguish between an early Han work and a post-Han work, for example.¹⁶ Modern scholars too have sometimes found arguments based on research into changes in the vocabulary of Classical Chinese useful in distinguishing pre- and post-Han works, and have been able to argue on the basis of concrete evidence, especially thanks to the far greater number of concordances that have become available during the twentieth century.¹⁷ Even today, however, few of these concordances cover the golden age of alchemy during the Tang and Song, with the valuable exception of those

concordances that have been produced for writings of the Chan (i.e. Zen) school of Buddhism, which are marked by a very high proportion of colloquial language.¹⁸ Dictionaries listing the Chinese vocabulary specific to a certain period have also appeared over recent years, and these may now provide information that may with care be applied to the task of delimiting the likely age of a piece of writing.¹⁹ Due attention, however, should be paid to possible limitations in the coverage of these works that may give a false appearance of lateness to the currency of some of the items included. This, at least, is the lesson one may derive from the work of the Japanese scholar Karashima Seishi, whose meticulous glossaries of the terminology of Buddhist translations of the *Lotus Sutra* reveal the fact that lexicographers appear to have overlooked the materials available to them in Buddhist texts and often list much later sources.²⁰

One important step that may be taken to remedy this situation is to go directly to the sources themselves, since institutions such as the Academia Sinica have now made available a vast amount of textual material covering much of China's bibliographical heritage in the form of online databases. The CBETA database putting the entire Chinese Buddhist canon at the service of researchers is another example of a similar initiative. Keeping up with the availability of such material is not easy, but even so my guess is that for the type of material covered in this volume we still lack online access as yet to everything a scholar would need to have online in order to carry out searches in the full confidence of having checked all relevant material, though one day no doubt this will be a possibility.

Vocabulary studies, therefore, despite our increased knowledge of the history of this aspect of the Chinese language, may yet prove inconclusive. For this reason Professor Ho is amongst those who have looked to the much longer established field of Chinese historical phonology for objective evidence revealing the period during which a text was written. Although the Chinese script usually only allows deductions to be made concerning the phonology of the period from rhyme schemes, at least the range of data transmitted in traditional dictionaries of rhymes and studied by Chinese scholars for centuries has during the twentieth century been systematically converted into reconstructions readily intelligible to the nonChinese scholar. At the time that these essays were written such reconstructions were only available in the publications of Bernhard Karlgren (1889–1978), whose interests mainly lay in an earlier period than that spanned by this volume. Now, however, Edwin G. Pulleyblank has provided us with both a lexicon outlining the main shifts in pronunciation into Mongol times and a separate monograph explaining his own researches.²¹ Of course such aids to research, though highly welcome, cannot be used unthinkingly: Chen Guofu, who resorts to phonological evidence much more than Professor Ho in his volume of essays mentioned earlier, frequently cautions that our lack of a detailed knowledge of dialect changes in phonology across the vast spans of space and time covered by our data means that we may sometimes be misled by checking alchemical materials against developments in the phonology of standard Chinese speech. But even he does not seem to take into account another possibility, namely that the knowledge of historical phonology embodied in dictionaries allowed the authors of later texts to keep to archaic phonological rules. Perhaps for that reason he sometimes appears to take too optimistic a view of the antiquity of some materials—though alternatively he may on closer inspection have uncovered received materials within later texts.²²

It is worth pointing out therefore that Professor Ho in his research into alchemical literature simultaneously espoused another approach, not in evidence in the essays collected in this volume, which provided a type of control over his own judgements of dating that does not appear to have occurred to Chen Guofu. In collaborative pieces of research in which Professor Ho, true to his perception of the nature of the Chinese tradition, enlisted the aid of scholars in the humanities, he also examined literary references to alchemy in well-known authors of the Tang and Song, thus providing at least some elements in alchemical terminology with unassailable dates for their usage.²³ Together with Joseph Needham he also investigated the appearance of alchemy in the dynastic histories and related historical material, though it must be said that even this type of source, whilst apparently offering firm dates for the existence of alchemical practices, still calls for careful evaluation.²⁴ The reader should therefore not expect to gain a complete picture of the research skills that may be deployed in verifying sources for the history of alchemy solely from the following pages, but equally they extend to at least two other important areas besides such preliminary research which also need to be taken into account in any enterprise such as the one that eventually resulted in the appearance of several stout monographs forming part of Volume V of SCC.

For having rigorously reviewed all evidence relating to the date and value of the hitherto obscure texts treated here, Professor Ho then went on in many cases to provide a scholarly edition, either reconstituting as much as possible from surviving fragments, or by careful collation achieving superior readings, as in the case of his original publication of Dugu Tao's work, the *Danfeng jianyuan*, which appears to survive more or less intact.²⁵ Textual scholarship is again an area where Chinese traditions of long standing may be beneficially compared with those that have evolved independently in Europe. But in a sense each scholar—especially a pioneer in a new field such as Professor Ho was at the time that he wrote the studies reprinted here—has to decide on the techniques and approaches appropriate to the materials in hand: models may be recommended for emulation, but if they relate to dissimilar materials, or to materials that have gone through dissimilar processes of transmission, they are often not entirely appropriate.²⁶ The alchemical texts of the Tang-Song period often use literary forms, such as poetry—hence the importance of rhymes, as noted earlier—but partake more of the nature of technical literature. Such writing, in the West at least, has been seen as engendering special problems of textual transmission, since they were more prone to revisions affecting their textual integrity.²⁷ In some cases integrity seems the last word to describe the resultant loose assemblage of heterogeneous material.²⁸ The problem does not seem to be a prominent one here, perhaps because the early arrival of printing foreshortened the period during which these works existed only in manuscript, or perhaps because their aspirations to literary form discouraged interpolation. It must be said, however, that there is one type of material surviving in manuscript from Dunhuang and elsewhere that have been described as 'fluid', but since this derives from the sayings of Zen masters it may reflect special features deriving from its initial oral circulation.²⁹ And even then, the only type of material from Dunhuang that seems to consist of an assemblage of scattered pericopes that make textual identity truly difficult to discern is not Chinese, but Tibetan manuscript material translated from Zen sources, something quite atypical when measured against what seem to be the general norms of Chinese scribal culture.³⁰ That is not to say that some of the works treated here may not have undergone a process of textual expansion

(or, less probably, contraction) before achieving the form in which we now know them. Chen Guofu displays a quite virtuosic exploitation of geographical names and the like to demonstrate that one text, the *Penglai shan xi zao huandan ge* 蓬萊山西竈還丹歌 can only have been compiled over a period of time, but it should be noted that he assigns this fluidity to a period of private transmission within a school or group of disciples: ‘publication’ to a wider circle, even in manuscript, perhaps subsequently entailed greater textual stability.³¹

With the sole slight caveat, then, that there may conceivably be sources for the study of alchemy overlooked so far exhibiting special problems of textual transmission, the studies republished here should provide material assistance to future researchers simply by acting as a template that may be followed for similar work, even if, as noted above, the most substantial Chinese edition originally published by Professor Ho is represented here by an English translation. Of course editing may also be seen as a preliminary step towards translation for the English language reader, and again as noted earlier, it is a step that Professor Ho has always been most scrupulous in approaching, often enlisting the aid of scholars in the humanities when dealing with materials possessing a distinct literary flavour. In the materials presented here, however, that scrupulousness is particularly evident in the rendering of the pharmacological terminology itself, another reason why the index should give this volume a double utility as both an example of good research and as a research tool in itself.

Last, as the great project of *SCC* nears completion, the appearance of retrospective studies such as that in Volume VII, Part 2 itself have brought to the fore the importance of understanding the ideas that have over the course of time gone into the creation of the whole. For over the course of time, as more than one—or, arguably, more than two generations—of scholars has become involved, the questions asked in the course of research have naturally progressively changed in character. So creative has been the stimulus of the entire exercise that it is now hard not simply to recapture the initial outlook of the first cohort of researchers, but also some of the insights that have developed along the way. Here, however, in a sequence of reflective observations prepared especially for this publication (albeit sometimes drawing on findings already published in part), Professor Ho outlines some of the broader issues that have intrigued him in the course of his research. Based as these essays are on a wealth of research experience, they will be read as an invaluable counterpoint to the main text of the relevant portions of *SCC* itself, offering complementary insights from someone who (as the reader of the main research investigations in this volume will not need to be told) provided some of the most exciting and significant new information that the series was able to incorporate. Yet, as the appended matter finally shows, he remains a scholar not content to rest on his considerable laurels, but also one who is still prepared to look ahead to possible routes for further advance. This is, in sum, not a book simply designed as a reflection of the road he has travelled, but also one that passes on the traveller’s accumulated practical wisdom and above all points to the road ahead. Written as much as thirty or more years ago, these pieces cannot be taken as a precise indication of where we are now: anyone wishing to push forward in the study of alchemy would do well for

example to consult also the publications, and equally the readily available bibliographical information, more recently put on the record by Fabrizio Pregadio, to say nothing of researchers in East Asia.³² But good scholarship, and especially technically proficient scholarship, retains its significance remarkably well, for the reasons I have tried to outline. It is in the firm conviction that Ho Peng Yoke's work can serve as an inspiration for others wishing to continue in the same direction that the preceding remarks have been written.

T.H.Barrett

Preface

Chinese Daoists established a long tradition of collecting texts. As expected most of the texts concerned Daoism itself, but the policy was never exclusive. During the eighth century many of the texts were printed for the first time as a vast collection. In spite of destruction by war and fire new collections and printing blocks were repeatedly made after each loss. This process lasted until the fifteenth century. The collections are generally referred to as the Daoist Canon (*Daozang* 道藏), and they are the primary source for the texts on Chinese alchemy.

In 1958 and 1959, I was on sabbatical leave from Singapore spending two years in Cambridge to work in collaboration with Dr Joseph Needham of Gonville and Caius College on his *Science and Civilisation in China* (SCC) project. Needham was then seeing Volume III on the mathematics, astronomy and geography sections through the press, and at the same time attending to the physics and engineering sections in Volume IV. Needham gave me the task of combing through the Daoist Canon to search for material on Chinese alchemy in preparation for the chemistry section in Volume V.

I was then a university lecturer in physics with only one year's previous study of chemistry in college. Doing research on alchemy would have little relevance to my future career in physics, and I was not entirely confident in my own ability to fulfil my obligations to Needham. I was able temporarily to set aside my fear of working on something remote from physics because my university authorities only required me to learn something about the methodology employed by Needham to write his SCC series. I gained the confidence to work on alchemy as a result of an impromptu test that J.R. Partington made me take. Partington was then living in Cambridge after his retirement as Professor of Chemistry at Queen's College, University of London. When I had studied chemistry in 1946 I had seen on the college library bookshelf a textbook on inorganic chemistry written by him, but it was no longer there the next day when I had tried to borrow it. Books were in extremely short supply in the post-war days when I was a student, and that was the only chemistry textbook available. It did not reappear in the library. I told Partington the story when I met him in Cambridge and gave this as a reason for my decision to choose physics instead of chemistry for my first-degree examination. When I confided in him my lack of confidence to do research on alchemy he set me a test to assess my ability to carry on. The question was 'Do you know what H₂O is?' When I replied in the affirmative and added that I also remembered several other formulae, he remarked that I had already passed with flying colours. He then explained to me that research in alchemy does not necessarily require knowledge of any chemical formula. This reassuring advice, from Needham's consultant on matters concerning history of Western chemistry, gave me the courage to carry on.

While studying the Daoist Canon I prepared notes and translations on relevant alchemical texts and wrote the first drafts of several reports on various topics of alchemical interest with the sole intention of collecting sufficient material for Needham to write his forthcoming chemistry section. That culminated in four joint papers with

Needham to serve as preliminary publications for Volume V of the SCC series. When working on the Daoist texts I faced numerous problems that had to be resolved before I could proceed. They included the vagueness of both authorship and date of many of the texts, technical terms with multiple meanings, an abundance of synonyms that could have multiple meanings themselves, and texts that exist only in fragments quoted in later works. At that time Needham had only seven physical volumes in mind for SCC. When I returned to Singapore to teach physics I thought that I had already done my part in supplying Needham with more than sufficient material to write a single section of Volume V. Before I left I handed over to him the unpublished notes and draft translations that I had prepared in Cambridge, thinking that I would not need them any longer and hoping that they might serve a more useful purpose to him at a later stage.¹

I returned to Singapore to teach physics thinking that my collaboration with Needham was already accomplished, not knowing that he was to turn the chemistry section into several physical volumes, and that he would have later plans to get me involved in something else. I laid aside Chinese alchemy and worked on ancient Chinese astronomical records and other topics that were at least marginally acceptable to my university and colleagues as not being totally irrelevant to my employment. In 1962, a Harvard PhD candidate, Nathan Sivin, spent several months with me in Singapore doing research on Chinese alchemy and kept my interest in the subject alive. In 1964 I was invited to take up the Chair of Chinese Studies at the University of Malaya, Kuala Lumpur. I then decided that, as departmental head, my own research interest should not be too remote from those of my colleagues. Together with some of them I worked on problems in Daoist texts and Chinese pharmacopoeia, alchemy in Chinese poetry and science in Chinese novels. My research emphasis turned to dating alchemy texts in the Daoist Canon and reconstructing lost alchemy texts from fragments quoted in later compendia and pharmacopoeia. Some of these texts had not found a place in the Daoist Canon, although I consider that they deserve to be called Daoist texts. In 1968 I spent another sabbatical leave in Cambridge sitting side-by-side with Needham writing the final drafts of the alchemy sub-volumes of Volume V.

I moved to Australia in 1973 to take up an appointment as the Foundation Professor and Head of the School of Modern Asian Studies, Griffith University. Needham had entrusted me with writing the first draft of the gunpowder section, but this did not entirely prevent me from writing a monograph on the dating of Daoist texts. In 1978 I submitted my draft on the gunpowder section to Needham. The next year I went on sabbatical leave to Tokyo and Hong Kong, where I wrote on the *Danfang jianyuan* 丹方鑒源 of Dugu Tao 獨孤道. Between the years 1981 and 1987 I was on secondment from my post in Australia as Professor of Chinese at the University of Hong Kong. Besides collecting and collating alchemical texts there I succeeded in persuading a colleague, Dr Wong Shiu Hon 黃兆漢, to work on Chinese alchemical terms. My interest later turned to the more sophisticated types of traditional Chinese divination (*shushu* 術數) that were employed to forecast natural events and mundane affairs alike.

It was in November 1986 that Needham approached me to succeed him as Director of the newly established Needham Research Institute in Cambridge when he eventually retired. I also decided to carry on doing research on *shushu*, which had the advantage of being ‘ground not covered’ by volumes of SCC. When I assumed my duties in Cambridge my research activity was mainly confined to this subject.² There were

relatively few historians of science then doing research on Chinese alchemy and I was rather contented to find a young Italian scholar, Fabrizio Pregadio, taking over the baton in the pursuit of knowledge on the history of Chinese alchemy.³ Daoism had also been off my mind for about a decade until Professor Tim Barrett of the London School of Oriental and African Studies rekindled my interest by showing me an article he had written on the Daoist Canon.⁴ I came to realise that although my past research on Daoism was primarily meant for historians of science, it could also be of some interest to humanists. As most of my writings had been published in East Asia and Australia their accessibility presented a problem.⁵ My retirement from the Needham Research Institute at the end of 2001 provided me with an opportunity to collect some of these writings and to present them in English.

This book concerns the dating and collation of alchemical texts in the Daoist Canon and the partial reconstruction of lost alchemical texts that escaped the attention of the compilers of the Daoist Canon. It goes beyond the Daoist Canon and sheds some new light on our understanding of the history of alchemy. In another respect this book serves as a sequel to Needham's SCC series by publishing some research results that were not included due to lack of space.⁶ Partington's remark on the need to know chemistry should not be taken out of context; it was meant as an encouragement to someone working among scholars with adequate knowledge on the subject. Likewise, Needham's devotion to Daoist alchemy does not mean that he overlooked other aspects of the early history of chemistry in China.⁷ The small section in this book on Chinese proto-chemistry from a study of pharmacopoeia and Daoist texts serves to illustrate the advantage of some knowledge of chemistry and what lies beyond the Daoist Canon in the study of this subject. The humanities and science cooperate as equal partners in the study of history of science, playing complementary roles. It is hoped that this book will appeal to both humanists and historians of science alike.

I am most grateful to Professor Tim Barrett, without whom I might not have thought of writing this book, for generously contributing his learned preface to this volume. I am indebted also to Professor Nakayama Shigeru 中山茂 of Kanagawa University and Professor Yano Michio 矢野道雄 of the Kyoto Sangyo University for giving me the benefit of their Japanese expertise, as well as to Professor Huang Yi-long 黄一農 and Professor Hsu Kwang-tai 徐光台, both of Tsing Hua University, Hsinchu. Mr John Moffett and Mr Cho Sungwu, both of the Needham Research Institute, have put in a lot of hard work editing this book. I wish to take this opportunity to thank both of them for their invaluable contribution to bringing out this work. The book was prepared entirely at home in Kenmore, Queensland, Australia. I wish to place on record the support lovingly given to me by my wife Lucy and my two youngest daughters, Sook Kee and Sook Pin. This short list of acknowledgement does not include many who helped me in my work during the past 45 years. Some will be mentioned in the individual chapters of this book.

The Western world knows Joseph Needham as the doyen of history of Chinese science of the last century, but seldom hears the name of his counterpart in East Asia in the person of Yabuuti Kiyosi 戴内清 (1906–2000), who had an even longer career in the history of Chinese science than the former. Yabuuti and Joseph Needham first met in the summer of 1959 at Gonville and Caius College when Yabuuti visited Cambridge. I was a witness to this meeting. Needham and Yabuuti had known of each other much earlier and had great mutual respect for one another. They soon became great friends. Thanks to

Yabuuti and his 'School' Needham was made known in Japan. Yabuuti initiated Needham's early visits to Japan and took a personal interest in the actual progress of the SCC project itself, encouraging the translation of SCC into Japanese. Both were eminent scholars, with contrasting approaches to the study of Chinese science. Needham, as a biochemist, attempted to study individual branches of science from ancient times down to the coming of Western science to China. Yabuuti, as a mathematician and astronomer, focused his attention on astronomical science and mathematics and led his team in the Research Institute of Humanistic Science at Kyoto University, popularly known as the Jimbun, to investigate all branches of science by periods. Needham was widely known internationally. Comparatively speaking, Yabuuti was much less known outside Japan, but there he had nurtured a whole generation of scholars of historians of science and commanded the greatest respect. Needham left behind an institute that bears his name; Yabuuti's legacy is a school, not built in bricks and mortar but in his teachings perpetuated by his host of disciples. To the memory of Professor Yabuuti Kiyosi this book is respectfully dedicated.

Ho Peng Yoke
Kenmore 2006

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A brief note on Chinese romanisation

The romanisation of Chinese characters follows the *pinyin* system, except for proper names where respect is given to known personal or local preferences for people and places outside Mainland China. A case in point is the name Yabuuti Kiyosi, which follows the official system rather than the Hepburn system adopted in this book for romanisation of the Japanese language. It was how Professor Yabuuti wrote his own name in English.

Abbreviations

AB	<i>Anonymous Baozanglun</i> 寶藏論
BG	<i>Bencao gangmu</i> 本草綱目
BT	<i>Beitang shuchao</i> 北堂書鈔
CLZ	<i>Chunyang Lü Zhenren yaoshizhi</i> 純陽呂真人藥石製
CX	<i>Chuxueji</i> 初學記
DJ	<i>Dijingtu</i> 地鏡圖
DL	<i>Dantailu</i> 丹臺錄
DT	Dugu Tao's 獨孤酒 <i>Danfang jianyuan</i> 丹方鑒源
FY	<i>Fayuan zhulin</i> 法苑珠林
FZ	<i>Shilei fuzhu</i> 事類賦注
GY	<i>Gengxin yuce</i> 庚辛玉冊
JY	<i>Danfang jingyuan</i> 丹房鏡源
KZ	<i>Kaiyuan zhanjing</i> 開元占經
QB	<i>Qingxiazhi's Baozanglun</i> 寶藏論
RL	Read and Liu (1936)
RP	Read and Pak (1936)
SCC	<i>Science and Civilisation in China</i>
SF	<i>Shuofu</i> 說郛
TY	<i>Taiping yulan</i> 太平御覽
WD	<i>Waidan bencao</i> 外丹本草
XHD	<i>Xuanyuan Huangdi shuijing yaofa</i> 軒轅黃帝水經藥法
XS	<i>Xuanyuan Shu's Baozanglun</i> 寶藏論
YL	<i>Yiwen leiju</i> 藝文類聚
ZD	<i>Zhengtong daoang</i> 正統道藏 (Daoist Canon)
ZH	<i>Zaohua zhinan</i> 造化指南
ZL	<i>Chongxiu Zhenghe jingshi zhenglei beiyong bencao</i> 重修正和經史證
ZY	<i>Zhongyao dacidian</i> 中藥大辭典 (<i>Jiangsu Xinyi Xueyuan</i> , 1977)

1

Introduction

Philosophy is odious and obscure;
Both Law and Physick are for petty wits;
Divinity is basest of the three,
Unpleasant, harsh, contemptible and vile:
'Tis magic, magic that hath ravished me.

(Christopher Marlowe,
The Tragical History of Dr. Faustus)

Marie Boas refers to the above quotation from Marlowe in describing the Scientific Renaissance in Europe.¹ Before the birth of modern science it was difficult to differentiate between natural philosophy and mystic science. Renaissance science was science, but was not universal and not modern science. This is also true in traditional Chinese science, and the book title of Yoshida Mitsukuni² underscores this similarity when applied to alchemy in pre-modern Japan. In a recently published work, I have shown the application of the anthropologist J.G.Frazer's two rules of similarity and contiguity of magic to Chinese astrology.³ While the relevance of the above quotation to Chinese alchemy will only emerge in the last chapter of this book, another commonly known but less defined characteristic of magic that distinguishes it from modern science pervades this book. Magic tries to conceal its secrets. This aspect of magic is of concern to alchemical texts. Unlike writers of modern science, Chinese alchemists made no attempt to write in a clear and unambiguous style. This is the first obstacle that one has to come to terms with when delving into Daoist alchemical literature in particular.

A brief account of historical trends of Daoist alchemical writings⁴

The earliest alchemical text found in the Daoist Canon (*Daozang*) that we now have is the (*Zhouyi*) *Cantongqi* 周易參同契 (Kinship of the Three Basing on the Book of Changes), written in the second century AD by Wei Boyang 魏伯陽.⁵ The style of the book is extremely obscure, admitting different interpretations. Another book, the *Cantongqi wuxianglei miyao* 參同契五相類秘要 (Arcane Essentials of the Similarities and Categories of the Five Substances in the Kinship of the Three) has been attributed to the same alchemist, but we are still uncertain about its actual authorship (see the discussion in Chapter 2, later on). Nonetheless, both these books are concerned with only a small number of minerals, including mercury, sulphur and lead. Zhao Kuanghua⁶ refers to another alchemist of the second century under the Daoist name Hugangzi 狐剛子, who

seemed to be a disciple of Wei Boyang and had made further contributions to alchemy, but we do not have much of what he wrote. The style of writing had become more lucid and the number of minerals used for elixir preparation gradually increased in number as we come to the fourth century, when Ge Hong 葛洪 wrote his *Baopuzi neipian* 抱朴子內篇 (Inner Chapters of the Book of the Preservation-of-Solidarity Master). Yet more minerals are mentioned in the *Taiqing shibiji* 太清石壁記 (Records in the Rock Chamber; a *Taiqing* Scripture), written after the time of Ge Hong. Alchemical procedures were more clearly and explicitly described in Sun Simiao's 孫思邈 *Taiqing danjing yaojue* 太清丹經要訣 (Essential Formulae for the Alchemical Classics: A *Taiqing* Scripture) early in the seventh century. By that time Chinese alchemy was well into its golden age of development. This period lasted until the latter part of the Tang dynasty in the ninth century.

Some of the minerals used by the Chinese alchemists for elixir preparation were highly toxic. Minerals like mercury, lead and even arsenic were among the ingredients used for different types of elixir. A few Tang emperors and presumably many of the more dedicated and competent alchemists died prematurely as a result of consuming these poisonous substances. The alchemists began to be more cautious. Alchemical texts once again became less explicit, perhaps in order to dissuade the uninitiated from experimenting with dangerous substances. Plants were gradually used more often because their action is milder than that of minerals. Operative alchemy (*waidan* 外丹) often gave way to psycho-physiological alchemy (*neidan* 內丹). This is the 'Silver Period' of Chinese alchemy, which lasted from the latter part of the Tang till the end of the Song dynasty—say between the ninth and the thirteenth or fourteenth centuries. This was also the period when we find many descriptions and illustrations of alchemical laboratory equipment in alchemical writings.

There is no doubt that *waidan* was practical laboratory alchemy, but as for *neidan* there have been speculations among some sinologists who have ventured near these fields that this might have been a Chinese parallel to the Western psychological tradition. C.G.Jung saw the purification of one's inner self as the motive of the Renaissance alchemists in their laboratory experiments. Some believe that this paradigm applied equally well in Chinese alchemy. Needham and Lu disagree with both and see the Chinese *neidan* as physiological rather than psychological, and even point out some elements of proto-biochemistry and proto-endocrinology within it that others thought to be entirely mystical and psychological, declaring that 'no greater mistake can be made than to analogise *neidan* with the spiritual alchemy of the West'.⁷ For *neidan* Needham has coined a new word 'enchymoma', the prefix of which relates to something within the body, and the main part of the word being derived from the Greek *chumos*, meaning juice. This book, however, confines itself to *waidan*, and for the present purpose the word 'alchemy' used in the text refers to operative alchemy, unless *neidan* is specifically mentioned.

Chinese alchemy began to decline when we come to the time of the Mongols, and alchemists paid more attention to plants, since they are generally less toxic than minerals. This trend continued right through the Yuan dynasty (1280–1368) and at least the early part of the Ming dynasty (1368–1644). The dates of composition of the *Chunyang Lü Zhenren yaoshizhi* 純陽呂真人藥石製 (The Immortal Lü Dongbin's Book on Preparation of Drugs and Minerals) and the *Xuanyuan Huangdi shuijing yaofa* 軒轅黃帝水經藥法

(Medicinal Methods from the Aqueous Manual of Xuanyuan, the Yellow Emperor) derived from the investigation presented in this book substantiate the historical trend of alchemical development in China.

The Daoist Canon

The first Daoist *Tripitaka* or Patrology came about during the reign of the Tang emperor Xuanzong 玄宗 (reigned 713–56) when some 3000 Daoist texts were collected and duplicate copies made of them in the year 748. Unfortunately most of them were destroyed during the uprisings of An Lushan 安祿山 and Shi Siming 史思明 in the middle of the eighth century. Between 860 and 873 a second collection amounting to some 5000 titles was made, but again the books suffered the same fate at the hands of Huang Chao 黃巢 around 880. A third collection was made during the Song dynasty by the emperor Zhenzong 真宗 (reigned 998–1022). Completed in the year 1019, it bore the title *Da Song Tiangong baozang* 大宋天宮寶藏 (The Precious Patrology of the Heavenly Palace of Great Song). More texts were later added to this collection, and by the time of the emperor Huizong 徽宗 (reigned 1101–25) its number of titles had increased from 4565 to 5387. For the first time blocks were made between the years 1111 and 1117 to print the collection, resulting in the *Wanshou daoang* 萬壽道藏 (Daoist Patrology with a Longevity of Ten Thousand Years). However, this collection did not last as long as its optimistic title implied, for before long it became a victim to war and fire and some of the blocks fell into the hands of the Jurchen Tartars. From this acquisition and other texts collected, the new owners produced their own Daoist Patrology in the year 1164. At one stage this collection consisted of 6455 titles, but again, it suffered the same fate of destruction by fire in the year 1202. In the year 1244 Song Defang 宋德方 printed the *Xuandu baozang* 玄都寶藏 (Patrology of the Mysterious Capital) consisting of 7800 titles, but in less than 10 years some of the blocks were burnt by the Mongols. The Mongols also destroyed many other Daoist texts that they found.

Finally, in the Ming dynasty the first printing of the *Zhengtong daoang* 正統道藏 (Daoist Patrology of the Zhengtong reign-period) was completed in 1445. It consisted of 5305 *juan* (rolls or chapters) in 380 *han* 函 (book-wrapping cases). There was another edition in the year 1524 with new blocks made (perhaps only partly, some using the old blocks of the 1445 edition). A third edition came about in the year 1598 during the Wanli 萬曆 reign-period following a substantial printing programme with new blocks made based on the 1445 edition. Then a supplement known as the *Wanli xudaoang* 萬曆續道藏 (Supplementary Daoist Patrology of the Wanli reign-period) was added in 1607. Between 1923 and 1926 the Commercial Press in Shanghai reprinted the last two collections in 1120 physical volumes from the collection preserved in the Baiyunguan 白雲觀 monastery at Beijing. In 1977 this edition was reproduced in reduced print in sixty volumes in Taipei, and in 1988 a Shanghai reproduction reduced it further to thirty-six volumes. Popularly known as the modern reprinted edition of the *Zhengtong daoang*, it actually contains material originating from three different sources, namely the 1445 edition, the 1598 edition and the 1607 edition. The Shoryōbu 書陵部 library department of the Imperial Household Agency (Kunaichō 宮内庁) in the Japanese Imperial Palace preserves a so-called Wanli edition of the *Daoang*. According to a study made by Liu

Ts'un-yan 柳存仁 this collection consists of 4115 *juan* in 439 *zhi* or *han* and is incomplete with 40 *han* missing. Liu shows that it originated from texts in the 1524 edition as well as those in the edition of 1598 and 1607.⁸ A small proportion of the texts are handcopied versions from the original block prints. This palace collection came originally from that of Mōri Takasue 毛利高標 (1755–1801), the Lord of Saeki 佐伯侯, who ruled over the fief of Bun'gō 豊後. Takasue was renowned as a book collector. In the Bunsei 文政 period (1818–29) Takahane 高翰 passed the Mōri family collections to the *bakufu*. Eventually these books went to the imperial palace in the year 1891, the twenty-fourth year of Meiji. Many books in the collections of the imperial palace still bear the seal of Takasue under his style name Baishō 培松. Here it turns out that Takasue's collection has proved extremely valuable in the study of an important Daoist alchemical text, the *Danfang jianyuan* 丹方鑑源.⁹

Other Daoist texts have also been collected since the early Qing period. There was the 1906 printed version of the *Daozang jiyao* 道藏輯要 (Essentials from the Daoist Patrology) from the Erxian'an 二仙庵 monastery in Chengdu.¹⁰ There was also the *Daozang xubian chuji* 道藏續編初集 (First Collection of the Supplement to the Daoist Patrology), compiled by Min Yide 閔一得 in the early nineteenth century. In 1965 Xiao Tianshi 蕭天石 selected texts from these three collections and some manuscript copies of Daoist texts from the Qing period that were not included in them to publish the *Daozang jinghua* 道藏精華 (Essence of the Daoist Patrology).¹¹ Earlier in 1975 Michael Saso published in Taipei a collection of Daoist texts under the title *Zhuang Lin xu Daozang* 莊林續道藏 (Zhuang Lin Supplementary Daoist Patrology). Finally, in 1992 Chen Dali 陳大利, He Zhihua 何志華 *et al.* published the *Zangwai daoshu* 藏外道書 (Daoist texts beyond the Daoist Patrology). It would not be a surprise to discover further still hitherto unnoticed Daoist texts lying around in monasteries, institutions and private collections. Alchemy texts that we use today generally come from the *Zhengtong Daozang* and its Supplement, which we refer to in this book as the Daoist Canon, bearing in mind the variant version in the Japanese Imperial Palace.

Chinese pharmacopoeia

Throughout history China has produced hundreds of pharmacopoeia. Several hundred are still extant, many others surviving only in fragments.¹² The Chinese tradition of the *bencao* 本草 pharmacopoeia began with the *Shennong bencaojing* 神農本草經 (The Pharmacopoeia of the Heavenly Husbandman) dating back to the time of the Han dynasty in the first century of the Common Era. Several reconstructions of the text have been made from fragmentary passages quoted in subsequent Chinese pharmacopoeia, especially those written in the style of compendia, and other works.¹³ Many other relevant pharmacopoeia, listed in the bibliographies, will be quoted in this study, the most important being the *Bencao gangmu* 本草綱目 (The Great Pharmacopoeia) by Li Shizhen 李時珍, published in 1596.

Identification of minerals and plants

One has to be mindful that botanists had to wait to the mid-eighteenth century before the Swedish naturalist Carolus Linnaeus (1707–78) developed a binomial system of nomenclature that eventually became accepted as a standard classification system. Before then botanists separated by space or time, or both, always had in their minds the uncertainty of whether or not they were referring to the same things. The problem became even more complicated in the case of the arcane arts, such as alchemy, where it had not been the purpose of the practitioner to help an outsider to understand his work.

Chinese culture is particularly rich in the use of synonyms. Scholars used them freely in poetry, ordinary people in conversation, secret societies employed different sets of vocabularies for internal verbal communications, and alchemists possessed a particularly rich repertoire of synonyms for professional if not personal protection. Many single alchemical synonyms were applicable to multiple objects. It is not surprising that synonyms gave problems to the alchemists themselves. Mei Biao 梅彪 in the early ninth century already saw the need to compose the earliest guide to alchemical synonyms, giving us the important reference work, *Shiyao erya* 石藥爾雅 (Synonymic Dictionary of Minerals and Drugs). A number of reference works have been written since then, most notably in the twentieth Century.¹⁴ Chinese pharmaceutical substances included alchemical substances. It goes without saying that none of the above works claims to contain a complete list of synonyms. Without doubt all of them are invaluable for the identification of Chinese alchemical and pharmaceutical substances.

Problems regarding the identification of synonyms are many. Let us take the case of the term *ziheche* 紫河車, which normally refers to the placenta. It was also a synonym for *zaoxiu* 蚤休 (*Paris polyphylla*, Sm.).¹⁵ The term appears twice in the *Danfang jingyuan* 丹房鏡源 under items DJ43 and DJ45 (see Chapter 3). Since the placenta found its use only in medicine and *zaoxiu* was used both in medicine and in alchemy, it is not too difficult to make the right choice for an alchemical text. Things get a little more complex, however, in the case of one of the dozens of synonyms for mercury. Since mercury could be recovered from cinnabar *zhusha* 朱砂, it also received the name *shazi* 砂子, ‘son of cinnabar’, omitting the character *zhu* 朱. The case of *ziheche* being a common name for two different substances is only one among 192 similar cases in a list provided by Li Shizhen himself.¹⁶ The list goes on to include thirty cases of three different substances sharing the same synonym, six cases of four different substances with a common name, and one case for the same name being shared by five different things.

The above underscores the problem arising from word omission in alchemical texts. Occasionally the character *sha* 砂 in the term *shazi* stands alone, as in the case of item JY 40 in the *Danfang jingyuan*, leaving the reader to figure out whether it is a straightforward word for ‘sand’ or to be read as a synonym for mercury with a missing character. This is not a unique case. Item JY 39 in the same book gives the characters *xiao* 硝 (unspecified nitrate or sulphate) and *jichang* 雞腸 (chicken intestines), each with a missing character required for the text to make sense. Probably the former has omitted the character *shi* 石 and the latter *cao* 草, actually meaning saltpetre and *Trigonotis p.* Bth. respectively. Word omission could be either due to oversight in the case of the

copyist or block maker, or intentional in the case of an alchemist who wished the secret art to be revealed only to the chosen few.

A writer quoting from another text might repeat the text in his own words while retaining its sense. He might also exercise his freedom of choice to use a variant character for the same word. For example the character *jian* 鑒 in the book title *Danfang jianyuan* appeared in two variant forms 鑑 and 鑒. Quotations by Li Shizhen do not often agree with the original texts word for word. The copyist and the publisher also seemed to enjoy similar liberty. A point in case is the naming of the three chapters (*juan* 卷) of the *Danfang jianyuan*, with one edition using the numbers ‘one’, ‘two’ and ‘three’ and another using the words ‘upper’, ‘middle’ and ‘lower’. However, critical errors did occur. For example, new blocks have been made over twenty times for the printing of the *Bencao gangmu* since its first printing in 1596, and typographical errors and corruptions are found in these versions.¹⁷ The book title *Dijingtu* 地鏡圖 in the 1596 version becoming *Yujingtu* 玉鏡圖 in the 1885 version is a case in point.

One often encounters missing characters and variant words in the collation of Daoist alchemical texts. Then there are cases where no other references in alchemical texts and pharmacopoeia can be found. An example is *tianchishui* 天池水 (‘water from the celestial pool’). It is here interpreted as seawater, because in Chinese literature the celestial pool refers to the sea. On some occasions educated guesses are called for—even a long shot is better than none.

Alchemical and pharmaceutical substances have been identified with various degrees of certainty according to the substances themselves. Names of substances are known to have changed over the course of time, the purity of substances differs from place to place and different substances sometimes share the same name. Take for example the modern term *xiaoshi* 硝石 for saltpetre that was used in the past in gunpowder formulae, and recognised in alchemy texts by the flame test. There was, however, no uniformity in its identification, and some other nitrates and sulphates were taken as *xiaoshi*. Masutomi Junosuke proves that a specimen of *xiaoshi* for medicinal use brought to Japan from Tang China is not saltpetre but Glauber’s salt.¹⁸ The name *xiaoshi* had also been applied in the past to Epsom salt. Meng Naichang points out that the alchemists generally meant saltpetre for *xiaoshi*, but in medicine Epsom salt and Glauber’s salt would sometimes be also used as *xiaoshi*.¹⁹ The point is that from the properties of the substance described by the alchemists it could be nothing other than saltpetre, but the ability of someone to identify the substance was another question, especially so when the physicians used other substitutes as medicine and gave them the same name. It is not always possible to identify a substance with a great degree of certainty in spite of all the useful references available to us.

Technical terms in Chinese alchemy

The texts translated in this book contain a good number of technical terms used in Chinese alchemy. Some of the terms refer to alchemical apparatus and others to the alchemical operation itself.²⁰ Attention should be given to the fact that the same terms were often employed in alchemy and medicine, especially by the fifteenth century when the *Gengxin yuce* 庚辛玉冊 was written.²¹

As mentioned in the Preface, my encouragement to study Chinese alchemy came from J.R. Partington when he reminded me that modern chemistry only developed in Europe during the later eighteenth and the early nineteenth centuries. When the Jesuits went to China in the sixteenth century they only brought along with them a limited amount of chemical knowledge that could in no way be called modern chemistry. Modern chemistry began with the experimental study of gases by Joseph Priestley (1733–1804) and the publication in 1789 of Antoine Laurent Lavoisier's (1743–94) *Traité Élémentaire de Chimie*, which replaced the Theory of Phlogiston by the modern view of combustion, introduced the law of conservation of mass, explained the elementary nature of oxygen and hydrogen, and introduced a rational system of chemical nomenclature. Then came the Atomic Theory that John Dalton (1776–1844) published in 1808 in his *New System of Chemical Philosophy*. The works of Justus von Liebig (1802–73) and his colleague Friedrich Wöhler (1800–82) between 1830 and 1840 laid the foundation of organic chemistry. Therefore, in the study of the history of alchemy it is important to bear in mind that while some knowledge of modern chemistry does sometimes help, one must not forget that the alchemist did not understand and was unable to explain his procedure in the light of modern chemistry.

Alchemy in the West was interwoven with mysticism, mythology, astrology, magic and religion. Alchemical writings in the West were characterised by their vagueness and their frequent use of cryptic and symbol. The same is often true with Daoist alchemical texts. Here we find an abundance of procedural and material technical terms to come to terms with before we can try to understand these texts.

The apparatus used in the laboratory of the Chinese alchemist and the procedural terms they used have been described elsewhere.²² A glossary of common Chinese alchemical terms is given in Table I at the end of this volume. In using Table I we need to remember that it is futile to attempt to translate the terms here accurately into equivalent terms in chemistry, since Chinese alchemists had no notion of the reaction of molecules. We cannot even assume that the technical terms used by them had been clearly defined. For example, they only had a general term *fei* 飛 for sublimation, distillation and vaporisation that we can now distinguish more finely with our knowledge of chemistry from the context. In the properties column we can observe several cases where different terms are used to describe the same property, suggesting that some of the terms were interchangeable. To add to the confusion, some of the terms were also used in Chinese pharmacy. For example, the term *fu* 伏 (to fix, to subdue) used in the alchemical sense, would mean to extract, or to prevent or delay the process of distillation or sublimation.²³ However, in Chinese pharmacy, the same term referred to the potency of a substance being suppressed by the presence of another. *Zhi* 制 (to control) in the alchemical sense, refers to the prevention or delay of the process of distillation or sublimation, or simply means to effect a change. In the pharmacopoeia it refers to the toxicity of a substance being suppressed by the presence of another substance. In the *Chunyang Lü Zhenren yaoshizhi* 純陽呂真人藥石製 (The Immortal Lü Dongbin's Book on Preparation of Drugs and Minerals) and the *Xuanyuan Huangdi shuijing yaofa* 軒轅黃帝水經藥法 (Medicinal Methods from the Aqueous Manual of Xuanyuan, the Yellow Emperor), to be discussed in the following chapter, these two terms are used interchangeably. Sometimes they are combined into another term *fuzhi* 伏制, with the same meaning. *Dian* 點 (to translate, to transmute, to project) meant a small quantity of a substance giving rise to changes in a

much larger quantity of another substance. *Hua* 化 (to translate, to transmute, to change) meant a substance giving rise to changes in another substance. *Dianhua* 點化 (to translate, to transmute) was a general term for both. Here one should remind oneself that the Chinese alchemists had no understanding of the difference of physical and chemical changes. *Hua* could also be an abbreviated form of *bianhua* 變化 (to change, to transform), which was not equivalent to *dianhua*. When a substance is changed such that its original form is beyond recognition, the alchemical term for the process was *si* 死 (to die). In the pharmaceutical sense, however, *si* would refer to an originally toxic substance with its toxicity suppressed by another substance. In Western alchemy terms like ‘petrification’ or ‘mortification’ were applied to the ‘death’ of a metal usually through oxidation.²⁴

As we shall note in Chapter 2, comparison of the properties of the plants in the two different texts shows up a number of discrepancies, either in the names of minerals or in the procedural technical terms. For example, in the case of *gancao* 甘草 (licorice), one text says that it fixes (*fu*) arsenic while the other says cinnabar, and in the case of *tuchuanguhua* 禿瘡花 (*Mazus rugosus*, L.), one text says that it fixes sulphur, while another says realgar. One example of technical terms apparently being used indiscriminately can be seen in the case of *changpu* 菖蒲 (*Acorus gramineus*, Ait.), where one text says that it translates (*dian*) realgar, while the other says that it fixes (*fuzhi*) realgar. Another similar example is found in the case of the plant *foercao* 佛耳草 (*Auricularia auriculajudae*, Schr.). Lacking the ability to give the terms proper definitions in alchemy, such discrepancy was inevitable. It is not at all surprising that some of the terms were used interchangeably in Chinese alchemical texts.

2

On the dating of Daoist alchemical texts

In 1958, when I began the study of Chinese alchemy under the tutelage of Joseph Needham at Gonville and Caius College, Cambridge, knowing that the development of alchemy in China was mainly due to the work of the Daoist alchemists, I went straight to the alchemical texts in the Daoist Canon (*Zhengtong Daozang* 正統道藏)²⁵ and at the same time began to read the writings of contemporary scholars on the same subject. The Daoist Canon consists of well over 1,000 Daoist texts, about only 7 per cent of which touch on alchemy in various degrees.

Like most texts in the Daoist Canon, many of the alchemical writings do not bear the dates of their origin or even give the real names of their authors. In some cases authorship is attributed to some legendary personality, such as the Yellow Emperor. Some attempts have been made by modern scholars to date these Daoists texts. In the nineteenth century Wylie made some general remarks on Daoists literature.²⁶ The survey of Wieger, produced during the second decade of the last century, became a widely used reference work for students of Daoism in the West.²⁷ Liu Ts'un-yan later pointed out many errors in it.²⁸ An index was also produced by Weng Dujian 翁獨健, with further in-depth studies by Chen Guofu 陳國符.²⁹ However, many Daoist texts still remain undated, while some of those that have already been can be more accurately dated. This does not devalue the contributions by the scholars mentioned earlier, but only serves to underscore the Herculean task these pioneers undertook in their search for a needle not in a haystack but in a vast ocean of abstruse Daoist literature abounding with pseudonymity and pseudoepigraphy.³⁰

In the decades following these publications, a wealth of scholarship on Daoism was published by Chinese, Japanese, American and European scholars.³¹ A comprehensive study of the Daoist Canon was also made by Liu Ts'un-yan.³²

In order to understand the historical background of Chinese alchemy it is necessary to know the dates of writing and the authors of the alchemical texts that are being studied. Hence in the process of studying, writing notes on, and sometimes translating in full these Daoist alchemical texts, I made an attempt to get them dated as far as possible. Some of the methods I adopted are quite conventional, but some are perhaps rather unusual. The purpose here is not to compose a new catalogue of the Daoist Canon that gives more accurate dates of the origin of the texts included in this canon, but rather to describe the various methods employed for the dating of some of these texts, hoping that these methods will stimulate those who share my interest to develop other new techniques, which together will help the bibliographical study of not only Daoist literature but also Chinese literature as a whole.

I wish to place on record my deepest gratitude to the late Dr Joseph Needham, FRS, FBA, formerly Master of Gonville and Caius College and Director of the Library of the History of East Asian Science in Cambridge, who passed away in 1995. As the Chinese

saying *yin shui si yuan* 飲水思源 (when drinking water think of its source) goes, this publication is made possible as a result of his suggestion, without which I might not have read even a single book in the Daoist Canon, not to mention writing anything about it. Besides Dr Needham, several friends and former colleagues of mine have collaborated with me in a number of articles cited here, and I ought to place my thanks to them on record. The late Professor Cao Tianqin 曹天欽, formerly of the Biochemistry Institute of the Chinese Academy of Sciences, Shanghai, was a Fellow of Gonville and Caius College, Cambridge, in the early part of the 1950s. In his spare time he helped Dr Needham by doing pioneering work in the study of the alchemical books in the Daoist Canon. The initial stage of my study of the Daoist Canon was rendered much easier by the notes made by Professor Cao. When I was working at the University of Malaya, Kuala Lumpur, my greatest joy was the presence of friends and colleagues who were happy to collaborate with me to work on areas entirely outside their own. Among them are Professor Francis Morsingh, who went on to be Professor of Chemistry at the University of Science, Malaysia, in Penang, Mr Beda Lim, the Librarian of the University of Malaya, Mr Chen Tieh-fan 陳鐵凡, formerly an Associate Professor in the Department of Chinese Studies at the University of Malaya, and Mr Su Ying-hui 蘇瑩輝, also formerly an Associate Professor in the same department. To all of them I owe a debt of gratitude. I must also thank my former secretary Miss Ong Chow Fong 翁紹鳳 of the Department of Chinese Studies, University of Malaya, for the meticulous care she took in the preparation of the typescripts in many of my publications cited here.

Since I came to Australia for the first time in 1972, I have had many occasions, although not as numerous as I could have wished, to meet Professor Liu Ts'un-yan of the Australian National University, who happens to share my interest in Daoist literature, although on a wider plain, mine being restricted to alchemy. I have benefited from the many discussions I had with him—and at least I do not feel like being a lonely person in the Southern Hemisphere with a strange interest in Daoist literature.³³ Last, but only in chronological order, I wish to thank three of my colleagues at Griffith University, namely Professor Colin Mackerras for generously giving me the benefit of his editorial expertise since 1972 when we were together at the Department of Far Eastern History of the Australian National University, and Mrs Kay Allen and Mrs Sue Esdale for the patience they took in preparing the typescript (for the original version). Mr Ling Wing Tim 凌榮添 helped the production of (the original version of) this book by filling in the Chinese characters³⁴ (Ho Peng Yoke 1979, amended 2004).

Methodology

Use of bibliographies

Having checked the text to ascertain whether it gives the name(s) of the author(s) and commentator(s), as well as the dates when the text and the commentary or commentaries were written, one can try to look up the title of the book and the name(s) in bibliographies. Some of the Chinese official dynastic histories include bibliographies with subsections on Daoist literature, and the most important dynastic histories for our present purpose are those of the Tang (618–907), Song (960–1279) and Yuan (1271–

1368), because they cover the period in which most of the literature in the Daoist Canon came into existence. The bibliographies in some of the compendia may also be useful, such as those in the *Tongzhi* 通志 (Comprehensive History of Institutions) by Zheng Qiao 鄭樵 (1104–62) of c.1150, and the *Wenxian tongkao* 文獻通考 (Comprehensive Study of Civilisation) by Ma Duanlin 馬端臨, compiled between 1254 and 1280.³⁵ Bibliographies of Daoist literature are contained in several Daoist texts in the Daoist Canon, for example in the *Baopuzi neipian* 抱朴子內篇 (Inner Chapters of the Book of the Preservation-of-Solidarity Master) written by Ge Hong 葛洪 (283–343) about AD 320, and in the *Shiyao erya* 石藥爾雅 (Synonymic Dictionary of Minerals and Drugs) written in the year AD 806 by Mei Biao 梅彪. Like all the other bibliographies mentioned above, the Daoist Canon itself also serves as a time-post. A text mentioned in it is at least earlier than the Canon itself. That is to say, if a title occurs in the *Zhengtong Daozang* 正統道藏, which came into being in AD 1445, the original text itself should pre-date the year 1445.

Personal names, styles and titles

Names of authors, commentators and persons mentioned in the text may also help to date the text. For example, if a text mentions Ge Hong (283–343) it cannot pre-date the years he flourished. The names may be searched for among the official dynastic histories, the compendia, and so forth, in the normal way adopted by Sinologists, including among the Daoist literature itself.³⁶ A biography of the alchemist and physician Sun Simiao 孫思邈 (c.581 to after 672), for example, can be found in the *Jiu Tangshu* 舊唐書 (Old History of the Tang dynasty), and this helps to identify the period when the alchemical text *Taiqing danjing yaojue* 太清丹經要訣 (Essential Formulae for the Alchemical Classics: A *Taiqing* Scripture) was written.³⁷

One has always to be careful when dealing with titles, styles and personal names as there are cases of two or more persons in different periods of time using the same title, cases where they adopted the same style name or even shared the same personal name. For example, the alchemist Ge Hong should not be confused with a Song civil servant known by the same name but who lived more than six centuries later.

Rank titles can also serve as a clue. Their applications in the dating of the *Cantongqi wuxianglei miyao* 參同契五相類秘要 (Arcane Essentials of the Similarities and Categories of the Five Substances in the *Kinship of the Three*) will follow shortly.

Textual comparison

Sometimes one Daoist alchemical text may be quoted partially or even fully in another text. If we know the date when one of them was written we can set either an upper or a lower date limit for the other. Take, for example, the *Taiqing jinye shendan jing* 太清金液神丹經 (Manual of the Potable Gold and the Magical Elixir: A *Taiqing* Scripture). It consists of three sections, the first of which carries a preface by Zhang Daoling 張道陵 (fl. AD c.156) in which it is claimed that the text was originally written in some very ancient script, but was rewritten in the script used during the Han dynasty (BC 206–AD 220) by Yin Changsheng 陰長生 (fl. AD 120?). The second section is attributed to Yin Changsheng himself and has a commentary by Zheng Yin 鄭隱 (c.220–300); it also mentions the name of Ge Hong and the demise of the Jin emperor Yuandi 元帝 in the

year AD 322. The third section carries a preface by Baopuzi (i.e. Ge Hong) and begins with the words ‘Ge Hong says’, but what Ge Hong is said to have said here does not appear in the chapters of the *Baopuzi*. However, we can find the first two sections quoted in the *Yunji qiqian* 雲笈七籤 (The Seven Bamboo Tablets of the Cloudy Satchel) compiled by Zhang Junfang 張君房 about the year 1022. Hence these preliminary observations enable us to place the text between the years 322 and 1022 at the first instance.³⁸

The *Yunji qiqian* looks like a miniature Daoist Canon. It contains several Daoist alchemical texts that are not directly included in the *Zhengtong daoze* 正統道藏 of 1445 or in the Supplement of 1607.³⁹ For example, Sun Simiao’s *Taiqing danjing yaojue* 太清丹經要訣 is preserved only in the *Yunji qiqian*.⁴⁰ There are several other texts in the Daoist Canon in the nature of compendia that perform functions similar to the *Yunji qiqian* in preserving some alchemical texts that would be otherwise lost. These compendia-like texts include the *Zhujia shenpin danfa* 諸家神品丹法 (Methods of the various Schools for Magical Elixir Preparations), a Song work by Meng Yaofu 孟要甫 *et al.*, the *Qiangong jiageng zhibao jicheng* 鉛汞甲庚至寶集成 (Compendium on the Perfected Treasure of Lead, Mercury, Wood and Metal), possibly a work of the Five Dynasties (970–1060) if not the Song period that quotes at least two Tang alchemical texts, and the *Gengdaoji* 庚道集 (Collections of Procedures for Gold-Making), compiled after 1144 by someone using the style Mengxuan jushi 蒙軒居士. One has to include in this category the *Shiyao erya* 石藥爾雅 mentioned earlier. This book is of special importance for dating purposes in view of its firm date of AD 806 and its known authorship.

To illustrate the usefulness of these compendia and dictionary in the Daoist Canon, let us take the example of the *Waidan bencao* 外丹本草 (Pharmacopoeia of Operative Alchemy), an alchemical book quoted by Li Shizhen in his *Bencao gangmu* 本草綱目 (The Great Pharmacopoeia) in 1596. For some time it was thought that the *Waidan bencao* was completely lost except for the fragments found in the *Bencao gangmu* and that no information regarding its author Cui Fang 崔昉 could be found either. However, some useful information on Cui Fang later turned up in the *Gengdaoji*, including the year 1043 when he flourished, how he acquired the art of alchemy and what sort of experiments he performed.⁴¹

The *Bencao gangmu* is one of the two Chinese pharmacopoeia that incorporate quotations from Daoist alchemical texts, some of which are no longer extant and are not found in the Daoist Canon. The other, and perhaps even more useful from the viewpoint of Daoist text, is the *Chongxiu Zhenghe jingshi zhenglei beiyong bencao* 重修正和經史證類備用本草 (New Revision of the Pharmacopoeia of the Zhenghe Reign-Period: The Classified and Consolidated Armamentarium) compiled by Zhang Cunhui 張存惠 in the year 1249 from two previous pharmacopoeia, one by Tang Shenwei 唐慎微 in 1108, and the other by Kou Zongshi 寇宗奭 c.1116. We have used the *Chongxiu Zhenghe Jingshi zhenglei beiyong bencao* to study the *Danfang jingyuan* 丹房鏡源 and *Danfang jianyuan* 丹方鑒源 later in this book.⁴² The *Chongxiu Zhenghe jingshi zhenglei beiyong bencao* also contains quotations from the *Taiqing shibiji* 太清石壁記 (Records in the Rock Chamber: a *Taiqing Scripture*) that should be of interest to those working on the Daoist Canon text of this alchemical work.⁴³

Taboo words

The internal evidence of a text may sometimes be quite revealing. One wellknown clue used by scholars of Chinese is the presence of ‘taboo characters’ (*huizi* 諱字) in the text. It was customary in China to avoid using the personal names of the reigning emperor and of his dynastic ancestors. One stroke in the *taboo character* would be deliberately omitted or another character either similar in meaning or with the same sound as the ‘taboo one’ but maintaining a good meaning would be used instead. This practice was quite common during the Song dynasties (960–1279) when it was rigorously enforced by the government. There is, however, a note of caution for scholars of the Daoist Canon. According to Chen Guofu’s observations, most of the works collected in the *Zhengtong daoze* avoid using *taboo characters* of the Song period, and hence it is apparent that although the blocks for the *Zhengtong daoze* were cut during the Ming dynasty, many of the texts were based on the Song *Wanshou daoze* 萬壽道藏.⁴⁴ In other words, when a text avoids the *taboo characters* of both the Tang and the Song it must belong to the Ming period, and if another avoids only those of the Song dynasty, it cannot be a pre-Song text. After all, the avoidance of *taboo characters* was not universally enforced in China before the Song period and we cannot expect every writer then, especially the Daoist alchemist who sought no fame and favour, to comply with such practice. It was only during the time of Song, between 1111 and 1117 when the whole collection of the Daoist Canon was first printed, that restriction on the use of *taboo characters* was legally enforced. Nathan Sivin has skilfully applied the method of examining *taboo characters* to investigate the date of composition of the *Taiqing danjing yaojue*.⁴⁵

Reign titles

Reign titles, needless to say, tell us about the dates and set date limits for the composition of a text. However, we need to know the way a Daoist text gives the reign title. For example, the *Jinshibu wujiushujue* 金石簿五九數訣 (Explanation of the Inventory of Metals and Minerals According to the Numbers of Five and Nine) mentions a *jiazi* 甲子 year in the Linde 麟德 reign-period of the Tang dynasty, referring to the year AD 664. The word ‘jin’ 近, meaning near or close to, appears immediately before the word ‘Tang’. At first sight one gets the impression of an event occurring near the time when the book was written. However, the two words taken together may also imply an event occurring in an immediately previous dynasty. A Tang writer would refer to the Tang dynasty as ‘*Da Tang*’ 大唐 and would avoid using the two words *jin* and *Tang* together so as not to lead to any misunderstanding, or else he would have dropped the word *Tang* instead. Hence one can deduce that the *Jinshibu wujiushujue* was a work of the Five Dynasties. This text deserves further investigation for its content on alchemy.

Geographical names

Geographical names may sometimes yield useful clues for the dating of texts. Place names often underwent changes during the course of history. If a text refers to a certain place by a name used exclusively in a certain period of history one can infer that the text

could not be earlier than that particular period. In other words, an upper limit of the date of composition can sometimes be deduced from geographical names. It does not necessarily follow, however, that the text was written in the period when the place name was in use. As Nathan Sivin puts it, one ‘cannot proceed on the assumption that officially promulgated changes in place names were promptly and consistently adopted in private writing’.⁴⁶ For example, when we find the name Xinzhou 信州, which first came into use during the Tang dynasty, in a text, as in the case of the alchemical manual *Longhu huandanjue* 龍虎還丹訣 (Explanation of the Dragon and Tiger Cyclically Transformed Elixir) we can only infer that the text was written not before the Tang dynasty, but not necessarily during the same period when the name Xinzhou was first instituted.

Technical names

Technical names also play a useful role in the dating of Daoist alchemical text. Names of minerals or plants may give useful hints concerning not only the approximate periods but also the geographical location of the writer. The pharmacopoeia are indispensable tools in this regard. This technique is employed in the dating of the *Chunyang Lü Zhenren yaoshizhi* 純陽呂真人藥石製 that follows.

Linguistic method

The style of writing may sometimes yield useful information on the period a book was written. Linguistic methods may also become a useful tool. They have been employed in the dating of the *Chunyang Lü Zhenren yaoshizhi* by comparing the period of writing with other periods phonologically to see which period would give rhyme to the most number of verses in the text. This method of dating the *Chunyang Lü Zhenren yaoshizhi* will be illustrated fully in a separate section. In addition, it will also be used, together with comparison of technical terms, to estimate the date of composition of another alchemical text in the Daoist Canon, namely the *Xuanyuan Huangdi shuijing yaofa* 軒轅黃帝水經藥法 (Medicinal Methods from the Aqueous Manual of Xuanyuan, the Yellow Emperor).

Dating the *Cantongqi wuxianglei miyao* 參同契五相類秘要 (Figure 2.1)

Authorship

The introduction of the text itself claims its author to be the second-century alchemist Wei Boyang 魏伯陽. However, it bears no resemblance to the (*Zhouyi*) *Cantongqi* 周易參同契 (Kinship of the Three Basing on the Book of Changes) that is believed to be written by Wei Boyang c.142,⁴⁷ while at the same time many of its alchemical terms are not found in the *Shiyao eryl* 石藥爾雅 that Mei Biao 梅彪 wrote in the year 806. It must have escaped Mei Biao’s attention if it was not written after his time. We shall return to this point later.

Commentators

The book begins with a line stating that it was submitted to the emperor by a civil servant named Lu Tianji 盧天驥, whose official ranks and titles were

第一 要秘題相五契同參

朱同契五相類秘要
太素 真人 魏 伯陽 撰
宣和 宣和 宣和 宣和 宣和 宣和
陽 一二三四五
水火本金土
陰 六七八九十

昔真人魏伯陽與淳子叔通授青州徐從事
來同契及古歌魏君丹成撰此五相類後昇
雲而去今弟子大萊諸本並無皆云朱同契
中卷是也深屬淺見矣且五相類者論諸相
類伏明三寶二寶也故云五也

篇四

天生元女者水銀也地生黃男者黃金也皆
稟性太和微妙之炁左陽右陰即位而相通
朱砂與金居東方復化為水銀居西方為
是也張翼虎虎虎虎虎虎虎虎虎虎虎虎虎
方當是未從朱砂中所化出乃受生之性一
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化為丹文時為一化矣
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承之者也 本合赤水水銀也

Figure 2.1 The first page of the *Cantongqi* wuxianglei miyao from the Daoist Canon.

Xuandelang 宣德郎 *quan faqian tiju Huainan xilu xueshi* 權發遣提舉淮南西路學事, *Jiefei yudai* 借緋魚袋.⁴⁸ The first task is to look up the name Lu Tianji in the official dynastic histories, but it is not there. One might think that Lu, being a civil servant, would have been particularly careful to avoid using *taboo characters*, but again no useful clue is found.

The next step is to look at Lu's rank, title and appointment. *Xuandelang* (Education Officer) was his titular office. During the Tang and Song dynasties this was a prestigious civil title, of the principal seventh grade (*zheng qipin* 正七品).⁴⁹ During the Zhenghe 政和 reign-period (1111–17) the name *Xuandelang* was changed to *Xuanjiaolang* 宣教郎. Since Lu was submitting this book officially he must be using his correct title of *Xuandelang*. This sets the year 1117 as the lowest possible limit for the text. The next word *quan* means expediently, referring to the temporary duty to which an officer was assigned. This word was included in the official ranks and duties of Song civil servants, until the Shaoxing 紹興 reign-period of Southern Song when the custom was dropped, that is, after 1132. This gives an additional clue as to the lowest limit of the date when Lu submitted the text.

Faqian 發遣 refers to the commission, meaning 'commissioned as'. *Tiju* 提舉 meant an Intendant. The office of *Tiju* was established during the Song dynasty. *Tiju xueshi* 提舉學事 was the post of Circuit Education Intendant, which was established in the year 1103 but was abolished in 1121. Lu Tianji was thus an Education Officer assigned to the post of Circuit Education Intendant. The range of the date of his presented text is immediately narrowed down to between 1103 and 1117.

The West Huainan 淮南西 Circuit was the place where Lu was assigned. It indicates that he was Circuit Education Intendant for the West Huainan Circuit. Before 1051 there

was only one single circuit for the whole of Huainan, but after that year the circuit was divided into the East Circuit and the West Circuit.

Under Song dynasty regulations an officer of the seventh grade would be permitted to wear only green. However, in the year 977 Emperor Taizong 太宗 gave permission to an officer commissioned to work outside the capital to wear a colour of the next higher grade. Officers of the sixth and seventh grades normally wore green, but when they were commissioned to work outside the capital they could wear the colour of the fourth and fifth grade officers, which was red. This was known as *jiefei* 借緋 (borrowed red). Lu, being only an officer of the seventh grade, had to use this term as an indication of his brevet grade.

Yudai 魚袋 (fish pouch) was a fish-shaped tally carried in a pouch by civil servants. An officer carried his fish pouch in accordance to the colour of his robe. When emperor Taizong in 977 gave permission to officers commissioned to work outside the capital to wear a colour of the next higher grade, the concession applied only to the colour of the robes. It was only in the year 1111 that emperor Huizong 徽宗 extended the privilege to the colour of the fish pouches. Since Lu was using the term *jiefei* in connection with his fish pouch, the earliest date that he could do so was 1111. This sets the upper limit for the year Lu submitted the book to the throne. One can then conclude that the *Cantongqi wuxianglei miyao* was submitted to emperor Huizong, a patron of Daoism, between 1111 and 1117.

Although the name Lu Tianji does not appear in the Song dynastic history, one can find the following entry on a certain Lu Xiang 盧襄 in the *Zhongguo renming dacidian* 中國人名大辭典 (Dictionary of Chinese Personal Names):

Lu Xiang, native of Quzhou 衢州, in the Song period; original name Tianji 天驥, style (zi 字) Junyuan 駿元, avoided the [taboo] word 'tian' during the reign of Huizong and changed his personal name to Xiang 襄, but retained his style Junyuan; gained *jinshi* 進士 degree during the Dagan 大觀 reign-period (1107–1110), was appointed *Libu shilang* 吏部侍郎 (Secretary to the Ministry of Personnel) during the Jingkan 靖康 reign-period (1126–1127); wrote *Xizheng ji* 西征記 (Travels to the West).⁵⁰

Although the *Zhongguo renming dacidian* is not always reliable, in this particular case it can be substantiated. The *Xizheng ji* is included in the *Hanfen lou* 涵芬樓 edition of the *Shuofu* 說郛 collection. For the authorship of the *Xizheng ji* the *Shuofu* gives: 'Song dynasty; Lu Xiang, style Zanyuan 贊元, person of Sanqu 三衢.'⁵¹

According to the *Qinding Sikū quanshu zongmu tiyao* 欽定四庫全書總目提要 (Abstracts for the Complete Table of Contents of the Complete Books of the Four Repositories), the *Xizheng ji* was written by Lu Xiang during the Song period and that Lu's style (zi) was Zanyuan.⁵² The preface says that he was from Quzhou. The book was written when Lu Xiang went to the capital to take part in the Spring Examination during the third year of the Yuanfu 元符 reign-period of emperor Huizong, that is, in the year 1100. It seems, however, that he was admitted to the *jinshi* degree in the year 1107, after more than one attempt. His official appointment would have to be after this event. The date agrees with the period between the years 1111 and 1117 when Lu Tianji presented the *Cantongqi wuxianglei miyao* containing the commentary he wrote. Furthermore, the *Zhejiang*

tongzhi 浙江通志 (Gazetteer of Zhejiang Province) includes the name Lu Tianji in the *jinshi* examinations pass list for the first year of the Daguan reign-period (1107) with a note stating that he was a native of Xi'an 西安 and had later changed his personal name to (Lu) Xiang.⁵³ Several places in China have been known as Xi'an, but here it must refer to a place in Zhejiang province since it is mentioned in the *Zhejiang tongzhi*. In fact it was a *xian* 縣 (district) in Quzhou prefecture. Written in a good literary style, the *Xizheng ji* reflects the 'other worldly' attitude of the author and his aspirations to visit the West to find the abodes of the holy immortals. Thus it is quite likely that the same author was responsible for both the *Xizheng ji* and the commentary in the *Cantongqi wuxianglei miyao*.

Main text of the *Cantongqi wuxianglei miyao*

The main text of the *Cantongqi wuxianglei miyao* differs very much from that of the commentary. It was also not common for Chinese authors to write both the text and commentary. The main text is unlikely to have been written by Lu and thus has to originate from before the period 1111 to 1117, when the commentaries were written. Its original form could be either an alchemical book or simply notes.

The bibliographies of the *Jiu Tangshu* 舊唐書 (Old History of the Tang Dynasty) list a book under the title *Zhouyi wuxianglei* 周易五相類 by Wei Boyang. Now Wei Boyang's *Cantongqi* has all along been also known as *Zhouyi cantongqi* 周易參同契. In other words, the term *Zhouyi* could be dropped when referring to the *Zhouyi cantongqi*. One may speculate whether it was possible that there was an original text known as *Zhouyi cantongqi wuxianglei* 周易參同契五相類 or *Cantongqi wuxianglei*, but the compilers of the *Jiu Tangshu* had dropped the term *cantongqi* instead and listed the title as *Zhouyi wuxianglei*. Should this be the case then there would have been such a text already known in the Tang dynasty, and the term *miyao* was later added to the title when the commentary was written.

Assuming the main text to be Tang, let us compare it with Mei Biao's *Shiyao erya* 石藥爾雅, written around the year 806. As noted earlier, many of the alchemical terms in the main text are not found in the *Shiyao erya*. One cannot jump to the conclusion that what Mei Biao missed must come after his time, since we cannot expect him to have had access to, or even to have heard of every text written on alchemy in such a vast country as China, not to mention the arcane nature of the subject. The question to ask should rather be which of the two was earlier. We are helped, at least partially, to answer this question by another text in the Daoist Canon, namely the *Wei Boyang qifan dansha jue* 魏伯陽七返丹砂訣 (Explanations of the Seven-Fold Cyclically Transformed Cinnabar Elixir of Wei Boyang). This book is attributed to the second-century alchemist Wei Boyang and contains a commentary by Huang Tongjun 黃童君. Mei Biao mentions Huang Tongjun in his *Shiyao erya* and lists a book entitled *Qifan lingsha ge* 七返靈砂歌 (Song of the Seven-Fold Cyclically Transformed Cinnabar Elixir) written by Wei Boyang and annotated by Huang (Tong) jun.⁵⁴ Huang Tongjun must have written his annotations earlier than the year 806, and the text he annotated must be still earlier. It is interesting to find that the early parts of the main texts of both the *Cantongqi wuxianglei miyao* and the *Wei Boyang qifan dansha jue* are almost identical. Hence one may conclude that the main text of the

Cantongqi wuxianglei miyao, or at least part of it, can be traced back to a time earlier than the eighth century.

All the bibliographies we have examined attribute both the *Cantongqi wuxianglei* or the *Zhouyi wuxianglei* and the *Qifan dansha jue* or the *Qifan lingsha ge* to the second-century alchemist Wei Boyang. But until we can find further evidence, whether Wei Boyang was the actual or only the putative author must remain an open question. Surely the style of the *Cantongqi wuxianglei miyao* is far less obscure than the basic work of Wei Boyang, the *Cantongqi* itself. But such is the continuity of Chinese prose style through the ages that there is no intrinsic ground for denying that this could be a Later Han text, and we cannot rule out the possibility that Wei Boyang wrote two different texts, the *Cantongqi* in an obscure style for the general reader (and hence it became widely known) and the *Cantongqi wuxianglei* for the specialists, his own disciples for example. Nevertheless, at this juncture we can only come to the conclusion that the main text of the *Cantongqi wuxianglei miyao* was written not later than the eighth century and the commentary must have been finished by the year 1117.

Dating the *Chunyang Lü Zhenren yaoshizhi* 純陽呂真人藥石製 (The Immortal Lü Dongbin's Book on Preparation of Drugs and Minerals)
(Figure 2.2)

Authorship

Quite a different method from that used for dating the *Cantongqi wuxianglei miyao* had to be employed when it came to the *Chunyang Lü Zhenren yaoshizhi* (hereafter *CLZ*). Apart from the name of its putative author Lü Chunyang 呂純陽, better known as Lü Dongbin 呂洞賓, the text mentions no other personal names, and says nothing about official ranks or titles, geographical names or reign titles. It also shows no effort to avoid *taboo characters*. At first sight one can only conclude that the text was written before the year 1445, when it was incorporated into the Daoist Canon, and that its putative author was Lü Dongbin, who subsequently became one of the *baxian* 八仙 (eight holy immortals) in Chinese folklore. We do not even know the exact period when Lü Dongbin flourished, if we even consider him to be a real person. Many legends built around him say that he flourished in the late Tang, about the eighth and ninth centuries, but it was only during the eleventh and the twelve centuries that he became heard of as a holy immortal; some modern scholars say that he was a Nestorian. This is not the place to get involved in this complex issue. We can only say, from the use of the name Lü Dongbin, that the eighth and ninth centuries give the upper limit of the date when the text was written, and from its inclusion in the Daoist Canon the year 1445 sets the lower limit for the date. To narrow down this wide range that extends to well over seven centuries, it is necessary to resort to linguistic analysis and comparison of technical names with known pharmacopoeia. The two studies, provided later on, both show that the *CLZ* was a fifteenth-century work, written not long before the publication of the Daoist Canon in the year 1445. Hence its author could not be Lü Dongbin, even if he was a real person.

一第 製石藥人真呂碧視

純陽呂真人藥石製
 天寶龍芽 赤斤
 草中第一最為先點成莫遇有蟄伏製五
 金井八石會無頑銅較似綿
 寶砂龍芽 桑葉
 青葉白華在野田農人栽種也為先凡流不
 解神仙果亦點頑銅較似綿
 對節龍芽 益母
 青葉白華長野田燒煉成霜大有蟄伏製五
 金井八石鴉塗尚自得延年
 味索龍芽 杜松兄
 不栽不種在高坡成時米醋莫輕他伏製水
 銀成頑定街人用意自消磨
 二氣龍芽 山荷葉
 水大造化結成砂水山背後我出家疏黃水
 銀伏成寶街人會得玉無瑕
 五鳳龍芽 管仲
 五鳳多生深淵中意生高長一叢叢只在五
 月中秋採恰似鳳凰翅尾同
 天刀龍芽 言蒲

Figure 2.2 The first page of the *Chunyang Lüzhennren yaoshizhi* from the Daoist Canon.

The poems

The whole text is written in verse, consisting of sixty-nine stanzas, of which one (stanza no. 46) is missing. By studying the prosody of these verses one can make a good estimation of the date of their composition. All except two (eight and nineteen) of the stanzas are of the type known as ‘seven-word broken-off lines’ (*qiyán jueju* 七言絕句) with each stanza consisting four lines of seven characters each. The two exceptions are of the type ‘five-word broken-off lines’ (*wuyan jueju* 五言絕句) with each stanza consisting four lines of five characters each. These two styles of poetry were developed during the Tang period and have been included among the so-called *modern style verses* (*jinti shi* 近體詩) by scholars since the time of Tang.

To illustrate the process of dating through linguistic analysis take, for example, stanza no. 6 of the text, which when rendered into English reads

The Five-Phoenixes Dragon Sprout (*Aspidium falcadum*; wood fern)
 Deep within the mountain streams,
 Phoenixes Five is their name;
 These the alchemist esteems,
 And their lushness will acclaim.
 Harvesting the leaves is done
 Only in the seasons blest;
 Fifth moon or mid-autumn—
 Under these the task is best.
 Strange the name and strange the shape—
 This is no prosaic thing—
 For the leaves distinctly ape
 Phoenix tail and phoenix wing.

The original verse read in the modern Chinese common dialect (*Putonghua*) would be as follows:

Wufeng longya

wǔ fēng duō shēng shēn jiàn zhōng

yì shēng gāo cháng yí cóng cóng

zhī zài wǔ yuè zhōng qiū cǐ

qià sì fēng huáng chì wěi tóng

五鳳龍芽

五鳳多生深澗中

意生高長一叢叢

只在五月中秋採

恰似鳳凰翅尾同

(The four marks ˊ, ˋ, ˊ and ˋ over each character denote Chinese tones rather than the usual diacritical marks.)

One needs to bear in mind that the sound of a Chinese character or word varies both with time and space. The original composer of the verse certainly did not read it in the same way as above, and it could never have been in modern Chinese. The above rendering is only meant for the purpose of explaining the process of rhyming in Chinese poetry. We shall presently return to the question of how it might have been read by its original composer.

The whole stanza is rhymed upon the last word *zhong* in the first line. We can observe that the last word of the second line and the least word of the fourth have the same final syllable ‘-ong’ as *zhong*. Here we have a case of double rhyming with two lines having a last word each rhyming with the last word of another line. There are other stanzas in the *CLZ* that are only single rhyming, having only two lines with their last words rhyming. The rhyming words in all the sixty-seven stanzas enable us to estimate the date of the text.

It is not possible here to go into the complex question of Chinese phonology in depth. For our present purpose it suffices to give a brief description of the functions of tones in Chinese poetry. Modern *putonghua* distinguishes four tones, namely *yin* even (*yinping* 陰平), *yang* even (*yangping* 陽平), rising (*shang* 上) and falling (*qu* 去). These four tones are not exactly similar to what are known as ‘the four tones’ (*sisheng* 四聲) in books of rhymes and in some other Chinese dialects, such as Cantonese. The four tones used by the books of rhymes are even (*ping* 平), rising (*shang*), falling (*qu*) and entering (*ru* 入). Thus the *putonghua* dialect is sometimes regarded to have only three tones, even, rising and falling, but with the even tone divided into two. In some other dialects, for example the Chaozhou dialect, each tone is subdivided into two, giving rise to eight tones, and in the case of Cantonese the even, rising and falling tones are subdivided into two each, while the entering tone is subdivided into three, giving rise to nine tones in all. Here it is sufficient to note that Chinese poetry takes the books of rhymes as guide.

The pronunciation of Chinese words changes with time. To take account of this variation Chinese scholars have, from time to time, compiled dictionaries of sounds grouping together words or characters that rhymed with one another. Among the many dictionaries of sounds written were the *Shenglei* 聲類 (Classifications of Sounds) compiled by Li Deng 李登 in the third century, and Lu Jing’s 呂靜 Yunji 韻集 (Collection of Rhyming Words) in the fourth century. In the year 601 Lu Fayan 陸法言 and others

composed the *Qieyun* 切韻 (Dictionary of the Sounds of Characters), while in 751 Sun Mian 孫愐 wrote the *Tangyun* 唐韻 (Tang Rhymes). However, only fragments of these two books survive. The earliest book extant in this subject in its complete text is the *Guangyun* 廣韻 (Enlarged Dictionary of Sounds) composed by Chen Pengnian 陳彭年 and others in 1008. The *Guangyun* was based largely on the *Tangyun* that succeeded the *Qieyun*. In the year 1039 Ding Du 丁度 and others revised the *Guangyun* to produce the *Jiyun* 集韻 (Collected Rhyming Words). Then in 1252 Liu Yuan 劉淵 composed the *Renzi xinkan libu yunlüe* 壬子新刊禮部韻略 (Ministry of Rites Outline of Rhymed Words Newly Published in the *Renzi* year). The rhymed words in this book formed the basis of what later became known as ‘poetry rhymes’ (*shiyun* 詩韻) or ‘pingshui rhymes’ (*pingshui yun* 平水韻), named after the birthplace of the author. Many changes were introduced in 1324 when Zhou Deqing 周德清 wrote the *Zhongyuan yinyun* 中原音韻 (Dictionary of Sounds of Henan Province). Several other dictionaries of sounds subsequently made their appearance. Among them the *Wufang yuanyin* 五方原音 (Original Sounds of the Five Directions), written by Fan Tengfeng 樊騰鳳 (1624–72), was used in the present study. For further information on dictionaries of sound one can refer to specialised book on the subject, such as the works of Wang Li 王力.⁵⁵

In dictionaries of sounds the characters are placed in groups where all characters within the same group rhyme with one another. A rhyme group is further divided according to the tone of the sound. The *Guangyun*, for example, has 206 rhyme groups, classified under high even (*shangping* 上平), low even (*xiaping* 下平), rising, falling and entering tones, while the *Zhongyuan yinyun* identifies only nineteen rhyme groups, classified under *yin* even, *yang* even, rising and falling, with words formerly under entering and some in the falling tone reclassified under these new categories. In Chinese poetry all except the even tones, namely the rising, falling and entering tones, are also known collectively as oblique tones (*zesheng* 仄聲 or *zeyun* 仄韻). The tones, whether even or oblique, have to match according to the particular style of the verse. In the rhymed seven-word broken-off lines beginning with a character in the oblique tone and rhymed on the last character in the first line with an even tone the pattern of the tones should be as follows:

oblique	oblique	even	even	oblique	oblique	even
even	even	oblique	oblique	oblique	even	even
even	even	oblique	oblique	even	even	oblique
oblique	oblique	even	even	oblique	oblique	even

Apart from some flexibility for the first, third and fifth characters in the lines, characters must be chosen according to this pattern. In the example of stanza no. 6, the character *zhōng* at the end of the first line has a high even tone, *cóng* at the end of the second line a low even tone, and *tóng* at the end of the last line also has a low even tone, all following the pattern. In this particular example all these three words are classified under the same group in the *Guangyun*.

On comparing all the sixty-seven stanzas in the book with the *Guangyun* dictionary of sounds only fifteen of them (namely stanza nos 3, 5, 6, 9, 22, 26, 34, 36, 39, 50, 52, 54 and 58) are found to rhyme perfectly. We then proceeded with similar dictionaries of

sounds of later dates. On comparing with Liu Yuan's *Renzi xinkan libu yunlüe* of 1252, it is found that twelve more stanzas (namely nos 1, 2, 4, 14, 15, 25, 37, 48, 51, 62, 63 and 68) rhymed perfectly. Then using Zhou Deqing's *Zhongyuan yinyun* of 1324 another seventeen more (namely nos 13, 18, 19, 20, 21, 29, 32, 35, 36, 40, 43, 47, 49, 57, 59, 61 and 65) are perfectly in rhyme, representing forty-four out of sixty-seven or almost two-thirds of all the stanzas. Finally, when we compared them to the *Wufang yuanyin* of Fan Tengfeng we found that all the stanzas were in perfect rhyme. Hence if all the stanzas were originally meant to rhyme they could not have been composed before 1324, the year Zhou Deqing wrote his *Zhongyuan yinyun*. However, since the book containing these stanzas was printed in 1445 in the Daoist Canon, the composer probably lived between 1324 and 1445, much closer to the time of Zhou Deqing's *Zhongyuan yinyun* than Fan Tengfeng's *Wufang yuanyin*. In the fourteenth century, stanza no. 6, which we have just cited, might have been recited somewhat as follows:⁵⁶

	fùn	tūo	ǎŋ	īm	kiàn	tǐūŋ
ì	ǎŋ	kāu	tǎŋ	ī	tsúŋ	tsúŋ
tǐ	tsài		yɛ	tǐūŋ	tsáu	ts i
ka	sì	f ŋ	χūaŋ	tǐ	vui	túŋ

(All the tones are those given in the *Zhongyuan yinyun*. Those unmarked ones, namely 'i', 'tǐ', 'yɛ' and 'ka' are of the entering tone.)

If we now write down the tones according to whether they are even or oblique we get the following:

oblique	oblique	even	even	even	oblique	even
oblique	even	even	oblique	oblique	even	even
oblique	oblique	oblique	oblique	even	even	oblique
oblique	oblique	oblique	even	oblique	oblique	even

Comparing with the pattern for the rhymed seven-word broken-off lines we find six of the characters have not followed the rule, but the first and the third characters in each line, and also sometimes the fifth, may be excused from the rule and we have at least one infringement in this case, namely, the second character in the third line.

Let us look at another example in one of the two rhymed five-word broken-off lines in stanza no. 8, which we have rendered into English to read:

The Embroidered Carpet Dragon Sprout

(*Euphorbia humifusa* Willd. or Thyme-Leaf Spurge)

Deep within the mountain range
You will find this mystic plant,
And its properties are strange—

Hidden powers it will grant.
 Flowers red, and red its leaves,
 And the leaves are round like coins;
 Strange effects the sage achieves—
 To the humble leaves he joins
 Some realgar—the result;⁵⁷
 Medicine's made successfully;
 Eaten as a sacred cult
 This will give longevity.

The original verse read in the fourteenth century probably sounded somewhat as follows:

χūŋ	χūa	tʃi n	.ʃim	ʃān	紅華長深山
yɛ	tʃi	yɛ'n	sì	tsíɛn	葉赤圓似錢
fu	tʃi	χīuŋ	ūi	iau	伏製雄為藥
fu	tʃi	ti	īɛn	nīɛn	服之得延年

In the *Zhongyuan yinyun* the last word of the second line rhymes with the last word of the fourth line, while by the time Fan Tengfeng wrote his *Wufang yuanyin* the last words of the first, second and fourth lines would rhyme with all of them taking the ending *-an*.

The pattern of a rhymed five-word broken-off lines stanza beginning the first line with a character in the even tone and rhymed on the last character of the first line, should be as follows:

even	even	oblique	oblique	even
oblique	oblique	oblique	even	even
oblique	oblique	even	even	oblique
even	even	oblique	oblique	even

Our original verse, however, is of the following pattern:

even	even	<i>oblique</i>	even	even
oblique	<i>oblique</i>	<i>even</i>	<i>oblique</i>	even
oblique	oblique	even	even	oblique
<i>oblique</i>	even	oblique	oblique	even

The tones in italics show the departure from the recognised pattern of a rhymed five-word broken-off lines verse. Allowing for the first and the third characters in the line we still find that the rules were infringed again three times in this stanza.

In these particular styles of Tang poetry standard patterns have to be strictly followed and at the same time the poet's feelings and sentiments should be fully expressed. These do not seem to be the characteristics of the verses in the *CLZ*. The two stanzas that we have seen are sufficient to show that the verses in the *CLZ* did not come from the pen of a distinguished poet or scholar, but rather from that of a very ordinary *literatus*. However, this unknown author has more to tell us about when and where he flourished in the plants that he wrote about. He could have been an unknown Daoist adept, flourishing some time between the years 1324 and 1443 and spending much of his time roaming among the mountains and the countryside studying the use of various wild plants for elixir purposes.

Plant names

The text of the *CLZ* mentions a total of sixty-two plants, all of which are supposed to be useful as elixir ingredients. All of them are given synonyms as different types of 'dragon sprouts' (*longya* 龍芽). However, the name *longya*, as applied to any one of these sixty-two plants, is not a special or technical term, but only a synonym for any of these plants, because of its use by the alchemist for the particular purpose of elixir making. The word *long* 龍, meaning dragon, refers to something auspicious or something beyond the mundane world. In any case, it was a common Daoist word used in conjunction with the word *hu* 虎, meaning tiger. The term 'dragon and tiger' (*longhu*) appear frequently in Daoist alchemical texts, such as the *Cantongqi*. The name 'dragon teeth plant' (*longyacao* 龍牙草; 龍芽草) first appeared in the early sixth-century medical treatise *Mingyi bielu* 名醫別錄 (Record of Famous Physicians) of Tao Hongjing 陶弘景 (456–536), which only survives in quotation. It also turns up in the thirteenth-century *Chongxiu Zhenghe jingshi zhenglei beiyong bencao* 重修政和經史證類備用本草, which also gives the name of another plant called 'purple spine dragon teeth' (*zibei longya* 紫背龍牙). The twelfth-century book *Xixi congyu* 西溪叢語 (Collected Remarks from the Western Pool) by Yao Kuan 姚寬 mentions a variety of tea called 'ten-thousand [years of] longevity dragon sprout' (*wanshou longya* 萬壽龍芽). Probably the two homonyms *ya* for teeth and sprout had become interchangeable. However, the term *longya*, whether meaning 'dragon teeth' or 'dragon sprouts', was quite uncommon in pharmacopoeia and Daoist alchemical texts written during or before the Song dynasty.⁵⁸

Only two alchemical texts use the term *longya* widely, namely the *CLZ* and the *Xuanyuan Huangdi shuijing yaofa*. The suggestion is that both these texts must be post-Song. We are also led to the same conclusion by Li Shizhen 李時珍, who wrote in his *Bencao gangmu* that 'recent alchemists called various plants as different dragon teeth, giving rise to considerable confusion' and doubted their credibility.⁵⁹ When referring to a period spanning over 1,300 years from the *Shennong bencaojing* 神農本草經 to the writing of the *Bencao gangmu* in 1596, 'recent alchemists' could mean alchemists up to three centuries before Li Shizhen's time. We take it to mean alchemists earlier than but close to the year 1445 when the Daoist Canon was printed.

Occurrences of plant names in the pharmacopoeia⁶⁰

The earliest Chinese pharmacopoeia *Shennong bencaojing* that came to its final form about the second century AD is no longer extant, but it forms the basis of all subsequent pharmacopoeias and is widely quoted. From these quotations the text of the *Shennong bencaojing* has been reconstituted. The names of the following twenty-five plants in the *Chunyang Lü Zhenren yaoshizhi* occur in the *Shennong bencaojing*:

Stanza no. 2	<i>sangye</i> 桑葉	mulberry leaves
Stanza no. 3	<i>yimu</i> 益母	<i>Leonurus sibiricus</i> , L.
Stanza no. 7	<i>changpu</i> 菖蒲	<i>Acorus gramineus</i> , Ait.
Stanza no. 9	<i>xuduan</i> 續斷	white nettle
Stanza no. 10	<i>gancao</i> 甘草	licorice
Stanza no. 11	<i>yangti</i> 羊蹄	<i>Rumex orisphus</i> , L.
Stanza no. 13	<i>tusizi</i> 兔絲子; 菟絲子	choisy or dodder
Stanza no. 17	<i>banxia</i> 半夏	<i>Pinellia tuberifera</i> , Ten.
Stanza no. 19	<i>lancao</i> 藍草	indigo plant
Stanza no. 21	<i>liuxu</i> 柳絮	<i>Salixbabylonica</i> , L.
Stanza no. 23	<i>daji</i> 大戟	Peking spurge
Stanza no. 27	<i>gouqi</i> 枸杞	<i>Lycium chinense</i> , Mill.
Stanza no. 28	<i>cheqianzi</i> 車前子	<i>Plantago major</i> , L.
Stanza no. 31	<i>songluo</i> 松蘿	pine creepers
Stanza no. 34	<i>juhua</i> 菊華	chrysanthemum blossom
Stanza no. 39	<i>shaoyao</i> 芍藥	Chinese peony
Stanza no. 40	<i>mudan</i> 牡丹	tree peony
Stanza no. 41	<i>song</i> 松	pine tree
Stanza no. 42	<i>bai</i> 柏	<i>arbor vitae</i>
Stanza no. 43	<i>kui</i> 葵	Chinese mallow
Stanza no. 51	<i>suanzao</i> 酸棗	wild jujube
Stanza no. 52	<i>cong</i> 蔥	Chinese small onion
Stanza no. 55	<i>dihuang</i> 地黃	<i>Rehmannia glutinosa</i> , Lib.
Stanza no. 58	<i>xiakucao</i> 夏枯草	<i>Prunella vulgaris</i> , L.
Stanza no. 64	<i>zhimu</i> 知母	<i>Anemarrhena asphodeloides</i> , Bge.

One more plant name entered the pharmacopoeia during the third century when Wu Pu 吳普 wrote the *Wushi bencao* 吳氏本草 (Pharmacopoeia of Mr Wu)⁶¹. That was the plant *huangcao* 黃草 (*Artemisia vulgaris*, L.) in Stanza no. 60. When Tao Hongjing wrote the *Mingyi bielu* in the sixth century he included another seven more plant names later found in the *CLZ*, namely:

Stanza no. 12	<i>yingtao</i> 櫻桃	cherry
Stanza no. 24	<i>machi</i> 馬齒	purslane
Stanza no. 33	<i>chunmu</i> 楮木	fragrant cedar
Stanza no. 37	<i>shacao</i> 莎草	nutgrass
Stanza no. 48	<i>dibianzhu</i> 地編竹	gooseweed
Stanza no. 53	<i>jiu</i> 韭	<i>Allium odorum</i> , L.
Stanza no. 57	<i>wasong</i> 瓦松	<i>Cotyledon fimbriata</i> ?

About the year 658 the *Tujing bencao* 圖經本草 (Illustrated Pharmacopoeia) was written, but subsequently became lost. Around 1061, Su Song 蘇頌 incorporated three more plant names into his Illustrated Pharmacopoeia, *Bencao tujing* 本草圖經, that was meant to replace the *Tujing bencao*.⁶² Three plant names come from quotations from the *Tujing bencao*. They are:

Stanza no. 25	<i>fuping</i> 浮萍	duckweed
Stanza no. 54	<i>naidong</i> 柰冬	<i>Trachelospermum divaricatum</i>
Stanza no. 56	<i>lingxiao</i> 凌霄	<i>Tecoma grandiflora</i> , Loisel

About the year 660 another three more plant names are listed in the *Tang xinxiu bencao* 唐新修本草 (Tang Pharmacopoeia) of Su Gong 蘇恭. These are as follows:

Stanza no. 1	<i>chiqin</i> 赤芹	<i>Corydalis incisa</i> , Pers.
Stanza no. 36	<i>xianlingpi</i> 仙靈脾	<i>Epimedium macranthum</i> , Morr. et Dene.
Stanza no. 63	<i>gegenman</i> 葛根蔓	<i>Pueraria hirsuta</i> , Schneid.

Stanza no. 30 about lotus leaf *heye* 荷葉 comes from the early eighth-century pharmacopoeia *Shiliao bencao* 食療本草 (Pharmacopoeia of Foodstuffs), written by Meng Shen 孟詵. Stanza no. 20 concerns the Chinese radish, *luobo* 蘿蔔 (*Raphanus sativus*, L.) that first came to mention in the tenth-century *Shu bencao* 蜀本草, compiled by Han Baosheng 韓保昇 *et al.* and which is now lost. Another lost tenth-century pharmacopoeia,

the *Kaibao bencao* (Pharmacopoeia of the Kaibao Reign) by Li Fang 李昉 *et al.*⁶³ contains four more plant names, namely:

Stanza no. 26	<i>gujingcao</i> 谷精草	pipewort
Stanza no. 38	<i>tiannanxing</i> 天南星	Jack-in-the-pulpit
Stanza no. 61	<i>qiezi</i> 茄子	eggplant
Stanza no. 62	<i>zisu</i> 紫蘇	<i>Perilla nankinensis</i> , Decne.

Another four plant names are included in the now lost *Rihuazi bencao* 日華子本草 (Pharmacopoeia of Master Rihua) composed during the first half of the tenth century,⁶⁴ namely:

Stanza no. 14	<i>xuancao</i> 萱	yellow day lily
Stanza no. 32	<i>ciji</i> 刺薊	tiger thistle
Stanza no. 35	<i>heidou</i> 黑豆	black soybean
Stanza no. 66	<i>lianhua</i> 蓮花	lotus flower

Then in the *Jiayou bencao* 嘉祐本草 (Pharmacopoeia of the Jiayou Reign),⁶⁵ compiled in 1059 by imperial order is listed the single item *yiban* 衣班 (thymeleaf spurge) in Stanza no. 8. The *Jiayou bencao* was followed by the *Bencao tujing* of Su Song. This mentions another three of the plant names in the *CLZ*, namely:

Stanza no. 44	<i>zhangliu</i> 章柳	poke root
Stanza no. 47	<i>duzhoucao</i> 獨帚草	<i>Kochia scoparia</i> , Schrad.
Stanza no. 65	<i>youdianye</i> 油點葉	<i>Potentilla Kleiniana</i> , Wight.

It is the *Bencao tujing* that helps to identify *youdianye*. *CLZ* gives it as a synonym for *zibei longya* 紫背龍牙, another synonym that the *Bencao tujing* identifies as *shehan* 蛇含 (*Potentilla Kleiniana*, Wight). The following table indicates the number of plant names in the *CLZ* that appeared for the first time in pharmacopoeia up to the Song period:

<i>Name of pharmacopoeia</i>	<i>Number of plant names</i>
<i>Shennong bencaojing</i> 神農本草經 (c.second century AD)	25
<i>Wushi bencao</i> 吳氏本草 (third century AD)	1

<i>Mingyi bielu</i> 名醫別錄 (sixth century)	7
<i>Tujing bencao</i> 圖經本草 (c.658)	3
<i>Tang bencao</i> 唐本草 (c.660)	3
<i>Shiliao bencao</i> 食療本草 (early eighth century)	1
<i>Shu bencao</i> 蜀本草 (tenth century)	1
<i>Kaibao bencao</i> 開寶本草 (c.973)	4
<i>Rihuazi bencao</i> 日華子本草 (tenth century)	4
<i>Jiayou bencao</i> 嘉祐本草 (c.1057)	1
<i>Bencao tujing</i> 本草圖經 (c.1061)	3
Total	53

The total number of plant names in the *CLZ* amounts to sixty-two, with two of the plant names repeated once in another stanza and one of the plant names repeated twice. Hence nine of the plant names appear to be unattested from the time of the Song and before, suggesting that what we are dealing with is a post-Song text.

We have no pharmacopoeia of the Yuan period (1271–1368) to make any useful comparison. However, about half a century after the Yuan we come to a period when the first illustrated botanical monograph on edible wild plants was written in China, the *Jiuhuang bencao* 救荒本草 (Famine Relief Pharmacopoeia) by one of the Ming princes, Zhu Su 朱橚 (1361–1425) in 1406.⁶⁶ This work contains 414 plant names, most of which are not found in previous pharmacopoeia. This is not surprising, because the purpose of the book was to find food substitutes and herbs for use in time of famine, unlike other pharmacopoeia that catered for the sick and seekers of longevity. The *Jiuhuang bencao* was followed in the next two centuries by three further similar writings, namely the *Yecai pu* 野菜譜 (Treatise of Wild Vegetables) by Wang Pan 王磐 (fl. 1522–66), the *Rucan pian* 茹草篇 (Book of Edible Herbs) by Zhou Lüjing 周履靖 in 1597, and lastly the *Yecai bolu* 野菜博錄 (Encyclopaedia of Wild Vegetables) of Bao Shan 鮑山 in 1622. It is interesting that no less than 30 per cent of the plant names mentioned in the *CLZ* are also listed in the *Jiuhuang bencao*, and three of them are found for the first time in that pharmacopoeia. The three plant names are as follows:

Stanza no. 22	<i>zaojiao</i> 皂角	soap bean
Stanza no. 46	<i>yangjiaomiao</i> 羊角苗	Chinese yam
Stanza no. 48	<i>dibianzhu</i> 地編竹	Knotweed or gooseweed

Another plant name *tuchuanghua* 禿瘡花 (*Mazus rugosus*, Lour.) in Stanza no. 16 appears in another book written by a brother of Zhu Su, namely the *Gengxin yuce* 庚辛玉冊 (Precious Secrets of the Realm of Geng and Xie, that is, Metals and Minerals), written by Zhu Quan 朱權 (1378–1448).⁶⁷ We are now left with five more plant names to be

accounted for. Among them four are mentioned in Li Shizhen's *Bencao gangmu* (first printed 1596), namely:

Stanza no. 4	<i>dulier</i> 杜梨兒	small coarse pear
Stanza no. 5	<i>shanheye</i> 山荷葉	umbrella leaf
Stanza no. 6	<i>guanzhong</i> 管仲	wood fern
Stanza no. 50	<i>bocai</i> 菠菜	spinach

The remaining name *huzhai* 護宅 ('guardian of the house') in Stanza no. 15 has not been found in the pharmacopoeia. It is very probably identifiable with *huhuo* 護火 ('guardian against fire') (*Seduin illboroseum*, Bak. or Stonecrop), judging from a synonym of the former, *suiyan longya* 碎焰龍芽 ('flame-crushing dragon sprout').

From our previous analysis of the prosody of the *CLZ* we showed that the work should have been written between 1324, when Zhou Deqing wrote his *Zhongyuan yinyun*, and 1445 when the Daoist Canon was printed. Comparison of plant names indicates that the author of this Taoist treatise might even have been a contemporary of the Ming prince Zhu Su. The author was studying different plants, especially wild ones, for their microbiotic properties, while the Ming prince was primarily interested in them for their use as food substitutes and herbs in time of famine. Some of these plants were later found also to have medicinal value and came to be included in the *Bencao gangmu*.

By studying the habitat of the plants included in this treatise it is found that Shandong province produced the largest number of these plants, followed by Henan and Anhui provinces. Other plants have their habitat in Hebei, Shanxi, Shaanxi, Gansu, Qinghai, Sichuan, Guizhou, Jiangsu, Zhejiang, Fujian, Guangxi, and Guangdong provinces. Some of the plant names were used exclusively in certain areas in China, for example the name *zhangliu* 章柳 in Stanza no. 44 was used by people in north China, and so was the name *zaojiao* 皂角 in Stanza no. 22. People in central and south China would call them *shanglu* 商陸 and *zaojia* 皂莢 respectively. Perhaps the author was a Daoist alchemist with a good knowledge of herbal medicine flourishing in China some time between 1324 and 1445, but probably around the turn of the century when Zhu Su wrote the *Jiuhuang bencao*. It is possible that he came from north China, probably Shandong and, if not, Henan or Anhui. In his search for elixir plants he had probably roamed the mountains and valleys in the confluents of the Yangzi and the Huanghe rivers, and had perhaps ventured to south China.

Dating the *Xuanyuan Huangdi shuijing yaofa* 軒輊黃帝水經藥法 (Medicinal Methods from the Aqueous Manual of Xuanyuan, the Yellow Emperor)

The *Xuanyuan Huangdi shuijing yaofa* (hereafter *XHD*) (Figure 2.3) is an alchemical tractate on aqueous solution using minerals, plants, vinegar and



Figure 2.3 The preface to the *Xuanyuan Huangdi shuijing yaofa* from the Daoist Canon.

alcohol. There are thirty-two different solutions in all, each with its own magical properties. For example, the first recipe claims to give the power of immunity to heat and cold, walking with the speed of wind and rain and seeing the spirits; the fifth would make one immune from drowning in water; the sixth would protect one against fire; the seventh would prolong one's life to 300 years and nullify the force of gravity so that one could rise at will to a height of 100 feet; the twentysecond would render the alchemist invulnerable to weapons, and so forth. A glossary of *longya* follows the recipes. The tractate ends with a poem written in the rhymed seven-word broken-off lines style. The aqueous solutions and their efficacies described in this tractate are quite different from those of the *Sanshiliu shuifa* 三十六水法 (Thirty-Six Methods of Bringing Solids into Aqueous Solutions).⁶⁸ A characteristic of their methods is the use of plants that had been given synonyms of *longya*. Hence, in spite of the attribution of the tractate to Xuanyuan, the Yellow Emperor of great antiquity in the legendary period, the first impression one gets is that this may not be such an old text after all.

Textual comparison

The dating of the *CLZ* earlier enables us to study the *XHD* with comparative ease. Table II at the end of this book compares the terms used for particular plants, the names of the actual plants being referred to, and their properties as mentioned in these two books. From the list we notice that five out of the sixty-six plant names in *CLZ* are not found in *XHD*, namely nos 12, 32, 33, 43, and 57, while six out of the sixty-seven plant names in *XHD*, items (a) to (f), are not to be found in *CLZ*. Hence there are sixty-one plant names common to both *CLZ* and *XHD*. Among the sixty-one common items, eighteen are exactly similar in both, namely plants numbered 4, 8, 19, 20, 23, 24, 26, 27, 28, 31, 41, 45, 54, 55, 60, 63, 64 and 66, while forty-one others are almost identical, namely plants numbered 1, 2, 3, 5, 6, 7, 9, 10, 11, 12, 15, 16, 17, 18, 21, 22, 25, 29, 30, 31, 35, 36, 37, 38, 39, 40, 42, 44, 47, 48, 49, 50, 51, 52, 53, 56, 58, 59, 61, 62 and 65.

There is a striking similarity between the *longya* in the two alchemical texts—fifty-nine out of sixty-one of them are identical or almost identical. We have shown that the *CLZ* was probably written between 1324 and 1445, perhaps around the turn of the century. The *XHD* looks very much like a contemporary work judging from the similarities of the plant names and descriptions of their properties. In the *XHD* the plants' names are placed in a glossary and given a less important place in the book, whereas in the *CLZ* descriptions of the plants form the main text itself. Perhaps by the time the *XHD* was written, the *longya* had become sufficiently well known to deserve only a secondary place in the glossary. Furthermore the text of the *XHD* is more corrupt, with more copyists' mistakes, than the *CLZ*. One may make a guess that the date of composition of the *XHD* was closer to the year 1445 than the *CLZ*. The *XHD* ends with a poem, written in the seven-word broken-off lines style. Using the *Guangyun* dictionary of sounds of 1011 the poem may be regarded as one that rhymes upon the last word of the second line. The last word of the fourth line is indeed found to rhyme. However, if we compare the tones of the individual characters of the poem with the set pattern for a seven-word broken-off lines beginning with an even tone and rhymed upon the last character of the second line, we find that two of the tones, one in the first and one in the fourth line, infringe the pattern. On the other hand, if we take the *Zhongyuan yinyun* as our basis, the last word of the second line and that of the last line are both found to rhyme with the last word of the first line. The poem follows another pattern, that is, that for a seven-word broken-off lines beginning with an even tone and rhymed upon the last character of the first line. Here we find only one character, that is, the last but one character in the fourth line, slightly out of tone. Assuming that a poet always tries his best, the prosody of his verse suggests a date after 1324. This confirms our earlier conclusion.

Comparing the properties of the plants mentioned in the two texts we find now and then certain discrepancies, either in the names of the minerals or the technical term for the reactions. For example, in the case of no. 10 for licorice one text says that it fixes (*fu* 伏) arsenic while the other says cinnabar, and in the case of no. 16 for *Mazus rugosus*, L., one text says that it fixes sulphur and the other realgar. Examples of technical terms being used indiscriminately can be seen in no. 7 where one says that *changpu* (*Acorus gramineus*, Ait.) translates (*dian* 點) realgar, while the other says fixes (*fuzhi* 伏制) realgar, and no. 29 where the same difference occurs for *foercao* (*Auricularia auriculajudae*, *udae*, Schr.). Both texts seem to be a little corrupt, although the *CLZ* appears to be a little less corrupt than the *XHD*. The information about the *longya* elixir plants probably came from a common source, or rather sources. Perhaps the herbalists and alchemists in Tang China already used the term *longya* for a very limited number of plants, and during the Song dynasty a small handful of plants used by the alchemists were given the synonym *longya*. By the time of the Yuan dynasty the number of plants used by the alchemists had proliferated and so did the number of synonyms for *longya*. This overlapped with the interest in edible wild plants as food substitutes in times of famine during the fourteenth and the first half of the fifteenth centuries. While roaming the mountains and valleys of China for these wild plants perhaps about the turn of the fifteenth century the anonymous alchemist who wrote the *CLZ* in verse might have done so for the purpose of rendering the plants and their properties to be committed to memory more readily. By the time the *XHD* was written, the *longya* and their properties had become more widely known, and hence they were only included in the glossary.

Acknowledgement

This Chapter is a modified form of a paper of the same title that was published as the inaugural number of *Griffith University Papers* in Brisbane, Australia and dedicated to Liu Ts'un-yan 柳存仁.⁶⁹ Some minor changes have been made for the sake of consistency, and updated information has been added to the original Preface written in the year 1979.

3

***Danfang jianyuan* (Mirror of Alchemical Processes—a Source Book) and *Danfang jingyuan* (Mirror of the Alchemical Laboratory)**

For over 1,000 years there was confusion over the identity of the *Danfang jianyuan* 丹方鑒源 by Dugu Tao 獨孤道 with an earlier text bearing a somewhat similar title, the *Danfang jingyuan* 丹房鏡源. The first and fourth characters of the two titles are identical. In both the second characters *fang* are homophones. In the case of the former it means ‘prescription’, ‘recipe’ or ‘method’, while in the latter it means ‘room’ or ‘laboratory’. The third character *jian* 鑒 normally means ‘to observe’ and is presented in two variant forms, one of which can also serve as a synonym for the third character *jing* 鏡 in the second title, meaning ‘mirror’. The original book bearing the title *Danfang jingyuan* was probably lost some time during the Song period. Chinese bibliographers since the time of Zheng Qiao 鄭樵 in the middle of the eleventh century added to the confusion by interchanging the two homophones and synonyms in the two titles and came to regard the two as one and the same book, with Dugu Tao as author.⁷⁰ Even Li Shizhen wrongly used the character meaning ‘room’ for *fang* when he quoted from Dugu Tao.

It is now known that the *Danfang jingyuan* existed in Tang China during the eighth century. One of the compendia in the Daoist Canon, namely the *Qiangong jiageng zhibao jicheng* 鉛汞甲庚至寶集成 (Complete Compendium on the Perfected Treasure of Lead, Mercury, Wood and Metal) reproduces a section of the *Danfang jingyuan* together with a preface written by Zhao Naian 趙耐菴 in the year 836, mentioning that this work was quoted by compilers of the pharmacopoeia in the year 762. Quotations from the *Danfang jingyuan* are also found in the two pharmacopoeia, the *Zhenghe jingshi zhenglei beiyong bencao* 重修政和經史證類備用本草 (New Revision of the Pharmacopoeia of the Zhenghe Reign-Period: The Classified and Consolidated Armamentarium) and the *Xinbian zhenglei tuzhu bencao* 新編證類圖注本草, more commonly known as *Tujing yanyi bencao* 圖經衍義本草 (Illustrated Dilations upon Pharmaceutical Natural History). Quotations from the *Danfang jingyuan* also appear in later works, such as the *Gezhi jingyuan* 格致鏡源 (Mirror Source Book for the Investigations of Things) and the *Shobutsu ruisan* 庶物類纂 (Things Categorised and Compiled). The *Danfang jianjuan* that came later than the *Danfang jingyuan* is a more complete and more important alchemical text than its predecessor (Ho Peng Yoke 2004).

Collation and translation of Dugu Tao's *Danfang jianyuan* 丹方鑒源
(Mirror of Alchemical Processes—a Source Book)

*Introduction*⁷¹

One of the most important Chinese alchemical writings is the *Danfang jianyuan*, (Figure 3.1), a laboratory handbook dealing with alchemical processes and reagents, probably compiled during the tenth century AD by Dugu Tao.⁷² The only text available to scholars until recently was the version found in the Daoist Canon (*Zhengtong daoang* 正統道藏) of 1445. It was first reprinted by the Commercial Press, Shanghai between 1923 and 1926 and later reproduced by photocopying at the I-wen Press in Taipei. The text of this printed version consists of three chapters or scrolls (*juan* 卷) divided into twenty-five sections (*pian* 篇). However, the text of the *Danfang jianyuan* seems to be corrupt in a number of places. Li Shizhen's *Bencao gangmu* 本草綱目 (the Great Pharmacopoeia) also quotes extensively from the *Danfang jianyuan*, but the quotations it makes are not always in agreement with the text in the printed version from the Daoist Canon. This has led to the suspicion that the text used by Li Shizhen was not the earliest version of Dugu Tao's *Danfang jianyuan*.⁷³

During researches at the University of Tokyo in 1979 I came across a rare manuscript of a slightly different version of the *Danfang jianyuan* in the Japanese National Diet Library (Figure 3.2). This was a copy made in Japan in the year 1804 from another Daoist Canon version. It is more complete and accurate than the modern printed version. Commentaries made by the copyist show that he had access to more than one version of the *Danfang jianyuan*. The Japanese manuscript

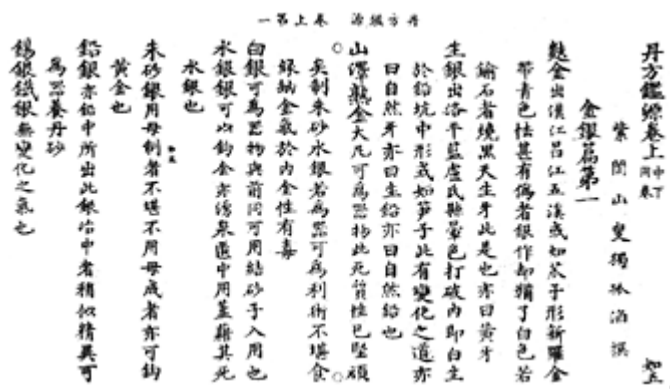


Figure 3.1 The first page of the *Danfang jianyuan* from the Daoist Canon.

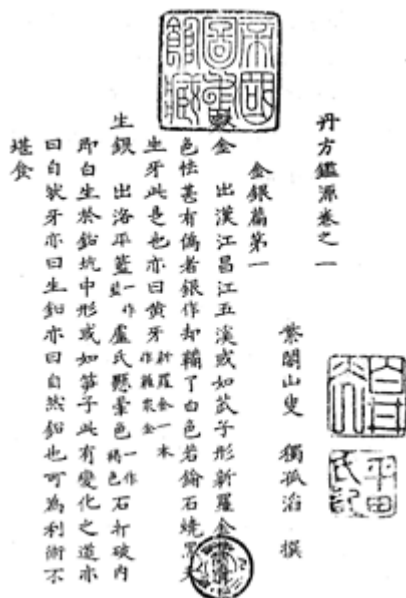


Figure 3.2 First page of the Japanese transcribed copy of the *Danfang jianyuan* preserved at the Japanese National Diet Library

version has been used for the present study collated with the printed Daoist Canon version and relevant quotations from the *Bencao gangmu* and some other compendia. Quotations from the *Bencao gangmu* can be seen to agree with the Japanese manuscript version in general. From the commentaries it can be noted that there were other versions of the *Danfang jianyuan* besides these two found in the present edition of the Daoist Canon and the 1804 Japanese manuscript copy made from the library collections of Takasue 高標, the Lord of Saeki 佐伯侯.

Contemporaneous with the alchemical writings of Jābir ibn Hayyan (c.721–817), there existed an alchemy handbook in Tang China about the year 762, entitled *Danfang jingyuan*. The original text was later lost, but portions of it are quoted elsewhere as stated above. Though the *Qiangong jiageng zhibao jicheng* 鉛汞甲庚至寶集成 (Compendium on the Perfected Treasure of Lead, Mercury, Wood and Metal) and some pharmacopoeia contain quotations not commonly shared by each other, none of them gives the complete text of the *Danfang jingyuan*. It is likely that Dugu Tao in the tenth century based his *Danfang jianyuan* on the *Danfang jingyuan*. Comparison shows that about one-third of the items in Dugu Tao's book bear similarity with the fragments of the *Danfang jingyuan* that we now possess. We do not know how much he borrowed from the latter, since the full text is no longer available to us. He may have enlarged the text, borrowing from some other sources. He also made an attempt to organise the material in his book into groups of things that seemed to him to have points of similarity. Being an improved and more comprehensive version, Dugu Tao's *Danfang jianyuan* gradually superseded the

book from which it was derived. The name of the author of the *Danfang jingyuan* had been long forgotten by then, and Dugu Tao's name became mistakenly attached to this earlier alchemy handbook.

It must have been a big step forward in alchemy towards the direction of modern chemistry when the Persian physician and alchemist al-Rāzī (866–925) classified substances into minerals, vegetables and animals, and when Dugu Tao, at most only a couple of decades later, reorganised Chinese alchemical substances into twenty-five sections. Perhaps it was not a coincidence that classifications of substances were made in the Muslim world and in China within such a short interval of time. But our attention must now be directed towards Dugu Tao himself.

Unfortunately our present information about Dugu Tao is extremely scanty. The copyist of the Japanese manuscript version regarded him as having lived in the Sui period (581–618), while Li Shizhen considered him to belong to the Tang dynasty (618–906). However, internal evidence indicates that the *Danfang jingyuan* could not have been compiled before the time of Nan Tang 南唐 (923–935), since the text mentions a place name, that is, Qianshan 鉛山 district in Xinzhou 信州 prefecture, that was first instituted in China during the time of Nan Tang. Perhaps this was the evidence used by Professor Li Xiangjie 李相傑 when he wrote to Dr Joseph Needham in the late 1940s saying that Dugu Tao flourished during the time of Meng Chang 孟昶 of Nan Tang.⁷⁴

'Dugu', however, was not originally a Chinese name. It was similar to 'Dugo', a name of the *Hu* 胡 peoples, which included those from Central and West Asia. During the latter part of the Tang period many Persians and Arabs came to south China by sea for purposes of trade. Among them were the Persians Li Xun 李珣, who wrote the *Haiyao bencao* 海藥本草 (Materia Medica of Countries beyond the Seas) and his brother Li Xuan 李璣, a medical practitioner who was also knowledgeable in the art of alchemy.⁷⁵ Many of the foreign residents in Guangzhou 廣州 (modern Canton) were Nestorians from Persia. It is said that some 120,000 foreign residents in that city were killed during the uprising of Huang Chao 黃巢 in AD 878. Some of the survivors left for home, while others migrated further inland into China and became integrated with the local population. Some of them went about disguised as Daoist alchemists. Li Xun and Li Xuan belonged to this group of migrants, and it would not be at all surprising if Dugu Tao was also one of them. If this speculation is correct, then Dugu Tao was merely introducing and modifying the tradition initiated by al-Rāzī, who was perhaps one of his fellow Persians. This may also help to explain the increased number of substances of Persian origin, for example, terebinth and Dragon's blood, in the *Danfang jingyuan*, as compared to those listed in fragments of the *Danfang jingyuan*.

Dugu Tao grouped nearly 240 substances into twenty-five different sections, describing their appearances, occurrences, alchemical properties, medicinal properties and uses as the case may be. The twenty-five sections are:

- 1 Metals, including gold, silver, copper, lead, tin, mercury
- 2 Minerals yellow in colour and having the word *huang'* 黃 (yellow) incorporated in their names, such as *xionghuang* 雄黃 (realgar), *cihuang* 雌黃 (orpiment), *liuhuang* 硫黃 (sulphur), etc.
- 3 Granular sand-like substances, with the word *sha* 砂 (sand) incorporated in their names, such as *zhusha* 朱砂 (cinnabar), *naosha* 礬砂 (sal ammoniac), etc.

- 4 Alum-like substances with the word *fan* 礬 (alum) incorporated in their names, such as *baifan* 白礬 (alum), *danzifan* 膽子礬 (blue vitriol), *qingfan* 青礬 (ferrous sulphate), etc.
- 5 Blue-green minerals with the word *qing* 青 (blue-green) incorporated in their names, such as *kongqing* 空青 (a large hollow variety of malachite), *cengqing* 曾青 (a stratified variety of malachite), etc.
- 6 Various stone-like substances with the word *shi* 石 (stone) incorporated in their names, such as *cishi* 礬石 (magnetite), *huashi* 滑石 (talc), *hanshuishi* 寒水石 (gypsum), etc.
- 7 Various stone-like medicinal substances prefixed by the word *shi* (stone), such as *shidan* 石膽 (potash alum), *shitan* 石炭 (coal), etc.
- 8 Various types of sublimates (*shuang* 霜) such as *fenshuang* 粉霜 (calomel), *pishuang* 砒霜 (arsenic), etc.
- 9 Various types of salts (*yan* 鹽) such as *yayan* 崖鹽 (rock salt), *Rongyan* 戎鹽 (desert salt), etc.
- 10 Various types of powder (*fen* 粉) such as *hufen* 胡粉 (white lead), *yunmufen* 雲母粉 (mica in a powdered form), etc.
- 11 Various types of substances—mainly nitrates—that incorporate the word *xiao* 硝 (to dissolve) in their names, such as *mayaxiao* 馬牙硝 (saltpetre crystals), *yanxiao* 鹽硝 (crude Glauber's salt), etc.
- 12 Various types of watery substances, such as rainwater collected under the roof of a thatched hut, honey, etc.
- 13 Various types of earth, such as *fulonggan* 伏龍肝 (earth collected under an old stove), *daizhetu* 代赭土 (earthly hematite), etc.
- 14 Miscellaneous ingredients, such as *huangdan* 黃丹 (minium), *yunmu* 雲母 (mica), *ruxiang* 乳香 (Gum olibanum), etc.
- 15 Miscellaneous ingredients in liquid form, such as milk, vinegar, urine, etc.
- 16 Various types of oil, including sesame oil, *shinaoyou* 石腦油 (petroleum), etc.
- 17 Various types of fats, such as lard, fats of cattle, sheep and camel, etc.
- 18 Various types of dung from birds and animals, such as sparrows' droppings, dogs' excreta, cow pats, etc.
- 19 Various types of ashes, such as mulberry wood ash, paper ash, etc.
- 20 Juices from various plants, such as lettuce, *zhizi* 梔子 (Gardenia florida, L.), *wubeizi* 五倍子 (nutgalls from *Rhus semialata*, Murr.), etc.
- 21 Miscellaneous, including *fuzi* 附子 (tuberous roots of *Aconitum Fischeri*, Reichenb.), *fuping* 浮萍 (*Lemna minor*, L.), etc.
- 22 Various paste-like ingredients, including those made from powdered magnetite, from mixing egg white with common salt, and from mixing powdered alum with the 'six-and-one' sealing compound (*liuyini* 六一泥).
- 23 Various types of fire, such as that from using cow dung as fuel, that from burning husks, that from burning bamboo, etc.
- 24 Three types of metal in granular form, namely copper, silver and lead and
- 25 Miscellaneous substances, such as the lodestone, sal ammoniac, etc.

The *Danfang jianyuan* also contains many technical terms, some of which were used exclusively in alchemy, but many others that were common to both alchemy and medicine. These are discussed in Chapter 1 of this book. Care should be exercised in interpreting a technical term like *fu* 伏, which in the alchemical sense would mean to

extract or to prevent the process of distillation or sublimation, but in the medical sense would mean the toxicity of a substance being controlled by another substance.

It is in large measure due to the generosity of three institutions of higher learning that research on the *Danfang jianyuan* was undertaken and completed. I am grateful in the first place to Griffith University, which granted me sabbatical leave to carry out research in Japan and Hong Kong. I extend my thanks also to the University of Tokyo and the University of Hong Kong, both of which granted me visiting staff status and provided me with excellent research facilities. I am very grateful for the kind help I have received from Professor Eto Shinkichi 衛藤瀋吉 and Dr Nakayama Shigeru 中山茂 of the University of Tokyo, from Mr Kishida Minoru 岸田實 and members of his staff in the Japanese National Diet Library, and from members of the Department of Chinese and the Centre of Asian Studies in the University of Hong Kong. I have also benefited from the editorial expertise of Professor Bernard Blackstone, Dr L.Y.Chiu and Dr C.K.Leung, to all of whom I must express my sincere thanks. But my mind is haunted by a more remote memory, and a deeper sense of indebtedness. Throughout the long months of work on this study of pre-chemistry—work carried out in residence on the beautiful campus of the University of Hong Kong—the recollection was always present of the day, twenty-six years ago, when I was introduced to Dr Joseph Needham of Cambridge by a friend and former colleague of mine at the University of Malaya, Singapore. That friend and colleague is Dr the Honourable Rayson L.Huang, the present Vice-Chancellor of the University of Hong Kong, and that day marks the crucial turning-point in my academic career, when I changed from physics to history of science. Although the connection between pre-chemistry and free radicals is very remote, this chapter is dedicated to Dr Huang, in the hope that it will remind him of his younger days as a chemist and of the day he did an old friend a good turn (Ho Peng Yoke, 1979).

***Danfang jianyuan* 丹方鑒源 (in english translation) with collations⁷⁶**

- [Abbreviations: BG=Li Shizhen's *Bencao gangmu* of 1596
 RP=Read and Pak (1936), by item number
 RL=Read and Liu (1936), by item number
 ZD=the Daoist Canon (*Zhengtong daoang*) edition of the text
 ZY=*Zhongyao da cidian* (Jiangsu Xinyi Xueyuan ed.)]

***Danfang jianyuan: juan 1* 丹方鑒源: 卷一**

Collation: ZD puts all three chapters or rolls (*juan*) into one.

Compiled by the Elder of Zige 紫閣 Mountain, Dugu Tao 獨孤道

Collation: ZD uses the more usual form 紫閣 for Zige.

Section on gold, silver [and other metals and minerals]**DT1. Fujin 鉄金 (gold nugget)**

[It] occurs in (the rivers) Hanjiang 漢江, Changjiang 長江 and Wuqi 五溪, sometimes in the shape of a rice grain. Silla gold has a blue-greenish tint. One has to be wary about imitations. That made from silver is embedded with a white colour, and if it is made from *toushi* 鑰石 (an alloy made from zinc-bloom and copper; RP 59) it will turn black when put in the fire. [Gold nugget] is *tianshengya* 天生芽, also called *huangya* 黃芽 (Commentary: In another version Silla gold is known as other miscellaneous gold.)

Collation: The word ‘Commentary’ refers to the commentary in the Japanese version. *ZD* misses out the Commentary. *BG juan 8* only gives ‘*tianshengya* is also called *huangya*’.

DT2. Shengyin 生銀 (native silver; RP 2b)

[It] occurs in Luoping 落平 (in modern Gansu province), Lan [shizhou] 藍氏州 (in modern Xinjiang Autonomous Region), and Lushi xian 盧氏縣 (in modern Henan if not in modern Hubei province). (Commentary: one version gives Lan with the bamboo radical instead of the grass radical.) It has a hazy appearance (Commentary: one version says that it is of a brown colour), but when broken apart the inside is white. It is found in lead mines and is sometimes shaped like a bamboo shoot. It can be made to undergo transformation. It is also [variously] called *ziranya* 自然芽, *shengqian* 生鉛 and *ziranqian* 自然鉛. It serves only commercial purposes, but is unsuitable for ingestion.

Collation: *ZD* misses out the Commentaries as well as the last sentence. *BG juan 8* says, ‘[Silver] is found in silver pits with a brownish colour and shaped like a bamboo shoot. When broken up it turns white. This is variously called *ziranya*, *ziranqian* and *shengqian*. It goes the way of transformation, but is unsuitable for ingestion.’

DT3. Shanze shujin 山澤熟金 (probably pure gold, also known as shanjin 山金)

[It] can be used for making artifacts and useful objects. Being a dead substance, it is hard and stubborn in nature and is useless [as an elixir]. It fixes cinnabar and mercury. When made into artifacts it can turn out to be a profitable proposition. It is unsuitable for ingestion, because contained within it is the *qi* 氣 of gold, which by nature is poisonous.

Collation: *ZD* gives the same text.

DT4. Baiyin 白銀 (silver; RP 2)

Similar to the above, it can be made into objects [and profit can be derived from them]. It can [also] be used for congealing cinnabar.

Collation: *ZD* gives the same text.

DT5. Shuiyin yin 水銀銀 (imitation silver made from mercury)

It can form alloys with other metals and can be made into the ‘bubbling-spring casing’ (*yongquankui* 湧泉匱) [that serves as a reaction vessel], utilising its capability to cause the death (*si* 死) of mercury (i.e. changing mercury so that it loses its original form or properties).

Collation: *ZD* gives the same text.

DT6. Zhusha yin 朱砂銀 (imitation silver made from cinnabar)

That made from the Mother (i.e. lead) cannot [be used for consumption as an elixir substance]. What is not made from the Mother can be used to alloy with the Yellow Metal (i.e. gold).

Collation: *Zaohua zhinan* 造化指南 (see Chapter 4, later) says that ‘lead is the progenitor of silver’. *ZD* gives the same text.

DT7. *Qianneiyin* 鉛內銀 (silver embedded in lead)

It is toxic by nature, [but] can be used to congeal cinnabar.

Collation: This entry is not in ZD, while *BG juan 8* only mentions its toxic nature.

DT8. *Qianyin* 鉛銀 (silver found within lead mines)

This is also found among lead and is slightly different from that found in silver mines. It can be made into alchemical apparatus to nourish (*yang* 養) cinnabar.

Collation: ZD gives the same text, but it is not in BG. Minor textual corruption in the Japanese version is amended to conform to ZD.

DT9. *Xiyin* 錫銀 (imitation silver made from tin) and *Tieyin* 鐵銀 (imitation silver made from iron)

It does not possess the *qi* of transformation [and hence is useless as an alchemical substance].

Collation: ZD gives the same text.

DT10. *Hongyin* 紅銀 ('red silver')

It can hook (*gou* 鉤; 勾) gold and can also turn into *Danyang* 丹陽 (copper) by projection.

Collation: ZD gives the same text.

DT11. *Zimuyin* 子母銀 ('Son-and-Mother' silver; silver amalgam)

[It is made by] congealing silver and mercury. It resists sustained heating without losing weight. It can be separately heated without interruption over a long period.

Collation: ZD gives the same text. Minor textual corruption in the Japanese version is amended to conform to ZD.

DT12. *Wuchangtong* 武昌銅 (Wuchang copper)

Occurring in Ezhou 鄂州 (Wuchang xian 武昌縣 in modern Hubei province), *baiman* 白慢 (i.e. copper) can project *Danyang* silver and *toushi* 鎔石 (alloy of zinc-bloom and copper). Folded (*zhe* 摺) copper from foreign tribal people and the *chizhatong* 赤扎銅 copper from Dongchuan 東川 do not crack when beaten while hot.

Collation: ZD gives the same text.

DT13. *Zirantong* 自然銅 (iron pyrites, RP 7)

This can be ingested. It occurs deep inside silver and copper mine pits in Qianshan xian 鉛山縣, Xinzhou 信州 prefecture. It is formed after many years by the *qi* of copper and iron ores. Its *qi* rises up like a horse. Its colour is deep purple. The genuine one is bitter and astringent in taste. People nowadays regard [the term] *dacashi* 大礬石 as referring to iron pyrites. They are mistaken.

Collation: ZD only has the first sentence 'zirantong can be ingested'. *BG juan 8* omits this first sentence but quotes the rest in full with less textual corruption. Corrupted text is amended to follow BG.

DT14. *Tongfen* 銅粉 (powdered copper; RP 6a)

Treated powdered copper can be used to cure injuries and fractures. It can be fixed and subdued together with cinnabar.

Collation: ZD gives the same text.

DT15. *Tiecishi* 鐵磁石 (iron magnet)

This is the essence of iron (*tiejing* 鐵精) and can be used [as an alchemical material].

Collation: ZD gives the same text. *Tiejing* also refers to iron acetate (RP 23).

DT16. *Qianyin* 鉛銀 (imitation silver made from lead)

There is no silver in lead. [In fact *qianyin*] is [only] refined lead. Occurring in Jiazhou 嘉州 (in modern Sichuan province), in the steep banks of the Long[shui] 隴[水] River (in Gansu province) and in Hezhou 和州 (in Anhui province), it is the very essence of *qianjing* 鉛精 (galenite lead; Wong (1989) no. 1938) and can be subjected to transformation. (Commentary: One version gives *qianxian* 鉛鹹 for *qianyin*, Lizhou 利州 for Hezhou, and a different wording but with the same meaning for essence of *qianjing*.)

Collation: ZD gives the same text in slightly different wording.

DT17. *Baiqian* 白鉛 (white lead; RP 12)

Also known as *zibeiqian* 紫背鉛, it is capable of breaking *jingangzuan* 金剛鑽 (diamond; RP 99).

Collation: ZD gives the same text, but with the wrong character for *bei* 倍 in *zibeiqian*. BG quotes this item in *juan* 10, but mixes item 17 and item 16 up in another quotation in *juan* 8.

DT18. *Diaojueqian* 釣膠鉛 (perhaps a kind of lead ore)

Occurring in the various districts of Yazhou 雅州 (in Sichuan province), it is about the size of the soap bean, shapes like a tadpole and is black in colour. It is found among sand in river streams. It can dry (*gan* 乾) mercury.

Collation: ZD gives the same text. BG *juan* 8 also has this item but with different wordings. This item is also quoted in *Gezhi jingyuan*, *juan* 34.

DT19. *Caojieqian* 草節鉛 (native lead; RP 10)

This is native lead from Jiazhou 嘉州 before being refined. It is brittle and breaks [easily], and when burnt it emits smoke with the smell of sulphur.

Collation: ZD gives the same text, but instead of 'emits smoke with the smell of sulphur' gives 'burns like sulphur'. BG *juan* 8 has this item in different wordings.

DT20. *Xinzhouqian* 信州鉛 (native lead from Xinzhou)

This is absolutely useless because it is mixed with the *qi* of copper. It cannot be used for working jade.

Collation: ZD gives the same text.

DT21. *Lushiqian* 盧氏鉛 (native lead from Lushi xian 盧氏縣

)

This lead is inferior in strength to that produced in Jiazhou. Its impurities must first be removed before it can be used.

Collation: ZD gives only the first sentence in the text.

DT22. *Yinpingqian* 陰平鉛 (native lead from Yinping)

Occurring in Jianzhou 劍州 (in modern Nanping xian, Fujian province) it is the progenitor of *gangtie* 剛鐵 (hard iron or even steel). (Commentary: one version says iron.) It cannot be used [as an alchemical material]. When lead enters mercury (i.e. forming an amalgam) and is steamed in vinegar the white substance [formed] is the same as (*qian*) *shuang* (鉛霜) (lead acetate; RP 11).

Collation: ZD gives the same text, missing one word. BG *juan* 8 combines items 20, 21 and 22 and gives *tongtie* 銅鐵 (copper and iron) in place of *gangtie*.

DT23. *Qianhuanghua* 鉛黃花 (lead tetroxide; see Needham (1974) p. 175)

This is put in mercury and heated [first] with a gentle and [then with] a strong fire. What floats on top (of the mercury) can be removed and roasted to form *huangdan* 黃丹 (minium the red triplumbic tetroxide of lead; RP 13). (Commentary: One version gives 'the colour of *huangdan*'.) This can then be collected.

Collation: ZD gives the text in slightly different wordings.

DT24. Xi 錫 (tin; RP 15)

It can [be used to] make silver. With sal ammoniac it hardens. With lead it stops resonating.

Collation: ZD gives the same text.

DT25. Shuiyin 水銀 (mercury; RP 44)

The best mercury is that recovered from cinnabar. When it shows a trail while running on a piece of cloth, presence of lead is indicated. It has a great dislike for minerals with a sour and astringent taste. The Essential says: 'If one wishes to "kill" mercury there is nothing better than [using] mercury that has been "killed".' The *Cantongqi* 參同契 says, 'Foxes and rabbits do not feed horses with their milk. Swallows and sparrows do not give birth to the phoenix.' The [*Cantongqi*] also says, 'To plant paddy one ought to use rice grains; to hatch chickens one ought to use eggs.' And again [the *Cantongqi*] says: 'How can different things not belonging to the same origin unite and live together?' Yuanyang[zi] 元陽[子] says, 'Gold transforms gold and silver transforms silver. The "gold butterfly" (*jinjiadie* 金蛱蝶) and the "silver silkworm" (*yincan* 銀蠶) are used in gold-making and silver-making.'

Collation: The first paragraph is also found in ZD. Another work in ZD, the *Daoshu* 道樞 (The Pivot of the Way), compiled by Zeng Zao 曾慥 during the Song period, mentions a text entitled *Cantongqi* 參同契 that contains a dialogue between the adept Yunyazi 雲牙子 and the commentator Yunyangzi 雲陽子. This book seems to be totally different from that written by Wei Boyang 魏伯陽. The second paragraph is also in ZD. The gold butterfly and the silver silkworm are both fictitious creatures in Chinese folklore. The former brings gold and the latter silver.

Section on various 'yellow' [minerals]

DT26. Xionghuang 雄黃 (realgar; RP 49)

The Essential says: 'Realgar after one thousand years transforms into the Yellow Metal (i.e. gold).' The *Huangdi* Book says, 'Realgar turns into copper', that produced in Wudu [xian] 武都縣 (near modern Cheng xian, Gansu province) is superior, while that from Western foreign regions comes next. That with the colour of iron is superior and that with the colour of the cockscomb comes next. The good quality type also leaves a yellow film on iron residuals from silver ore that sink in water, when rubbed with the latter. There is another saying that states, 'To test [realgar] the genuine ones kill shellfish. Next in quality is that which does not taste pungent and has an offensive odour when thoroughly chewed in the mouth and mixed with warm water.'

Collation: ZD gives essentially the same text, but without the portion regarding another saying. BG *juan* 9 repeats in different words and also omits the last portion of this text.

DT27. Cihuang 雌黃 (orpiment; RP 50)

That occurring in the Cheng[shan 誠山 peninsula on the] Zi 淄 [River in Shandong province] is of a dark colour, and dry and light in weight like a burnt [object]. [Artificial gold] made from pieces of tin and *chouhuang* 臭黃 (realgar, RP 49) is hard and without an outer layer. To test [orpiment] rub it on a [finger-]nail. Good quality [orpiment] sticks to the nail. (Commentary: One version says that it stains the nail.) Another method is to rub

it on a hot household iron. The good quality variety leaves a red-yellowish line. It is indispensable in gold making. *Cihuang* inclines towards the *Yin* and hence [the name] *Ci* (*huang*). It can soften the Five Metals and dry mercury. The imported variety that looks like blood spitting out of the mouth is the best, and next comes the variety from Hunan (province). (Commentary: One version gives Xiangnan 湘南 for Hunan.) The blue-green ones are also good, and particularly good are those that have the appearance of leaves. Orpiment can transform sulphur and subdue *fenshuang* 粉霜 (purified calomel; RP 46). One has to remember this and not to put the substance to wrong use.

Collation: ZD is essentially similar, but without the two commentaries. BG *juan* 9 gives the same item in slightly different wordings.

DT28. *Pihuang* 砒黃 (arsenic; RP 91).

It occurs in Xinzhou 信州. It forms a white sublimate. It can transform copper, is edible, able to dry mercury, and can be made into a [reaction vessel of the] *kui* 匱 [type] (Figure 3.3) for *dansha* 丹砂 (cinnabar).

Collation: ZD gives the same text.

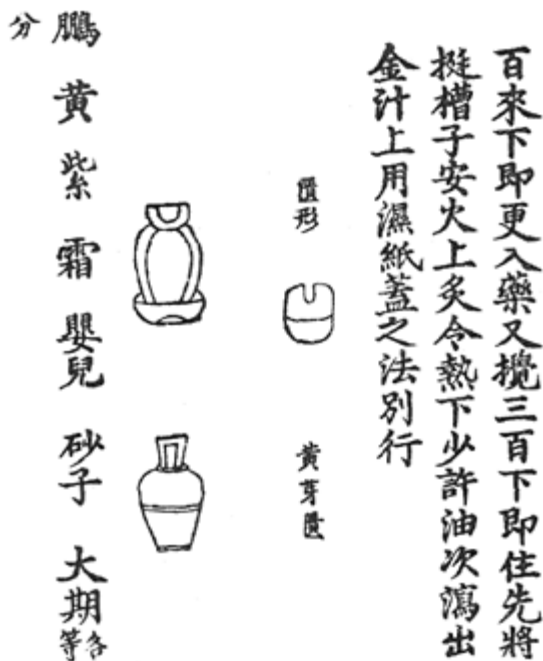


Figure 3.3 Illustration of reaction vessels of the *kui* 匱 type from the *Taiji zhenren zadan yaofang* 太極真人雜丹藥方 (Medical Recipes for Miscellaneous Elixirs of the Supreme Ultimate Adept) in the Daoist Canon.

DT29. *Shehuang* 蛇黃 (serpents' bezoar; RP 112)

It can be made into a [reaction vessel of the] *kui* [type] for cinnabar after it has been subdued by fire.

Collation: ZD gives the same text.

DT30. *Shizhonghuang* 石中黃 (brown hematite; RP 81)

It can dry mercury and bring out the gold colour.

Collation: ZD gives the same text.

DT31. *Shiliuhuang* 石硫黃 (sulphur; RP 128)

It fixes mercury. The Essential says, 'Sulphur turns black when it comes into contact with [any of] the Five Metals; and turns red when it comes into contact with mercury. It is also called *huangnan* 黃男, and it is also said that it takes root from *huangya* 黃牙 (gold nugget).

Collation: ZD gives essentially the same text. BG *juan* 11 omits the last sentence.

DT32. *Chouhuang* 臭黃 (realgar that yields an odour; RP 49)

[It] transforms copper.

Collation: ZD gives the same text.

Section on various types of *sha* 砂 ('sand')

DT33. *Zhusha* 朱砂 (cinnabar; RP 43)

The *Ji* 記 says: 'Cinnabar is the essence of Water. It combines when coming into contact with Metal'. In Chenzhou 辰州, Jinzhou 錦州 and Wuxi 五溪 are found the *furong* 芙蓉 (hibiscus), the *jianzu* 箭鐵 (arrow-barb), the *jingmian* 鏡面 (mirror surface), the *tiese* 鐵色 (iron-like colour), and the *guangming* 光明 (brilliant) varieties of cinnabar, all of which are ingestible and can be subjected to transformations for making gold and silver.

Collation: ZD gives essentially the same text. It is not known which book the word *Ji* refers to. The quotation is not found in the *Taiqing shibiji* 太清石壁記 and the *Dadanji* 大丹記 in the Daoist Canon. This passage, however, comes from the *Zhouyi cantongqi* 周易參同契 with a Commentary by Yin Changsheng 陰長生 (*juan* 2, p. 31b) mentioning an earlier alchemical work, the *Huoji* 火記. Perhaps this was the book referred to.

DT34. *Shangzhousha* 商州砂 (native cinnabar from Shangzhou)

This is unusable, so also is cinnabar from Yunnan. They possess the extremely *Yin* 陰 *qi* 氣 of mercury. [But] in the presence of the *qi* of gold, silver, copper and lead and subjected to fire it can be changed materially.

Collation: ZD gives the same text.

DT35. *Naosha* 礲砂 (sal ammoniac; RP 126)

It occurs in Beiting 北庭 (in modern Xinjiang Autonomous Region). The yellow variety can harden tin. (Commentary: One version says yellowish white.) The *Jue* 訣 (*Essentials*) says, 'It is the robber of the Five Metals'. (Commentary: One version gives 'It is called *jinzei* 金賊 (gold robber).') It is the go-between that can fix and combine the various [alchemical] ingredients, and it has the power to fix realgar and orpiment. (Commentary: One version gives, 'It is the intermediary for fixing and combining [medical and alchemical] ingredients for ingestion and it has the power to fix realgar and orpiment.')'

Collation: For the main text *ZD* only says that sal ammoniac occurs in Beiting and that there was the yellow variety As for what the *Jue* says, *ZD* is almost exactly the same, except for calling sal ammoniac *jinzei* (gold robber) while leaving out the commentaries.

DT36. Dapengsha 大朋砂 (borax)

It can fix mercury and can dull the sound of copper. Borax is produced in Guozhou 果州 (near modern Nancong xian, Sichuan province). It can congeal cinnabar.

Collation: *ZD* gives the same text. It is also quoted in *BG juan* 11 without mentioning its occurrence, but with a different character 蓬 for *peng*.

DT37. Zhensha 針砂 (powdered iron; RP 21b)

It can fix sulphur and can be used for making *zifen* 鑒粉 (litharge; Needham (1974) p. 175). It can be used as an iron lute for sealing [reaction vessels].

Collation: *ZD* gives the same text.

DT38. Hunüsha 胡女砂 (ore found alongside with silver)

Also known as *yinhuang* 銀黃, it occurs in silver mines. It can soften iron and fix cinnabar.

Collation: *ZD* gives the same text.

DT39. Luansha 鸞砂 (cinnabar from Luanshan mountain, Hunan province)

It occurs in the river in Lantian 藍田; 藍田 (near modern Anhua xian, Hunan province). As large as a bean and black in colour it can be used for making the [reaction vessel of the] *kui* [type].

Collation: *ZD* gives the same text.

DT40. Haibaisha 海白砂 (sand; Needham (1974) p. 180)

It can be made into an outer [reaction vessel of the] *kui* [type] that allows the *qi* of fire to pass freely.

Collation: *ZD* gives the same text.

Section on various types of fan 礬 (alum)

DT41. Huangfan 黃礬 (yellow-coloured alum; ferric sulphate; RP 133)

The imported variety from overseas is good. That from Guazhou 瓜州 (in Gansu province) is superior. Next comes a variety with thread patterns from Xichuan 西川 (i.e. the western part of Sichuan province). Yellow-coloured [alum is often mixed with] *zaofan* 皂礬 (copperas; RP 132) and can be picked out [from the mixture]. The superior quality variety is just sufficient to attract a golden thread (after rubbing.) It can transform mercury into gold and can also transform iron. (Commentary: One version says: ‘*Wuse shanzhi* is 五色山脂 yellow alum from Wu 吳 (modern Jiangsu province).’)

Collation: *ZD* gives the same text without the commentary, while *BG juan* 11 gives only the commentary

DT42. Zifan 紫礬 (purple-coloured ferrous sulphate?)

That from Persia looks like a piece of purple stone. It can transform silver into gold and can also dry mercury That from Wenzhou 文州 (near modern Donglan xian, Guangxi province) looks like a piece of lead.

Collation: *ZD* gives the same text.

DT43. Baifan 白礬 (potash alum; RP 131)

It is used for drying mercury, for tempering (*cui* 淬) tin and for fixing the various Yellow [Minerals].

Collation: ZD gives the same text.

DT44. *Bosi baifan* 波斯白礬 (purified potash alum from Persia; RP 131)

It looks like a bundle of needles. It can dry mercury.

Collation: ZD gives a somewhat similar text, but for 'bundle of needles' it says 'thorn needle'.

DT45. *Qingfan* 青礬 (ferrous sulphate; RP 132)

It can nourish (*yang* 養) cinnabar and can be used to boil copper.

Collation: ZD gives the same text.

DT46. *Lufan* 綠礬 (ferrous sulphate; RP 132)

It can fix mercury and bring out the colour of gold.

Collation: ZD gives the same text.

DT47. *Zaofan* 皂礬 (ferrous sulphate; RP 132)

It can fix mercury [and it can be used] for making fenshuang 粉霜 (purified calomel).

Collation: ZD gives the same text.

DT48. *Jishifan* 雞屎礬 ('chicken-dropping alum'; perhaps dirty-looking native alum shale)

It fixes mercury and brings out the colour of gold.

Collation: ZD gives the same text.

DT49. *Kunlunfan* 崑崙礬 ('alum from the Kunlun Mountains'; perhaps a variety of alum shale)

It fixes mercury and nourishes cinnabar.

Collation: ZD gives the same text.

DT50. *Tiefan* 鐵礬 (iron tinctoria; RP 93)

It occurs in Wenshui xian 文水縣 of Taiyuan 太原 (in modern Shanxi province) and shapes like *chishizhi* 赤石脂 (red bole; RP 57e). That with golden specks is considered genuine. It can fix sulphur.

Collation: ZD gives the same text.

DT51. *Liuxufan* 柳絮礬 (purified potash alum; RP 131)

It can nourish cinnabar, congeal mercury and [can be made into] a [reaction vessel of the] *kui* [type].

Collation: ZD gives the same text.

DT52. *Jiangfan* 絳礬 (ferrous sulphate; RP 132)

It congeals cinnabar.

Collation: ZD gives the same text.

DT53. *Yunmufan* 雲母礬 (purified potash alum; RP 131)

It congeals mercury.

Collation: ZD gives the same text.

DT54. *Danzifan* 膽子礬 (copper sulphate; RP 87)

[Occurring in] Puzhou 蒲州 (in modern Rongji xian, Shanxi province) it can transform silver into gold. It can congeal mercury and bring out the golden colour.

Collation: ZD gives the same text.

DT55. *Xuefan* 雪礬 (probably purified potash alum)

It dries mercury and fixes fenshuang 粉霜 (purified calomel).

Collation: ZD gives the same text.

DT56. *Tianloufan* 天漏礬 (probably potash alum from the Tianlou Mountain)

It softens iron sheets and occurs in the Tianlou Mountain in Pengzhou 蓬州 (in Sichuan province). It is white in colour.

Collation: ZD gives the same text.

DT57. *Zhoufan* 粥礬 ('congee alum', probably alum-stone deflagrated in a fire and then macerated in vats into a liquor)

It [can be used to] boil copper.

Collation: ZD gives the same text.

DT58. *Yashifan* 鴨屎礬 ('duck's-droppings alum', perhaps a type of dirty-looking native alum shale)

It occurs in silver mines in Lantian 藍田. It congeals mercury.

Collation: ZD gives the same text.

DT59. *Jimaofan* 雞毛礬 ('chicken feather' alum, probably another synonym for alum shale, because of two other synonyms for alum, namely *yuze* 羽澤 and *yunie* 羽涅, which include the word *yu* 羽 for 'feather')

It congeals cinnabar.

Collation: ZD gives the same text.

DT60. *Jurongfan* 句容礬 (alum shale from Jurong)

It brings out the colour of gold and it congeals mercury.

Collation: ZD gives the same text.

DT61. *Xuanzhou sifan* 宣州斯礬 (probably green vitriol from Xuanzhou)

It occurs as *lufan* (green vitriol). That with a deep blue-green colour, and is lustrous and clean can be used for making the [reaction vessel of the] *kui* [type].

Collation: ZD gives *Xuanzhou qifan* 宣州期礬, otherwise the two texts are similar.

DT62. *Fanshi* 礬石 (potash alum; RP 131)

It can transform copper and iron into silver.

Collation: ZD gives the same text.

Section on various types of *qing* 青 ('blue-greens')

DT63. *Kongqing* 空青 (large hollow variety of malachite; RP 82)

It can transform copper into silver and congeal mercury droplets.

Collation: ZD has the same text.

DT64. *Cengqing* 曾青 (stratified variety of malachite; RP 83)

After being arrested by fire and having turned into a sticky liquid mass, it will congeal mercury and fix cinnabar, because it originates from the *qi* of Metal. It has to be boiled with wine and vinegar before use.

Collation: ZD misses out the last sentence, but *BG juan* 10 gives it in full.

DT65. *Baiqing* 白青 (light-coloured azurite; RP 86)

It can be used for making swords.

Collation: The text in ZD is similar.

DT66. *Daqing* 大青 (*Polygonum tinctorum*; RP 86)

It is used for making green jade.

Collation: The text in ZD is similar.

DT67. *Shiqing* 石青 (azurite?)

It transforms copper.

Collation: The text in ZD is similar.

End of *Danfang Jianyuan*: *juan 1*

Collation: ZD omits the word 'end' and gives 'Upper *juan*' instead of '*juan 1*'.

***Danfang jianyuan*: *juan 2* 丹方鑒源: 卷二**

Collation: ZD calls it Middle *juan*.

Section on various shi 石 (minerals)

DT68. *Cishi* 磁石; 慈石 (magnetite; RP 76)

[A specimen] that attracts iron on all its surfaces is of superior quality. It subdues cinnabar, nourishes mercury, removes tints on silver and hardens mercury.

Collation: ZD gives the same text; also in BG *juan 10*, but with the omission of the first and last part of the text.

DT69. *Rushi* 乳石 (dolomite)

It can be used for making an outer [reaction vessel of the] *kui* [type].

Collation: ZD gives the same text.

DT70. *Qianyashi* 鉛牙石 (a sort of impure lead ore)

Produced in lead mines and of a pale yellow colour, it can fix cinnabar.

Collation: ZD gives the same text.

DT71. *Woxue yushi* 握雪礬石 (fine flakey arsenolite; RP 90)

It dries mercury and fixes mercury and cinnabar. It occurs in Qutanyi 曲灘驛 (a place too small to be mentioned unless it is a misprint for Qujiangyi 曲江驛, a place in Yunnan province). In extremely cold weather one finds arsenolite [exuding from] stones, [like] marrow growing on them. When collected one *fen* of it will congeal ten *hang* of mercury (i.e. one part of arsenolite by weight to 100 parts of mercury).

Collation: ZD has a somewhat similar text, but leaves out the first sentence. BG *juan 10* also leaves out the first sentence and gives Qutanze 曲灘澤 in place of Qutanyi.

DT72. *Jinxing yushi* 金星礬石 (golden-coloured arsenolite; RP 89)

It is used for drying mercury. It fixes cinnabar and sal ammoniac.

Collation: ZD has the same text.

DT73. *Yinxing yu[shi]* 銀星礬[石] (silver-coloured arsenolite?)

It is used for drying mercury. It fixes cinnabar and sal ammoniac.

Collation: ZD has the same text.

DT74. *Tesheng yushi* 特生礬石 (coloured arsenolite)

It can be used to subdue sal ammoniac.

Collation: ZD has the same text, but without the character *shi*.

DT75. *Hongpi yushi* 紅皮礬石 (red arsenolite)

It subdues cinnabar and nourishes mercury.

Collation: ZD has the same text, but without the character *shi*.

DT76. *Taohua yushi* 桃花礬石 (peach colour arsenolite)

It dries mercury.

Collation: ZD has the same text.

DT77. *Ziyushi* 紫礬石 (purple arsenolite)

It can fix mercury.

Collation: ZD has the same text.

DT78. *Yangqishi* 陽起石 (asbestos tremolite; RP75)

It can be made into an outer [reaction vessel of the] *kui* [type].

Collation: ZD gives the same text, but leaves out the word *ke* 可 (can).

DT79. *Changlishi* 長理石 (a variety of gypsum, RP 52)

It can be ingested.

Collation: ZD gives the same text.

DT80. *Hemushi* 賀母石 ('mother-of-tin', probably arsenolite)

Just as silver ore, it nourishes cinnabar.

Collation: ZD gives the same text.

DT81. *Huashi* 滑石 (soapstone; RP 55)

It can fix realgar and orpiment and can be used as an outer [reaction vessel of the] *kui* [type].

Collation: ZD gives the same text, but leaves out the word *ke* (can).

DT82. *Hanshuishi* 寒水石 (gypsum; RP 51; also calcareous spar; RP 119)

It can be used as a [reaction vessel of the] *kui* [type]. It fixes cinnabar and *xuanjing*[shi] 玄精[石] (selenite; RP 120).

Collation: ZD gives the same text.

DT83. *Qiushi* 秋石 (arsenolite)⁷⁷

This can be used to make white lapid lazuli.

Collation: ZD gives the same text.

DT84. *Fushuishi* 浮水石 (probably *fushi* 浮石 or *fuhaiishi* 浮海石, pumice stone; RP73)

It removes impurities from [alchemical] substances.

Collation: ZD gives the same text.

DT85. *Pishi* 辟石 (perhaps *pilizhen* 霹靂震, meteorites; RP 113)

Black in colour it subdues *pi* [shi] 砒[石] (arsenic) and *fenshuang* 粉霜 (purified calomel), and is used for shrinking (*su* 縮) lead.

Collation: ZD gives the same text.

DT86. *Fengkeshi* 蜂巢石 ('beehive stone', probably beehive)

It can be made into an outer [reaction vessel of the] *kui* [type].

Collation: ZD has the same text.

DT87. *Ningshuishi* 凝水石 (Calcareous spar; RP 119)

It can be used as a paste. It can be ingested. It fixes cinnabar, can be (used as) a [reaction vessel of the] *kui* [type], and subdues *[xuan]jing* [玄]精 (selenite).

Collation: ZD gives the same text, but omits the last sentence. *BG juan* 11 mentions only the properties of fixing cinnabar and subduing *xuanjing*. The word *xuan* is added to the text following *BG*.

DT88. *Dushi* 獨石 ('solitary stone', perhaps ordinary stone)

[It can be used as an] outer [reaction vessel of the] *kui* [type].

Collation: ZD has the same text.

DT89. *Xiaoshi* 硝石 (saltpetre; Epsom salt; RP 125)

It is the envoy (*shi* 使) of the Five Metals. It fixes arsenic and sulphur, and can be used for making jade.

Collation: ZD has the same text.

Section on various shi 石 alchemical substances (i.e. substances with names beginning with the word shi)

DT90. *Shigao* 石膏 (gypsum; RP 51)

[It occurs in] Guizhou 桂州 (modern Guilin, Guangxi province). It can congeal mercury.

Collation: ZD gives the same text.

DT91. *Shizhi* 石脂 (siliceous clay)

It can be used [as a lute] for sealing the outer [reaction vessel of the] *kui* [type].

Collation: ZD gives the same text in slightly different wording.

DT92. *Shidan* 石膽 (blue vitriol, also green vitriol; RP 87)

[This mineral occurs in] Hezhong 河中 (in modern Shanxi province), in the form of eight-angular (i.e. cubic) [crystals]. It transforms silver into gold and iron into copper. It brings out colour and removes tint.

Collation: ZD gives the same text.

DT93. *Shiqilinjie* 石麒麟竭 (Dragon's Blood, Daemonorops Draco, B1.; ZY 1858)

It brings out the colour of gold.

Collation: ZD gives the same text. *BG juan* 34 says, 'This substance comes from the Western *hu* 胡 (tribal people). It was endowed with the *qi* of Mars when formed. Put in the fire a red liquid oozes out, eventually it turns into ash but retains its colour. This is the test for the genuine one.'

DT94. *Shihui* 石灰 (limestone; RP 71)

Collation: The text gives *shitan* 石炭 (coal), but is amended after *BG juan* 9. See separate item DT 98 on *shitan*.

It subdues sulphur, removes the tint in tin, fixes realgar and orpiment. It is used occasionally for fixing sal ammoniac.

Collation: ZD gives essentially the same text. *BG juan* 9 gives the text under *shihui*.

DT95. *Shi[zhong]ru* 石[鐘]乳 (stalactites; RP 63)

It can be used for making an outer [reaction vessel of the] *kui* [type].

Collation: ZD has the same text.

DT96. *Shihua* 石花 (stalagmites shaped like a flower; RP 65b)

It can congeal *shazi* 砂子 (mercury; Wong (1989) no. 2177).

Collation: ZD gives the same text.

DT97. *Shigansui* 石甘穗 ('stone sweet grains', perhaps stalactites in grain-like tiny pieces)

It has markings like tin. It congeals mercury and brings out the colour of gold.

Collation: ZD has the same text.

DT98. *Shitan* 石炭 (coal; RP 70)

It removes silver tint, fixes the Three Yellow [minerals] (i.e. sulphur, realgar and orpiment), sal ammoniac and saltpetre.

Collation: This item is not in ZD.

DT99. *Shilu* 石綠 (Persian zingar; RP 121)

It congeals mercury.

Collation: ZD has the same text.

DT100. *Shishuang* 石霜 ('stony frost' perhaps frost-like stalactites)

It congeals mercury.

Collation: ZD has the same text.

DT101. 石蠶蠶 silkworms', perhaps the larvae of the dragonfly; RP 110)
It fixes cinnabar.

Collation: ZD has the same text. BG juan 10 calls it *shican* 石蠶.

DT102. *Shisui* 石髓 (a kind of stalactite; RP 68)

It can congeal mercury.

Collation: ZD gives the same text.

DT103. *Zishiying* 紫石英 (amethyst; RP 41)

The red and white variety can be ingested and can be made into an outer [reaction vessel of the] *kui* [type].

Collation: ZD gives the same text.

Section on various *shuang* 霜 (sublimates)

DT104. *Fenshuang* 粉霜 (purified calomel; RP 46)

It transforms copper.

Collation: ZD gives the same text.

DT105. *Pishuang* 砒霜 (arsenic; RP 91)

It transforms copper and can harden tin and dry mercury.

Collation: ZD gives the same text, but omits the reference about tin.

DT106. *Dabianshuang* 大便秘霜 ('human faeces efflorescence', perhaps a substance extracted from excreta)

It fixes cinnabar and cures illnesses of the pneumatic type (*feng* 風).

Collation: ZD has the same text.

DT107. *Sangshuang* 桑霜 (crystalline substance recovered from steaming mulberry wood ash; ZY 4040)

It fixes cinnabar and sulphur.

Collation: ZD has the same text.

Section on various *yan* 鹽 (salts)

DT108. *Yanjing* 鹽精 (calcareous spar; RP 119)

It resembles rock crystal and occurs in salt beds. It fixes mercury and cinnabar.

Collation: ZD gives the same text. BG juan 11 gives the text without mentioning mercury and cinnabar.

DT109. *Rongyan* 戎鹽 (desert salt; RP 116)

It is either red or black in colour. It occurs in the Western foreign regions. It can pile up eggs, fix cinnabar and dry mercury.

Collation: ZD and BG juan 11 give essentially the same text in slightly different wordings.

DT110. *Manyan* 蠻鹽 (a kind of foreign native salt)

It can subdue realgar and orpiment. For making gold it is best to use the red variety, *hongyan* 紅鹽 (red salt).

Collation: ZD gives the same text. BG juan 11 is also essentially similar but without reference to gold making.

DT111. *Qingyan* 青鹽 (green-coloured salt; RP 115)

[It occurs in] Fuzhou 鄜州 (near modern Fu xian in Shaanxi province). It can dry mercury and fix cinnabar.

Collation: ZD gives the same text.

DT112. *Xinluo huangyan* 新羅黃鹽 (Silla yellow-coloured salt)

It transforms mercury into gold. It can nourish cinnabar and can be used for boiling mercury.

Collation: ZD has the same text.

DT113. *Luyan* 鹵鹽 (native lake-salt; RP 118)

It boils the Four Yellow [minerals] (e.g. sulphur, realgar, orpiment and arsenious oxide) and can be used in soldering. When used with sal ammoniac to immerse iron, after a moment, the iron will soften.

Collation: ZD only refers to the Four Yellow [minerals]. BG *juan* 11 gives the text in slightly different wordings.

DT114. *Yayan* 崖鹽 (cliff-salt; RP 115)

Occurred in Lingzhou 陵州 (near modern Renshou xian, Sichuan province), it is also called *shengyan* 生鹽. It looks like potash alum and can nourish cinnabar and dry mercury.

Collation: ZD gives the same text.

DT115. *Yanlu* 鹽綠 (Persian zingar; RP 121)

It congeals mercury.

Collation: ZD gives the same text.

DT116. *Yandan* 鹽膽 (? perhaps *yan'gen* 鹽根, calcareous spar)

It boils the Four Yellow [minerals] and is used for soldering.

Collation: ZD and BG *juan* 5 both give the same text.

Section on various types of fen 粉 (powder)

DT117. *Dingfen* 定粉 (white lead; RP 12)

It can fix realgar and nourish cinnabar.

Collation: ZD gives the same text with one missing character.

DT118. *Hufen* 胡粉 (another name for white lead)

It can fix sulphur and can be used for making the outer [reaction vessel of the] *kui* [type].

Collation: ZD gives the same text, but with two missing characters.

DT119. *Nifen* 膩粉 (calomel; RP 45)

It subdues and transforms copper.

Collation: There is one corrupt word in the text after the word 'subdues'. ZD gives the same text.

DT120. *Yunmufen* 雲母粉 (mica powder; RP 55)

It fixes mercury, subdues cinnabar and can be ingested.

Collation: ZD gives the same text; BG *juan* 8 gives the text minus the words 'powder' and 'can be ingested'.

Section on various types of xiao 硝 (mainly Nitrates)

DT121. *Mayaxiao* 馬牙硝 (purified sodium sulphate; RP 123)

It nourishes cinnabar and fixes sal ammoniac.

Collation: ZD gives the same text.

DT122. *Puxiao* 朴硝 (crude Glauber's salt, RP 123)

It boils sulphur and is contraindicated (*fan* 反) with orpiment and realgar.

Collation: ZD gives the text with one missing character.

DT123. *Sushuixiao* 縮水硝 (?) (shrinking-in-water xiao)

It dries mercury and nourishes cinnabar.

Collation: ZD has the same text.

DT124. *Mangxiao* 芒硝 (saltpetre; RP 125, also Glauber's salt)

It subdues realgar.

Collation: ZD has the same item, but with one missing character.

DT125. *Kengxiao* 坑硝 (? perhaps some sort of impure nitrate)

It can subdue cinnabar.

Collation: ZD has the same text.

DT126. *Yanxiao* 鹽硝 (saltpetre; RP 125)

Brought into solution it can resist the heat of fire.

Collation: This item is not found in ZD.

Section on various (substances with names containing the character for) shui 水 (water)

DT127. *Shuijing* 水精 (rock crystal; RP 37)

It can nourish cinnabar.

Collation: ZD has the same text.

DT128. *Maowu yushui* 茅屋雨水 (rain water collected from roof of thatched hut)

It can be used for boiling mica.

Collation: ZD has the same text.

DT129. *Mishui* 蜜水 (honey)

It can be used for boiling cinnabar.

Collation: ZD has the same text.

Section on various tu 土 (earths)

DT130. *Tumu* 土母 (?) (some sort of a red-coloured earth)

It is red in colour and occurs in *Sanxuesan* 三學山 Mountain (in Jintang xian, Sichuan province). It subdues sal ammoniac.

Collation: This item is also found in ZD. The transcribed Japanese version originally mentions a *Wuxueshan* 五學山 mountain that ZD calls *Sanxueshan*. Since the former mountain name is unknown, it is amended above to follow ZD. This is probably a case of confusion arising between the two characters san 三 and wu 五.

DT131. *Tuhuang* 土黃 (compound powder of arsenic; RP 92)

It fixes realgar.

Collation: ZD and BG *juan* 10 both give the same text.

DT132. *Fulonggan* 伏龍肝 (silicate)

It occurs (about) one foot deep below a furnace that has been in use for 10 years [or more] and looks like a row of purple porcelain. (Commentary: One version has the word colour after porcelain.) It can be used to subdue cinnabar and to contract tin.

Collation: ZD and BG *juan* 10 both give the same text with slightly different wordings.

DT133. *Baojintu* 苞金土 (earth where metals burst forth, perhaps earth in the mine)
It congeals mercury.

Collation: ZD gives the same text.

DT134. *Daizhetu* 代赭土 (perhaps earth where red hematite occurs)
It brings out the gold colour.

Collation: ZD gives the same text.

DT135. *Qiankeng chitu* 鉛坑赤土 (red earth in lead mines)

It can be used for making *danshayin* 丹砂銀 (artificial silver made from cinnabar).

Collation: ZD gives the same text.

DT136. *Disui* 地髓 (*Rehmannia glutinosa*, Lib.; RL 107)

Occurring in Jun[zhou] 均州 (in modern Hubei province) and Fang[zhou] 房州 (in modern Hubei province), it fixes cinnabar and can be used for making the outer [reaction vessel of the] *kui* [type].

Collation: ZD gives the same text.

DT137. *Chiniaojue* 赤鳥膠 (?)

It can be used for making the outer [reaction vessel of the] *kui* 匱 [type].

Collation: ZD gives the same text.

End of *Danfang jianyuan*: *juan* 2

Collation: ZD gives Middle *juan*, and without the words ‘End of.

***Danfang jianyuan*: *juan* 3 丹方鑒源: 卷三**

Collation: ZD gives Lower *juan*.

Section on miscellaneous ingredients

DT138. *Huangdan* 黃丹 (minium; RP 13)⁷⁸

It subdues arsenic, and fixes sal ammoniac and sulphur. The method of roasting *qiandan* 鉛丹 (minium) [is as follows:] Take one pound of lead, one ounce of coarse sulphur and one ounce of saltpetre. The lead is first melted into liquid and a little vinegar is added. While [the molten lead] is still boiling put in a small piece of sulphur and gradually add saltpetre a little at a time. When the molten metal boils again add in a little vinegar, and as before, introduce a little saltpetre and sulphur until all the saltpetre and sulphur are gone. The liquid mass is roasted to produce minium in powder form.

Collation: ZD has only the first sentence, without the method. BG *juan* 8 gives only the method.

DT139. *Xuanjing [shi]* 玄精[石] (selenite; RP 120)

It nourishes cinnabar and fixes sulphur.

Collation: ZD gives the same text.

DT140. *Chiyogu* 蚩尤骨 (?) (‘the bone of *Chiyu*’, a legendary figure who fought the Yellow Emperor) (perhaps *chixiu* 蚩休, *Paris polyphylla*, Sm.; RL 685)

It can be used for making the outer [reaction vessel of the] *kui* 匱 [type].

Collation: ZD gives the same text.

DT141. Yuning 雲英 (mica; RP 39)

It can nourish cinnabar.

Collation: ZD gives the same text.

DT142. Yunmu 雲母 (mica; RP 39)

It can fix sulphur and dry mercury. It can also be ingested.

Collation: ZD gives only the first sentence without the second.

DT143. Wuse Yuyuliang 五色禹餘糧 (brown hematite with yellow streak?)

It dries mercury and brings out the colour of gold.

Collation: ZD gives the same text, but without mentioning the colour of gold. BG juan 10 gives the text together with another substance *shizhonghuang* 石中黃 (geode; RP 81).

DT144. Taiyin xuanjing 太陰玄精 (selenite; RP 120)

It fixes cinnabar and subdues sulphur.

Collation: ZD gives the same text. BG juan 11 gives the text in a different order, calling it *xuangjingshi* 玄晶石.

DT145. Yumoshā 玉末砂 (perhaps powdered jade)

It nourishes cinnabar.

Collation: ZD has the same text.

DT146. Tonghuang 銅黃 (perhaps *huangtong* 黃銅, a copper alloy containing tin)

[It is an ingredient for making the] lute.

Collation: ZD has the same text.

DT147. Xiangmo 香墨 (fragrant Chinese ink)

[It is an ingredient for making the] lute.

Collation: ZD has the same text.

DT148. Milizi 蜜梨子 (a kind of limestone; RP 62)

It dries mercury.

Collation: ZD has the same text.

DT148. Yuganzi 榆甘子 (Indian gooseberry; RL 330)

It softens the Five Metals.

Collation: ZD has the same text,

DT150. Ruxiang 乳香 (terebinth tree)

It dulls [the sound of] copper.

Collation: ZD gives the same text. BG juan 34 also gives the same text. Copper here perhaps refers to bronze.

Section on miscellaneous medicinal concoctions

DT151. Su 酥 (cheese)

It can be used for soaking (moistening) [alchemical or pharmaceutical] ingredients.

Collation: ZD has the same text.

DT152. Ru 乳 (milk)

It removes all sorts of toxicity due to fire.

Collation: ZD gives the same text.

DT153. Kujiu 苦酒 (vinegar); danfan 膽礬 (copper sulphate); zuowei 左味 (vinegar) and micu 米醋 (rice vinegar)

Each (of these can be used to) boil the Four Yellow [minerals] (i.e. sulphur, realgar, orpiment and arsenious oxide), and to dissolve various [alchemical or pharmaceutical] ingredients [including] cinnabar.

Collation: ZD does not mention cinnabar. BG *juan* 11 takes only *danfan* and *micu* into account.

DT154. *Xiaobian* 小便 (urine)

It boils potash alum and subdues sulphur.

Collation: ZD has the same text.

Section on various types of oil

DT155. *Damayou* 大麻油 (castor oil; RL 598)

It can be used to boil lead and it congeals mercury.

Collation: ZD has the same text.

DT156. *Jushengyou* 菑勝油 (sesame oil; RL 97); *Zisuyou* 紫酥油 (*Perilla nankinensis*, Decne, oil; RL 135)

They soften the Five Metals and smoothen the Eight Minerals.

Collation: ZD gives the same text, while BG *juan* 14 calls the second item *Suziyou* 蘇子油.

DT157. *Gulumanzi* 骨律蔓子 (probably *Gelemanzi* 葛勒蔓子 wild hop seeds oil; RL 604)

It can be used for boiling mercury

Collation: ZD gives the same text.

DT158. *Caomayou* 草麻油 (*Ricinus communis* L. oil; ZY no. 5108)

It can be used for boiling tin.

Collation: ZD gives the same text, so does BG *juan* 9.

DT159. *Yushiyou* 礬石油 (white arsenical ore in solution)

It congeals mercury.

Collation: ZD gives the same text.

DT160. *Shinaoyou* 石腦油 (petroleum; RP 69)

It transforms copper and fixes arsenic.

Collation: ZD gives the same text.

Section on various types of fats

DT161. *Niuzhi* 牛脂 (fats of cattle)

It renders copper more pliable.

Collation: ZD and BG *juan* 50 both give the same text.

DT162. *Yangzhi* 羊脂 (fats of sheep and goat)

It softens silver and renders copper more pliable.

Collation: ZD gives a similar text without mentioning copper. BG *juan* 50 gives the same text as the Japanese version.

DT163. *Tonggu* 銅骨 (copper bone?)

Collation: This should read *Yangtonggu* 羊[骨+同]骨 (shinbone of sheep and goats) after BG *juan* 50, which also identifies *tonggu* as *jinggu* 經骨.

It can subdue sal ammoniac.

Collation: ZD gives a similar text, but without the word *sha* for sal ammoniac. [骨+同]骨, also has the same text and gives the correct name *yangtonggu* 羊

DT164. *Guyangjue* 羖羊角 (ram's horn)

It contracts *xi* 錫 (tin). (Commentary: One version gives *he* 貲, which is a synonym for tin.)

Collation: ZD and BG *juan* 8 give more or less the same text as above.

DT165. *Zhuzhi* 豬脂 (lard)

It is used to boil copper and tin.

Collation: ZD gives the same text.

DT166. *Weizhi* 蜚脂 (hedgehog fat)

It subdues realgar. (Commentary: One version gives fat from hedgehog skin.)

Collation: ZD gives more or less the same text.

DT167. *Luotuozi* 駱駝脂 (camel fat)

It softens metals (*Jin* 金)

Collation: ZD gives more or less the same text. BG *juan* 50 gives the 'Five Metals' (*wujin* 五金) clarifying that the word *jin* should be read in its broader sense as 'metals' instead of 'gold'.

DT168. *Luomazhi* 駱馬脂 (fat of a white horse with black mane)

It softens the Five Metals.

Collation: This item is not found in ZD. BG *juan* 50 calls it *mazhi* 馬脂 (horse fat).

DT169. *Lumazhi* 驢馬脂 (mule fat)

It softens the Five Metals.

Collation: ZD gives the same text.

DT170. *Wuzeyugu* 烏賊魚骨 (squid's bone)

It flattens the taste of salt.

Collation: ZD gives the same text.

Section on various types of dungs from birds and animals

DT171. *Quefen* 雀糞 (sparrow's droppings)

It subdues arsenic.

Collation: ZD gives the same text.

DT172. *Mafen* 馬糞 (horse dung)

Horse dungs nourish fire to cultivate the strength of all (alchemical and medicinal) substances.

Collation: The text has a misprint for the word 'fire', giving *da* 大 instead of *huo* 火. The text is amended after its equivalent passages in ZD and BG *juan* 50.

DT173. *Baigoufen* 白狗糞 (of a white dog)

It [serves as a fuel for] heating copper. (Commentary: One version gives *tang* 湯, hot water; instead of *tong* 銅, for copper.)

Collation: ZD gives white excreta from dogs instead of from white dogs. BG *juan* 50 gives the same text as the Japanese version.

DT174. *Niufen* 牛糞 (cow dung)

It removes the tint in copper.

Collation: ZD gives the same text. BG *juan* 50 has the same text and in addition gives 'It nourishes fire to cultivate the strength of all sorts of (alchemical and medicinal) ingredients.'

DT175. *Qiuyinfen* 蚯蚓糞 (earthworm excreta)

It is used as a lute.

Collation: ZD has the same text.

DT176. *Hanhaoniaofen* 寒號鳥糞 (droppings from a species of nightingale that is said to sing at dawn)

It contracts tin.

Collation: ZD gives the same text.

DT177. *Bogefen* 鴿鴿粉 (pigeon's excreta)

It contracts tin.

Collation: ZD gives the same text.

Section on various types of ashes

DT178. *Hongxin huidiao* 紅心灰條 (*Chexxpodiuxn album*, L., pink variety;

RL 561a; BG *juan* 11 calls it *hongxin huiguan* 紅心灰罐)

It fixes potash alum.

Collation: ZD gives the same text.

DT179. *Qiaomaihui* 蕎麥灰 (buckwheat ash; RL 564)

It can be used for boiling calomel.

Collation: ZD gives the same text.

DT180 *Xianecaohui* 仙娥草灰 (?) (perhaps ash from *xiannuhao* 仙女蒿, red poppy; RL 489)

It fixes sulphur.

Collation: ZD gives the same text.

DT181. *Buhuimuhui* 不灰木灰 (asbestos ash or powder)

It can be used for boiling mercury.

Collation: ZD gives the same text. BG *juan* 9 gives the same text with additional information.

DT182. *Baojincaohui* 苞金草灰 (perhaps ash from *baojinlian* 苞金蓮, *Rumex madaio* Mak.; ZY no. 0143)

It congeals mercury.

Collation: ZD gives the same text.

DT183. *Machi[xian]hui* 馬齒[莧]會 (purslane ash)

It is used to boil cinnabar and it congeals mercury.

Collation: ZD gives the same text.

DT184. *Yimucaohui* 益母草灰 (Siberian motherwort ash)

Mixed with noodle soup and heated over the fire it cures *fengci* 風刺 ('pneumatic punctures', perhaps referring to acne) on the face. It also fixes sulphur.

Collation: ZD only says that it fixes sulphur. BG *juan* 15 says that it fixes sulphur, realgar and arsenious oxide.

DT185. *Zigehui* 紫葛灰 (*Vitis coignetiae*, Pull, ash; RL 283)

It fixes saltpetre.

Collation: ZD gives the same text.

DT186. *Sanghui* 桑灰 (mulberry ash)

It fixes sulphur, subdues sal ammoniac and congeals mercury.

Collation: ZD gives a similar text, but leaves out any mention of mercury.

DT187. *Tongcaohui* 苘草灰 (probably *tonghaohui* 苘蒿灰, garden daisy ash; RL 23)

It fixes orpiment and realgar.

Collation: ZD gives the same text.

DT188. *Poluomencaohui* 婆羅門草灰 (perhaps *xianmaohui* 仙茅灰; star grass ash; RL 660)

It can be used to boil mercury.

Collation: ZD gives the same text, but omits the word *cao* 草 (plant).

DT189. *Hecaohui* 禾草灰 (crops ash)

It removes the tint of tin.

Collation: ZD gives the same text.

DT190. *Qinjinhuai* 勤堇灰 (probably celery ash)

It fixes cinnabar and sulphur. (Commentary: One version gives different Chinese characters for *qinjinhuai* 勤堇灰.)

Collation: ZD gives the same text, but without the commentary.

DT191. *Yujingenhui* 鬱金根灰 (*Curcuma longa*, root ash)

It can be used to congeal mercury.

Collation: ZD gives essentially the same text and so is BG *juan* 14, but without the word for root.

DT192. *Dongguamanhui* 冬瓜蔓灰 (ash from the vine of the white gourd)

It can be used for boiling mercury and cinnabar or for tempering copper and tin.

Collation: ZD gives the same text.

DT193. *Zhihui* 紙灰 (paper ash)

It can retain fire over a long period.

Collation: ZD gives the same text.

DT194. *Dayinhui* 打銀灰 (perhaps ash from the process of beating silver)

It is used to project (*dian* 點) green jade.

Collation: ZD gives the same text.

Section on juices from various plants

DT195. *Wuzhicao* 五枝草 (perhaps *Wufangcao* 五方草, purslane)

It congeals mercury.

Collation: ZD has the same text.

DT196. *Zhanglu* 章陸 (*Phytolacca aririosa*, Roxb.; RL 555)

It extracts tin.

Collation: ZD gives the same text.

DT197. *Canger* 蒼耳 (*Xanthium Strumarium*, L.; RL 50)

It removes tint from tin.

Collation: ZD has the same text.

DT198. *Wuse xian* 五色莧 (amaranth of various colours)

It is used to boil mercury.

Collation: ZD has a similar text but calls it *wuse renxian* 五色仁莧.

DT199. *Zhupicao* 豬皮草 (?) (perhaps *zhuyacao* 豬牙草, ink plant; RL 32)

It congeals mercury.

Collation: ZD gives the same text.

DT200. *Tianjiancao* 天劍草 (hedge bindweed; RL 155)

It can be used for boiling mercury.

Collation: ZD gives the same text.

DT201. *Zhizi* 梔子 (the Gardenia nut)

It can be used for tempering metal.

Collation: ZD gives the same text.

DT202. *Qijiecao* 七節草 (? perhaps *qiyecao* 七葉草, *Sedum Kaintschaticum*, Fisch.; ZY no. 3589)

It congeals mercury.

Collation: ZD gives the same text.

DT203. *Wojuzhi* 萵苣汁 (lettuce juice)

If lettuce is grown on sulphur, [its juice] can congeal mercury and fix cinnabar.

Collation: ZD gives the same text, but omits the word for juice. BG juan 27 also gives the same text without the word for juice.

DT204. *Mabiancao* 馬鞭草 (verbena; RL 147)

It contracts tin.

Collation: The text seems to be corrupt as it consists of only two characters *xi* 錫 (tin) and *sha* 砂 (possibly a short form of *shazi*, which was a synonym for mercury). The text is amended after BG juan 8. ZD gives the same text as the Japanese version.

DT205. *Yinxiancao* 銀線草 (*Chloranthus japonicus*, Sieb.; ZY no. 4479)

It congeals mercury.

Collation: ZD gives the same text.

DT206. *Qingmazhi* 靛麻汁 (?) (perhaps Indian mallow juice)

It is used to soak [alchemical or medicinal] substances.

Collation: ZD puts DT 206 to DT 210 all under *Tianjiancao*.

DT207. *Xusuicao* 續莨菪草 (?) (perhaps *Xusuicao* 續隨草, *Euphorbia lathyris*, L.; ZY no. 0445)

It congeals mercury.

Collation: ZD puts items nos. 206 to 210 all under *Tianjiancao*.

DT208. *Huercao* 虎耳草 (saxifrage; RL 468)

It can be used for boiling mercury.

Collation: ZD puts items nos. 206 to 210 all under *Tianjiancao*.

DT209. *Shuitianwengcao* 水田翁草 (green duckweed; RL 702b; see Yan (1973) p. 504)

It can be used for boiling mercury.

Collation: ZD puts items nos. 206 to 210 all under *Tianjiancao*.

DT210. *Dumaicao* 獨麥草 (perhaps *shanfengzi* 山封子, *Portentilla freyniana*, Bornm.; ZY no. 0128)

It is also called *shanfengzi* 山蜂子. [Its juice can be used for] tempering tin.

Collation: ZD puts items nos. 206 to 210 all under *Tianjiancao*.

DT211. *Jushengzhi* 巨勝汁 (sesame juice)

It can be used for boiling cinnabar.

Collation: This item is missing in ZD, but is given in BG juan 22.

DT212. *Haiyu* 海芋 (big-rooted caladium; RL 705)

It subdues sal ammoniac.

Collation: ZD gives the same text.

DT213. *Wubeizi* 五倍子 (nutgall; RL 316, also Aleppo galls; RL 615)

It withers (*ku* 枯) lead.

Collation: ZD gives the same text.

DT214. *Gouzhi* 構汁 (juice from the paper mulberry)

It [can be used to] soak [both alchemical and medicinal] substances and mercury.

Collation: This item is not found in ZD.

DT215. *Liujiao* 柳膠 (gum from the willow tree)

It congeals mercury.

Collation: ZD has the same text.

Section on miscellaneous essential substances

DT216. *Heidou* 黑豆 (black soybean; RL 388)

It renders copper more pliable.

Collation: ZD has the same text.

DT217. *Fuzi* 附子 (autumn root; RL 523a)

It can be used for boiling copper.

Collation: ZD has the same text.

DT218. *Badou* 巴豆 (croton oil; RL 322)

It softens copper, removes tint and can fix tin and congeal mercury.

Collation: ZD gives the same text, but omits the reference to tin, while *BG juan* 8 gives only this particular reference.

DT219. *Kuhu* 苦瓠 (calabash; RL 63)

It [is used to] boil mercury.

Collation: ZD has the same text.

DT220. *Fupingcao* 浮萍草 (duckweed)

It subdues sulphur.

Collation: ZD has the same text.

Section on various paste-like ingredients

DT221. *Tieni* 鐵泥 (iron paste)

Temper powdered iron and use the powder together with the *liuyi[ni]* 六一泥 as a lute.

Collation: ZD gives the same text.

DT222. *Yanjiaoni* 鹽膠泥 (salt paste)

Beat egg white and common salt [with the pestle] into a paste.

Collation: ZD gives the same text.

DT223. *Fanni* 礬泥 (alum paste)

Grind (alum shale) into powder and it is particularly good when used with the *liuyi[ni]* as a lute.

Collation: ZD gives the same text.

DT224. Niufenhuo 牛糞火 (cow dung fire)

For extracting [alchemical or medicinal] substances its strength is greater than that of charcoal.

Collation: ZD gives the same text.

DT225. Mafenhuo 馬糞火 (horse dung fire) [As above].

Collation: ZD gives the same text.

DT226. Kanghuo 糠火 (husks fire)

[It produces an] even [fire] that doubles the intensity of the ordinary.

Collation: ZD gives the same text.

DT227. Zhuhuo 竹火 (bamboo fire)

It covers and nourishes mercury. By nature this fire is slow.

Collation: ZD gives the same text.

DT228. Qingganghuo 青剛火 (fire using the *Quercus acutissima* Carr. plant as fuel; see ZY no. 5433)

Its strength is comparable to that of a goat shinbone.

Collation: ZD gives the same text.

On making copper, silver and lead beads (sha 砂)

DT229. Tongsha 銅砂 (copper-coated beads)

Take molten [copper], add powdered porcelain or tile and stir. Beads [coated with copper] will be formed immediately.

Collation: ZD gives the same text.

DT230. Yinsha 銀砂 (silver-coated beads)

Take molten [silver], pour in some liquid alum shale and stir with wet rolled paper.

Collation: ZD gives the same text.

DT231. Qiansha 鉛砂 (lead-coated beads)

Pour molten [lead] into a basin containing sand and grind with a wooden pestle.

Lead-coated beads will form instantly.

Collation: ZD gives the same text.

Section discussing miscellaneous substances

DT232. Zhushayou 朱砂油 (cinnabar oil)

This is a prepared medicine. [Cinnabar] is covered with saltpetre and crude Glauber's salt until a liquid is formed. Prolonged ingestion does not yield any remarkable result.

Collation: ZD gives the same text.

DT233. Liuhuangsū 硫黃酥 (sulphur cheesecake)

Some [people] eat it after steaming it in honey. [However,] the toxicity of coarse sulphur still remains and hence this substance should be avoided.

Collation: This entry is not in the Japanese version. It comes from ZD.

DT234. Cishi 磁石 (magnetite; RP 76)

This is a useless [elixir] substance. It does not possess the *qi* 氣 of fusion. Some [people] consume only its *qi* (perhaps meaning boiling the ingredients with magnetite, but leaving magnetite as a residual at the time of consuming the concoction), but this

must not be done over a long period. If magnetite itself is also consumed together with the concoction over a period of time serious consequences will arise.

Collation: ZD gives the same text, but says instead that the concoction ‘can be taken over a long period’.

DT235. *Naosha* 礞砂 (sal ammoniac; RP 126)

By nature sal ammoniac is highly toxic. It can be consumed in the case of pneumatic illness of deep and sustained cold (*leng* 冷), but the dosage must stop as soon as the illness is cured. Overdose leads to accumulation of blockages. (Commentary: One version gives ulcers instead of blockages.)

Collation: ZD gives essentially the same text, but without the commentary. *BG juan* 11 gives a somewhat similar text mentioning blockages and ulcers together.

DT236. *Longhutou* 龍虎頭 (‘Head of the Dragon and the Tiger’, probably referring here to cinnabar)

Mercury and sulphur together turn red. Sometimes the red colour comes when the two substances are heated for less than 10 days. People regard this as superior, not knowing that the toxicity of sulphur has grown on mercury. Although [the mercury] has turned red due to the influence of the *qi* [of sulphur], the substance should not be ingested.

Collation: ZD gives the same text.

DT237. Method of preparing the *Wuhuang* 五黃 [elixir] pills

Take one ounce each of *xionghuang* (realgar), *cihuang* (orpiment), *pihuang* (arsenic), *liuhuang* (sulphur) and *huangfan*. These together with saltpetre are mixed with rice vinegar and grounded so that they are soaked through. [The mixture] is heated in a fire to remove the *qi* of *Yin* 陰 before use. First of all, crystallise one pound of common salt and collect the crystals. [Next take a pan] and spread a layer of the salt over it. Take a new pottery pot with its rim fitting exactly that of the pan. Then put the above mixture on top of the layer of salt and cover the pan with the pottery, inverted such that the two rims meet. [The outer surface of the pan and the pot] is smeared over with a lute containing salt. After sealing place the pan over a flame so that the sublimate rises to the bottom of the [inverted] pot. When the sublimation is completed remove the sublimate by sweeping [with a feather]. The sublimate is again ground up, then rice vinegar is introduced and the *qi* of *Yin* is removed as before. Repeat the above sublimation process, collect the sublimate and after grinding put it in a [reaction vessel of the] *kui* 匱 [type] at the *wei* 未 double-hour (i.e. 13:00–15:00 hours). One pound of fuel is used to heat [the reaction vessel]. [After heating] the substance inside is removed and ground up. It is then mixed with lard and made into pills of the size of white soybeans. One pill fixes one pound of mercury. Take a new pan and put some yellow earth on it. Make a hole in the yellow earth and pour one ounce of mercury inside the hole. When [the pan is heated over a fire and the mercury] gets hot and becomes agitated put one pill [in the mercury] and listen to the [sizzling] sound. When the sound subsides the *qi* is attained. This is unlike *shanze* [shujin] 山澤[熟金] (pure gold). The process stops at the third (sublimation). The method of using the [reaction vessel of the] *kui* [type] is given elsewhere.

Collation: ZD gives essentially the same text.

DT238. *Guijiu* 鬼臼 (*Dysasma persipellis* (Hance) M.; ZY 3485; umbrella leaf, RL 520)

There are two varieties of *shulücao* 術律草 with roots resembling those of (*tian*)*nanxing* (天) 南星 [*Arisaema consanquineum*, Schott; ZY 0656] and red stalks

growing vertically upwards bearing leaves at the tips. In one variety a blade consists of seven leaflets, and in another the leaflets form multifold. The leaves resemble those of *pima(zi)* 花麻子 [*Ricinus communis*, L; ZY 5108], green on the upper surface and purple on the lower, which has tiny hairs. A flower grows at the junction of the stalk and the blade, hanging down like an inverted bell. It is whitish blue in colour, with yellow stamens and hollow in the centre. It bears yellow fruit. The plant sways by itself, not by the wind. It can fix cinnabar and mercury.

Collation: This item is neither in the Japanese version nor in *ZD*. It comes from *BG* *juan* 17.

End of *Danfang jianyuan*: *juan* 3 丹方鑒源: 卷三

Collation: *ZD* omits the word *End* and says ‘Lower *juan*’.

[Colophon] (Figure 3.4)

This (copy of the) *Tanbō kangen* (*Danfang jianyuan*) in three *maki* (*juan*) by Dokko Tō (Dugu Tao) of the Zui (Sui 隋) period, was presented to me by my live-in student (*ka tei[shi]* 家[弟子]) Tō Andō (Tang Andao 湯安道, who transcribed it from the Daoist Canon and did the impressive book-binding. The 4600 books of the Daoist Canon in the collection of our (*yo* 予) (Mōri 毛利 Takasue 高標, the Lord of Saeki 佐伯侯 are extremely rare. This book shows some variations from the quotations made by Ri Hinko (Li Binhu 李瀕湖) (i.e. Li Shizhen) (1518–1593) in his *Honsō* (*Bencao* [gangmu]). I am looking forward to the day when (someone) collates the two texts.

Written on the eve of Mid-Autumn Day in the First Year of the Bunka period (17th of September 1804) by Rekisō dōjin 樸窓道人.

Annotation

The 1928 exhibition of Japanese and Chinese pharmacological books at the Osaka [Furitsu] Library identified the writer of this colophon as Taki Motohiro 多紀元簡 (also read as Taki Genkan) (1755–1810), physician to the Shogun, as one of the three seals on the first page of the book bears his official title. Rekisō dōjin was the appellation name of Taki Motohiro. He came from the Taki family of government physicians that founded a private school in 1765. Its family members were knowledgeable about rare old books and he himself was a great writer and collector of medical works of his time even though he had incorrectly given the wrong period for Dugu Tao. Tang Andao was probably a Chinese student who lived in his family school.

Mōri Takasue (1755–1801), the Lord of Saeki (also read as Saiki), was famous as a book collector. In the Bunsei period (1818–29) Takahane 高翰 passed his Mōri family collections to the *bakufu*. Eventually these books went to the imperial palace in the year 1891, the twenty-fourth year of Meiji. Many books in the collections of the imperial palace still bear the seal of Takasue using his style name Baisho 培松. Taki would probably have known Takasue, as suggested by the use of the word *yo* (usually in singular number and either nominative or objective case) to show their regional affiliation

右隋獨孤泊丹方鑑源三卷家藏
 安道抄於道藏中手裝潢以見贈道
 藏四千六百本係予佐伯侯高標儲藏
 洎軍世之寶錄也此書與李瀕湖本
 草可援引互有異同俟他日校讎耳
 文化紀元中於前日 樓憲道人簡

Figure 3.4 Colophon in the last page of the transcribed copy of the *Danfang jianyuan* preserved in Japanese National Diet Library.

and common interest in book collection, although the Mōri family was not particularly supportive of the Tokugawa regime and eventually helped to overthrow it about half a century later to restore the power of the emperor. Taki could have borrowed the original text either from Takasue before 1801 or from the latter's successor for his student to copy. His seal on the first page signifies his ownership, which now has eventually passed to the National Diet Library (see Figure 3.2, p. 35 above).

Partial restoration, translation and collation of *Danfang jingyuan*
 丹房鏡源 (Mirror of the Alchemical Laboratory) (Figure 3.5)

[Abbreviations: DT=*Danfang jianyuan* 丹方鑑源

RL=Read and Liu (1936), by item number

RP=Read and Pak (1936), by item number

ZL=*Chongxiu Zhenghe jingshi zhenglei beiyong bencao*
 重修正和經史證類備用本草⁷⁹]

Items restored from the Qiangong jiageng zhibao jicheng

鉛汞甲庚至寶集成

JY1. Yunmufen 雲母粉 (mica powder; RP 55)

[It] controls mercury, subdues cinnabar and can also be ingested.

三第四卷 成集寶至庚甲汞鉛

雲母粉制汞伏丹砂亦可食之并花立起資
 形如芍藥花色赤青可長三又已米葉上黃
 班色味苦混堪用資離黃立佳火雷公云離
 得并花立便成庚補天石又名霄天石伏鉛
 立拒大紫背天葵背紫面青能堅鉛形反死
 鉛宗心草今呼石竹花能留砒住鼎青提草
 今呼虎鬚草黃砂即住火立便成庚砂過
 赤顏玉木可養丹砂芒硝可伏雌黃石鍾乳
 可為置養丹砂可制硃砂紫礬石可制汞滑
 石可制雌雄二黃為外匯石膽出蒲州余鄉
 縣如雞卵大為上擊之縱橫解皆成疊文色
 青見風久則綠其中亦青也今信州鉛山縣
 有若泉流以為潤抱其水熱之則成膽礬即

沒藥 滴乳 赤石 餘糧
 八寶震靈丹 朱砂 代赭 靈脂 紫英
 胡蘆巴 豆蔻 茴香
 金鈴子 硫黃 木香 肉桂 陽起石
 附子 補骨脂
 深附黑錫丹 沉香 黑鉛

Figure 3.5 First page of the *Danfang jingyuan* incorporated into the *Qiangong jiageng zhibao jicheng* compendium in the Daoist Canon.

Collation: This item is also quoted in DT 120 without the word ‘also’ and in ZL juan 3.

JY2. *Qinhua* 芹花 (flower of *Oenanthe stolonifera*, DC (M. St. J.); RL 225)

[It] relieves poverty instantly. Its appearance is like the peony, red and blue in colour. [The plant] grows within three feet in height, with yellow stripes on the leaf surface and a bitter taste. It can be used for boiling orpiment, enabling it to stay with the heating instantly. The *Leigong[pao]* says: ‘Orpiment with *qinhua* turns instantly into *geng* 庚 (i.e. gold).’

Collation: This item is not found in ZL and DT.

JY3. *Butianshi* 補天石 (?) (‘firmament-mending stone’; perhaps multicoloured stone, probably referring to wuse *shizhi* 五色石脂, coloured siliceous clays; RP 57)⁸⁰

Also known as *xiutianshi* 修天石, it subdues lead, rendering it to resist fire instantly.

Collation: This item is not found in ZL and DT.

JY4. *Zibei tiankui* 紫背天葵 (probably *luokui* 落葵, which is *Brasella rubra*, L., also known as *tiankui*)

[The leaf] is purple on the lower surface and blue on the upper. It hardens lead but causes its death.

Collation: This item is not found in ZL and DT.

JY5. *Zongxincao* 宗心草 (*Duarrhena japonica*, Cry. Var. Koenigii, Hack; ZY no. 4821)

Now known as *shizhuhua* 石竹花, it enables arsenic to remain inside the cauldron.

Collation: This item is not found in ZL and DT.

JY6. *Qingxucao* 青蘗草 (*Juncus effuses*, L. var. *decipiens*, Buchen; RL 696, ZY no. 1901)

It is now known as *huxucao* 虎鬚草. When boiled together with sal ammoniac [the latter] stays with heating. *Geng* (gold) forms instantly when sal ammoniac meets *chixu* 赤鬚 (perhaps the red variety of the plant).

Collation: This item is not found in *ZL* and *DT*.

JY7. Yumo 玉末 (powdered jade)

[It] can nourish cinnabar.

Collation: *DT*145 calls it *yumosha* 玉末砂 and drops the word ‘can’; it also appears in *ZL juan* 3 without the word can.

JY8. Mangxiao 芒硝 (saltpetre; RP 125)

[It] can subdue orpiment.

Collation: This item also appears in *ZL juan* 3 and *DT* 124, but both without the word can.

JY9. Shizhongru 石鐘乳 (stalactites; RP 63)

[It] can be used to make an outer [reaction vessel of the] *kui* 匱 [type].

Collation: *DT*69 calls it *shiru* 石乳, while *ZL juan* 3 calls it *shizhongru* and *shiru*. Otherwise the texts are similar.

JY10. Mayaxiao 馬牙消 (saltpetre; RP 123)

[It] nourishes cinnabar and can control sal ammoniac.

Collation: The word *mayaxiao* is added from *DT*121 and *ZL juan* 3, both have identical text but without the word can.

JY11. Zifanshi 紫礬石 (purple-coloured ferrous sulphate)

[It] can control mercury.

Collation: *DT* 42 gives greater detail and calls it *zifan*. This item is also quoted in *ZL juan* 3 without the word can.

JY12. Huashi 滑石 (soapstone; RP 55)

[It] can control the two yellow [substances], orpiment and realgar, when used to make the outer [reaction vessel of the] *kui* 匱 [type].

Collation: Quoted in *ZL juan* 3 with the alternative word *neng* 能 replacing *ke* 可, both meaning can. *DT* 81 also uses the alternative word and omits the term ‘two yellow [substances]’.

JY13. Shidan 石膽 (blue vitriol; RP 87)

[It] occurs in Yuxiang xian 余鄉縣 of Puzhou 蒲州 and is of the size of a hen’s egg. When struck at the top vertical and horizontal crack lines will appear, forming folding marks. Blue in colour, it turns green with long exposure to wind, although there are some that remain blue. Nowadays there is a bitter spring at Qianshan xian 鉛山縣 in Xinzhou 信州. [The water] flows as a brook. When the water is taken and heated *danfan* 膽礬 (copper sulphate) is obtained. Copper can be formed. If one boils *danfan* in an iron pan, after some time copper would be formed.

Collation: A misprint in the text for the word ‘bitter’ (*ruo* 若 instead of *ku* 苦) is amended here. This item is not in *ZL* and *DT*. *DT* 92 for *shidan* is quite different.

JY14. Cengqing 曾青 (stratified variety of malachite; RP 93)

That coming from Weizhou 蔚州 is genuine. Do not use any that is embedded with pebbles or *tongqing* 銅青 (basic acetate of copper). In the procedure, to one ounce of the substance use the three ingredients *zibei tiankui* 紫背天葵 (probably *Brasella rubra*, L.), *gancao* 甘草 (licorice) and *qingzhicao* 青芝草 (*Ganoderma japonicum* (Fr.) Lloyd; *ZY* 2395), and [separate the] dry and wet into two different bowls.⁸¹ With equal amounts of

the ingredients boil [the mixture] gently over 5 days and nights, keeping water and fire under control. When the time is up, remove the content and wash it in water taken from a west-to-east flowing stream. Then grind it to powder in a mortar for application. *Cengqing* congeals mercury and controls cinnabar, being derived from the *qi* of Metal 金. It is also said that when *cengqing* stays with heating and appears like grease it can instantly control mercury turning it into silver to take its place among the Eight Minerals.

Collation: ZL *juan* 3 merely says that *cengqing* congeals mercury and controls cinnabar, being derived from the *qi* of Metal. DT 64 also mentions the greasy form and adds that vinegar should be used during the boiling process.

JY15. *Kongqing* 空青 (large hollow variety of malachite; RP 82) [The procedure for preparation] is the same as above. Products from Weizhou are of good quality.

Collation: DT 63 gives a different quotation. It is not in ZL. A misprint 'zhu 住 (to live in)' is amended to read 'jia' 佳 (good quality).

JY16. *Xionghuang* 雄黄 (realgar; RP 49)

[It] transforms into gold after a thousand years. Take realgar that has the colour of partridge liver and the four ingredients *gancao* 甘草 (licorice), *tiankui* 天葵 (probably *Brasella rubra*, L.), *didan* 地膽 (*Taraxacum mongolicum*, Hand.-Hazz; ZY 5130; also the oil-beetle; ZY 1611) and *bilinghua* 碧稜花 (? perhaps *bichanhua* 碧蟬花, *Cammelina communis*, L.; ZY 3783), all finely cut, taking 5 ounces of each. Put 3 ounces of realgar into a bowl containing water obtained from a west-to-east flowing stream and boil it over three double-hours during the sixth lunar month. Remove sediments by filtering and grind it to a powder. Boil it in water to remove any black [foreign matter] and heat to dry before grinding it for use. That embedded with iron or stone is not usable.

Collation: DT 26 and ZL *juan* 4 quote only the first sentence about realgar transforming into gold after 1,000 years.

JY17. *Yanxiao* 鹽硝 (saltpetre; RP 123)

[It] makes a solution that resists the strength of fire.

Collation: DT 126 and ZL *juan* 4 both quote the same item with slightly different wordings.

JY18. *Shiliuhuang* 石硫黃 (sulphur; RP 128)

[It] can dry up mercury The Essential Statement says: 'Sulphur in contact with the Five Metals turns black, but with mercury it turns red'. It is also known as *huangya* 黃芽 (yellow sprout). Use only sulphur with a lustrous colour. Take 4 ounces of sulphur, one bowl of natural juice from the *longwei* 龍尾 plant (*Cayratia japonica*, (Thunb.) Gagn.; ZY 0962), three bowls of water taken from an eastward flowing stream, one bowl of *zibei* 紫背天葵 (*Brasella rubra*, L.) mixed together with juice extracted from the stem of *xusuizi* 續遂子 (*Euphgorbia lathyris*, L.; ZY 0445 with the middle Chinese character given as a homophon 隨 stirred well, and placed in a *ganguo* 甘鍋 reaction vessel with its bottom sealed with a lute of six-and-one mud. The sulphur should be broken into fragments, and heating should continue until the liquid boils off. Next take 10 ounces of *baibei* 柏倍 (*Achryanthes bidentata*, B1.) rendered into powder, 2 pounds of *liubang* 柳蚌 (a kind of oyster?) [shell] powder, and a cluster of grass weighing 2 pounds, grind them finely together and boil together with the mixture in eastward flowing water for two double-hours during the sixth lunar month. At the end of the day remove the sulphur from the mixture and boil it with boiled licorice. Then grind it thousands and thousands of time before wrapping it with leaves.

Collation: DT 31 and ZL *juan* 4 quote only the first part, but give the word *yu* 語 incorrectly instead of *jue* 訣. The text is amended accordingly. The passage in the *Tujing yanyi bencao* 圖經衍義本草 *juan* 3 is similar to that in ZL.

JY19. *Cihuang* 雌黃 (orpiment; RP 50)

It can change sulphur and subdue purified calomel (*fenshuang*). One should bear in mind not to use it wrongly. Take 4 pounds of orpiment, 5 ounces each of the three plants *tianbizhi* 天碧枝 (perhaps *biyucao* 碧玉草, common rush; RL 676 that alchemists used to subdue cinnabar), *heyangcao* 和陽草 (perhaps *heqicao* 和氣草, *Pacteilis susannae*, L.; ZY 2988) and *xusuicao* 續遂草 (*Euphgorbia lathyrus*, L.; ZY 0445 with the middle Chinese character given as a homophon 隨 in a dry state, or double the amount if wet, and boil together in a porcelain vessel for three double-hours during the sixth lunar month until a golden colour liquid is obtained. Build a bed with earth that piles up at the sides and pour in the contents rapidly with water from an eastward flowing stream. Repeat this process three times, remove the contents from water and wipe until dried, before grinding and sieving it to a powder in a useable form. Be warned that it will turn black in contact with dirt. Orpiment subdues and maintains the source of heating, its colour remains unchanged, and in liquid form it can transform base metals by projection (*dian* 點).

Collation: The text is rather different from DT 27, which is more similar to ZL *juan* 4. It is also different from that in *Tujing yanyi bencao* *juan* 3.

JY20. *Shigao* 石膏 (gypsum; RP 51)

That from Guizhou can congeal mercury that can be poured in sand. Raw *shigao* should first be boiled with the two ingredients *tiankui* 天葵 (probably *Brasella rubra*, L.) and *yediaoteng* 夜交藤 (*Polygonum multiflorum*, Thumb.) in *zhiranzhi* 自然汁 ('natural juice', perhaps rainwater) for one double-hour in the sixth lunar month and its toxicity will remove itself. Use 10 ounces of the ingredients, and wait till it is well boiled in each containing crucible. Steam will emit when the substance is poured in.

Collation: DT 90 and ZL *juan* 4 both give only part of the first sentence that mentions gypsum from Guizhou 桂州 can congeal mercury.

JY21. *Cishi* 磁石 (magnetite; RP 76)

Take 4 ounces of *cishi* that attracts matter to subdue cinnabar, nourish mercury, to remove tint from copper and to soften solid matter that hardens mercury. For each pound of *cishi* take one bowl of *wuhuapi* 五花皮 (perhaps misprint for *wujiapi* 五加皮, which has a synonym *wuhuamei* 五花眉, *Acanthopanax gracilistylus*, W.W.Smith; ZY 0767], one bowl of *diyu* 地榆 (*Sanquisorba officinalis*, L.) and 15 ounces of *gumian* 故綿 (old wool?) and shred the three ingredients together before grinding them on a stone slab into small pieces. Then place the ingredients in a porcelain vessel and boil them with eastward flowing water over 3 days and nights. Then drain out the water and wipe the ingredients dry before wrapping them in a piece of cloth and pound them with a pestle on a stone slab. Finally grind the product to a fine dust-like powder in a mortar for use.

Collation: This entry gives more details than DT 68, but its first sentence does not read well. The word for 'ounces' should be replaced by the words 'four surfaces', so as to follow DT 68 to read '*Cishi* that attracts matter on all four surfaces...' ZL *juan* 4 also contains the same misprint.

JY22. *Ningshuishi* 凝水石 (calcareous spar; RP 119)

It can be used as a paste. It can be ingested. For fixing cinnabar, it can be (used as) a [reaction vessel of the] *kui* [type]. It subdues [*xuan*]*jing* [玄晶] (selenite).

Collation: Similar to *ZL juan 4* and *Tujing yanyi bencao*, but with a different character for *jing* 精. *DT 87* gives the same character for *jing*, but omits the character *xuan* before it. Otherwise *DT 87* is similar.

JY23. Yangqishi 陽起石 (asbestos tremolite; RP 75) It can be used to make an outer [reaction vessel of the] *kui* [type].

Collation: Same as *DT 78* and *ZL juan 4*.

JY24. Buhuimu 不灰木 (asbestos powder; RP 56)

It can be used for boiling mercury. That from Luzhou 潞州 is superior.

Collation: *DT 181* gives *Buheimuhui* 不灰木灰 (asbestos ash or powder) and only says that it can be used for boiling mercury.

JY25. Fulonggan 伏龍肝 (silicate) That which has been under a furnace for 10 years [or more] and found 1 foot deep bearing a purple porcelain-like colour can subdue cinnabar and is eminently useful for contracting tin.

Collation: Somewhat similar to *ZL juan 5*. *DT 132* says that it occurs (about) 1 foot deep under a furnace that had been in use for 10 years [or more] and looks like a row of purple porcelain. It can be used to subdue cinnabar and to contract tin. One version has the word 'colour' after 'porcelain'.

JY26. Shihui 石灰 (limestone; RP 71)

It subdues sulphur, removes the tint in tin and fixes realgar. It can also be used for fixing sal ammoniac. Again it can be used for making a [reaction vessel of the] *kui* [type], known as the *baihukui* 白虎灰.

Collation: Similar to *ZL juan 5* and *Tujing yanyi bencao*, *juan 5*, but without the last sentence about the *kui* type of reaction vessel. *DT94* says that it subdues sulphur, removes the tint in tin, fixes realgar and orpiment and is used occasionally for fixing sal ammoniac.

JY27. Hongpi fanshi 紅皮礬石 (misprint for *hongpi yushi* 紅皮礬石, red arsenolite; RP 89)

It subdues cinnabar and nourishes mercury.

Collation: Similar to *ZL juan 5* and *DT75*, with both giving *hongpi yushi*.

JY28. Pishuang 砒霜 (arsenic; RP 91) It transforms copper and dries mercury. When subdued by grass (*cao* 草) and while the colour of the heating source remains, that which turns into liquid and receives the *qi* can project (*dian* 點) the precious metal, (but) that which turns dry or broken is useless.⁸²

Collation: *DT105* says that it transforms copper and can harden tin and dry mercury, while *ZL juan 5* is similar to *DT105* but without any reference to mercury.

JY29. Daizheshi 代赭石 (red hematite; RP 78)

It brings out the gold colour.

Collation: *DT134* is similar, but calls it *daizhetu* 代赭土, *ZL juan 5* also has the same entry, but calls it *daizhe* 代赭.

JY30. Naosha 礬砂 (sal ammoniac; RP 126)

It can fix realgar and orpiment. That subdued by grass in heating without disintegrating can control (*zhi* 制) the various minerals.

Collation: Only the first sentence is found in *DT35*, *ZL juan 5* and *Tujing yanyi bencao*, *juan 5*. However, although without the last sentence, the entries in all three are in greater detail than *JY30*.

JY31. Heiqian 黑鉛 (lead; RP 10)

That subdued by grass and turned into a precious substance can change copper into silver and be used for making cauldrons. It nourishes (*yang* 養) cinnabar to sustain it during heating. It nourishes mercury to sustain it during heating. It (enables) purified calomel to remain heated to a high temperature (*duan* 煅).

Collation: This item does not occur in *DT* and *ZL*.

JY32. Method of preparing [huang]dan [黃]丹 (minium; RP 13)

To prepare [*huang*]*dan* take 1 pound of lead, 2 ounces of sulphur and 1 ounce of saltpetre. [The lead] is first melted into liquid and a little vinegar is added. While [the molten lead] is still boiling put in a small piece of sulphur and gradually add saltpetre a little at a time. When it boils again add in a little vinegar, and as before, introduce a little saltpetre and sulphur until all the saltpetre and sulphur are gone. The liquid mass is roasted to produce *huangdan* (minium) in a powder form.

Collation: *DT* 138 gives a similar method of preparing *qiandan* 鉛丹, but instead of 2 ounces of sulphur says 1 ounce of coarse sulphur.

JY33. Hufen 胡粉 (white lead; RP 12) It can fix sulphur and can be used for making the outer [reaction vessel of the] *kui* [type]. It is the white lead made today from lead.

Collation: *DT* 118 is similar to *ZL juan* 5, without the last sentence in *JY* 33 above.

JY34. Wuchang tong 武昌銅 (Wuchang copper)

It makes elixir. It is not broken when beaten.

Collation: *DT* 12 gives more detail and clarification, saying that *baiman* 白慢 (i.e. copper) can project Danyang silver and *toushi* 鑄石 (alloy of zinc-bloom and copper) and folded (*zhe* 摺) copper from foreign tribal people and the *chizhatong* 赤扎銅 copper from Dongchuan 東川 does not crack when beaten while hot.

JY35. Rongyan 戎鹽 (desert salt; RP 116)

It is of one of the three pure *li* 利 colours, red and black. It can pile up eggs, dry mercury and fix cinnabar.

Collation: The text seems to be corrupt here. One cannot understand what 'pure *li*' colour means. *DT* 109 mentions only two colours, saying that desert salt is either red or black in colour, that it occurs in the Western foreign regions and that it can pile up eggs, fix cinnabar and dry mercury. *ZY juan* 5 does not have the words for pure *li* either.

JY36. Luyan 潞鹽 (native lake salt; RP 118)

It purely controls the Four Yellow [minerals] and (can be) made into a soldering material.

Collation: *ZL juan* 5 is similar, though without the water radical for the word *Lu* in *Luyan*. *DT* 113 gives more detail, saying that it boils the Four Yellow [minerals] (e.g. sulphur, realgar, orpiment and arsenious oxide) and can be used in soldering and when used with sal ammoniac to immerse iron, after a moment, the iron will soften.

JY37. Woxuefan 握雪礬 (amended to *woxue yushi* 握雪礬石)

It dries mercury and fixes mercury and cinnabar.

Collation: *DT* 71 gives *woxue yushi* (fine flakey arsenolite; RP 90) and contains further information besides saying that it dries mercury and fixes mercury and cinnabar. *ZL juan* 5 also gives *woxue yushi*.

JY38. Fanshi 礬石 (alum; RP 131)

Put [alum] in a porcelain jar and heat to a high temperature until the jar turns red hot, both outside and inside. Open the lid with a pair of pincers and presently introduce a beehive into the jar to be heated until it completely dissolves. Then take out the product

with a pair of pincers and allow it to cool before beating it to pieces and grinding to a fine powder in a bowl. Dig a hole about 5 or 6 inches deep in the floor of the house and wrap the product in paper, leaving it overnight in the hole. [Finally] take out the product and grind it again. For every 10 ounces [of alum used] in the process take 6 ounces of beehive.

Another method is as follows: Grind [alum] to a powder. Take a porcelain jar [that has a volume] of three *sheng* 升, seal the jar with six-and-one lute and heat it near a fire until dry. Then insert the alum that was previously ground. Take one bowl containing the two ingredients *wujiaocao* 五角草 (?) and *tiankui* 天葵 (probably *Brasella rubra*, L.) and one bowl of *ziran汁* (water?) and presently add this to the alum inside. Heat the jar from underneath until the liquid in the content dries out. Put a cover over the jar and seal it with a lute. Heat it to a high temperature from the *si* 巳 double-hour (i.e. 09:00–11:00 hours) to the *wei* 未 double-hour (i.e. 13:00–15:00 hours). Then remove [the jar] from the fire, allow it to cool and [finally] grind its contents to a fine powder to be used like calomel.

Collation: This item does not occur in *DT*, or in *ZL*.

JY39. Xiao (shi?) 硝[石] (saltpetre?; RP 125) Grind it to powder and heat 5 pounds of it in a jar to a high temperature until (the whole jar) turns red hot. Mix *jichang* 雞腸 [*cao* 草] (*Trigonotis p.* Bthe.) and *baiziren* 柏子仁 (arbor vitae seeds) together and divide them into pills of the size of small *dizhu* 地珠.

Collation: This item is not in *ZL* and *DT*. The text is rather corrupt here. At least one character is missing either before or after *xiao*, so it is hard to tell exactly what substance the text is talking about. *Jichang* means chicken intestine. The missing character *cao* is added. *Dizhu* is probably *di zhenzhu* 地珍珠 (*Phyllanthus siaplox*, Retz.?).

JY40. Sha[zi?] 砂[子] (mercury?)

First wash it with fragrant water, then wipe it dry and grind it in a mortar over three double-hours during the hottest month in the year. Then put the *shazi* in a porcelain bowl and place *gancao* (licorice), *tiankui* (probably *Brasella rubra*, L.) and *wufangcao* 五方草 (*Portulaca oleracea*, L.) that have been mashed together underneath and over it. Wash (the contents) clean with eastward flowing water, allow to dry under the hot sun then grind to powder. Insert the powder in a small porcelain jar and cover it with half an ounce of *qingzhicao* 青芝草 (a rare variety of green *Ganoderma japonicum* (Fr.); *ZY* 2395) and *shanxucuo* 山鬚草 (?), unless it means *longxucuo* 龍鬚草, *Pea sphondylodes*, Trin; *ZY* 1293). Heat (the jar with its content) to a high temperature using 10 pounds of fuel from the *si* 巳 doublehour (09:00–11:00 hours) to the *zi* 子 double-hour (23:00–01:00 hours). Allow to cool and grind (the contents) again to a powder for use. For every 5 ounces of *shazi* use 2 ounces of *gangcao*, one bowl of *tiankui*, one bowl of *wufangcao* and a sufficient amount of eastward flowing (water).

Collation: This item is not found in *ZL* and *DT*. At least one character is missing either before or after the character ‘*sha*’, which on its own means sand.

JY41. Yunmu 雲母 (mica; RP 39)

Take 1 pound of it that is lustrous and clear as water and one bowl each of some small *didancao* 地膽草 (earth gall), *zibei(longyd)* 紫背龍芽 (poke root), *tianbei* 天背 (perhaps misprint for *tiankui*, probably *Brasella rubra*, L.), raw *gancao* (licorice), and *dihuang* 地黃 (*Rehmannia glutinosa*, Lib.) juice.⁸³ The dried ones are to be finely filed; the juice is taken from the wet ones. Put some pebbles in a porcelain pot together with the above

ingredients and three bowls of *tianchishui* 天池水 (seawater) and boil over 7 days and nights, taking care to maintain both the fire and the water. The pebbles will naturally turn into (the form of a) jade-like glue at the bottom (of the pot). (At this point) quickly pour in (more) seawater, stir it and remove the floating substance that looks like snail saliva. Perform this cleaning process three times. Then take about 3 pints of boiled *chenxiang* 沉香 (gharu wood; ZY 2384) water, wash the content three times and simmer it to dry for use.

Collation: This item is not found in *ZL* and *DT*. The *Zaohua zhinan* item ZH20 (see Chapter 4) gives *didancao* as a variety of *kuyao* 苦蕒 (thistle, *Cnicus chinensis*, Maxim; RL 28).

JY42. *Zhushacao* 朱砂草 (probably *danshacao* 丹砂草, a synonym of *shichangsheng* 石長生, *Adiantum monochlomos*, *Fat. or cliff maidenhair*; RL 799)

It fixes and maintains the source of fire and its colour. When forming a liquid it projects the precious substances.

Collation: This item is not found in *ZL* and *DT*.

JY43. *Shuiyin* 水銀 (mercury; RP 44)

It combines with sulphur and congeals with lead. To kill mercury use *ziheche* 紫河車 (*Paris polyphylla*, Sm.; RL 685) and when mercury is about to be killed use *zibei tiankui* 紫背天葵 (probably *Brasella rubra*, L.).

Collation: This item is different from the texts given in *ZL* and *DT*. *ZL juan* 4 says that mercury can form alloys with other metals and can be made into the ‘bubblingspring casing’ (*yongquankui* 湧泉匱) [that serves as a reaction vessel], utilising its capability to cause the death (*si*) of mercury (i.e. changing mercury so that it loses its original form or properties). *DT* 5 is similar to *ZL*, but has an extra character *yin* after *shuiyin*. *Ziheche* normally refers to the placenta, but here it is more likely used as a synonym of *zaoxiu* 蚤休, which Chinese alchemists used to subdue realgar, orpiment, sulphur, cinnabar and mercury. See *BG juan* 17B.

JY44. *Yehejiaoteng* 夜合交藤 (*Polygonum multiflorum*, Thumb.); *ziranzhi* 自然汁 (perhaps water, or better rainwater)

Boil the two over one double-hour during the hottest month of the year, then add *oujie* 藕節 (Indian arrowroot; RL 542) and boil together with *awei* 阿魏 (*Ferula assafoetida*, L.; ZY 2404). [The product can] kill copper.

Collation: This item is not found in *ZL* and *DT*.

JY45. *Ziheche* 紫河車 (*Paris polyphylla*, Sm.; RL 685)

It whitens copper and mercury with lasting effect.

Collation: This item does not appear in *ZL* and *DT*.

JY46. *Yimucao* 益母草 (Siberian motherwort)

It fixes sulphur.

Collation: *DT* 184 gives Siberian motherwort ash stating that when mixed with noodle soup and heated over the fire it cures *fengci* 風刺 (‘pneumatic punctures’, perhaps referring to acne) on the face and that it also fixes sulphur. What *DT* says is close to *ZL juan* 6 and *Tujing yanyi bencao juan* 8.

JY47. *Yujinhui* 鬱金灰 (*Curcuma longa* ash)

It can congeal mercury

Collation: *ZL juan 9* says that the ash from the *yujin* 鬱金 plant can be used to congeal mercury, while *DT191* says that the ash from the root of the *yujin* plant can be used to congeal mercury

JY48. Gouzhi 構汁 (juice from the paper mulberry)

It [can be used to] soak [both alchemical and medicinal] substances and mercury

Collation: This is similar to *ZL juan 12* and *DT214*.

JY49. Ruxiang 乳香 (terebinth tree)

It dulls [the sound of] copper and softens copper.

Collation: *ZL juan 13* and *DT 150* both state that *ruxiang* dulls (the sound of) copper, without any reference to softening copper.

JY50. Sanghui 桑灰 (mulberry ash)

It fixes sulphur.

Collation: *ZL juan 13* is similar to the above. *DT 186* is also similar, but it states further that mulberry ash subdues sal ammoniac and congeals mercury.

JY51. Tuozi 拖子 (a misprint for *zhizi* 梔子, the Gardenia nut)

It can be used for softening metal.

Collation: *ZL juan 13* says that the gardenia nut can be used for softening metal, whereas *DT 201* says that it can be used for tempering metal.

JY52. Wubeizi 五倍子 (nutgall)

It is an adjutant for lead.

Collation: Similar to *ZL13*, although an alternative word is used to denote lead.

However, *DT 213* states that it withers (*ku* 枯) lead.

JY53. Yangliujiao 楊柳膠 (willow gum)

It congeals mercury.

Collation: *ZL juan 14* and *DT 215* are similar but without the first character *yang*.

JY54. Mazhi 馬脂 (horse fat)

It softens the Five Metals. [Horse] dungs nourish fire to cultivate the strength of all [alchemical and medical] substances.

Collation: Similar to *ZL juan 17*. *DT* separates the item into two. *DT 169* gives *lūmazhi* 驢馬脂 (mule fat) softens the Five Metals and *DT 172* says that horse dungs nourish fire to cultivate the strength of all [alchemical and medicinal] substances.

JY55. Niushi 牛屎 (cow dung)

It removes the tint in copper.

Collation: *ZL juan 17* has a similar item. *DT 174* is similar except for using the alternative and slightly more elegant term *niufen* 牛糞 (cow dung).

JY56. Yangzhi 羊脂 (fat of sheep and goat) It softens silver and makes copper more pliable.

Collation: *ZL juan 17* has the same item. *DT 162* is also similar. This item is also quoted in *Gezhi jingyuan*, *juan 34*.

JY57. Guyangjue 羖羊角 (ram's horn) It contracts *he* 賀 (tin).

Collation: *ZL juan 17* says that ram's horn contracts *he*, which is *xi* 錫 (tin).

DT164 says that ram's horn contracts *xi* (tin). This item is also quoted in *Gezhi jingyuan*, *juan 34*.

JY58. Baigoufen 白狗糞 (dung of a white dog)

It [is used as a fuel for] heating tin.

Collation: An item in *ZL juan* 17 says that dung of a white dog is used for nourishing tin, but *DT* 173 says that it is used (as a fuel) for heating copper instead of tin.

JY59. Weipizhi 蝟皮脂 (fat from hedgehog skin)

It subdues realgar and softens copper.

Collation: *ZL juan* 21 contains a similar item without any reference to softening copper. One version of *DT* 166 gives hedgehog fat and another gives fat from hedgehog skin subduing realgar, again without reference to softening copper.

JY60. Wuzeiyugu 烏賊魚骨 (squid's bone)

It flattens the taste of salt.

Collation: The same item is found in *ZL juan* 21. *DT* 170 is also similar but gives an alternative character for 'flattens'.

JY61. Huma 胡麻 (sesame)

Jusheng 巨勝 (synonym of *huma*) turns cinnabar yellow.

Collation: The equivalent item in *ZL juan* 24 says that *jusheng* (is used to) boil cinnabar, while *DT* 211 says that the juice of *jusheng* (is used to) boil cinnabar.

JY62. Sucaohui 粟草灰 (ash from maize crop)

It removes the tint of tin.

Collation: An item from *ZL juan* 25 says that *hecao* 禾草 (crops) removes the tint of tin, while *DT* 189 says that *hecaohui* 禾草灰 (crop ash) removes the tint of tin.

JY63. Qiaomaihui 蕎麥灰 (buckwheat ash; RL 564)

It can be used for boiling calomel.

Collation: A similar item is found in *ZL juan* 25; *DT* 179 is also similar.

JY64. Kuhu 苦瓠 (calabash; RL 63)

It [is used to] boil mercury.

Collation: A similar item is found in *ZL juan* 29; *DT* 219 is also similar.

JY65. Kanghuo 糠火 (husks fire)

[It produces a fire] that doubles the intensity of the ordinary.

Collation: The original text in the *Qiangong jiageng zhibao jicheng* does not make sense. The word 'xin 信' is amended here to 'bei 背' following the texts in *DT*. Then the text becomes almost similar to *DT* 226, which adds one word to refer to the fire being even. This entry is not found in *ZL*.

JY66. Jincaihui 葦菜灰 (probably celery ash)

It fixes cinnabar and sulphur.

Collation: *ZL juan* 29 calls it *lejinhui* 勒葦灰 and *DT* 190 calls it *qinjinhui* 芹槿灰. Otherwise the three texts are similar.

JY67. Machi[xian]hui 馬齒[莧]灰 (purslane ash)

It is used to boil cinnabar and it congeals mercury.

Collation: *ZL juan* 29 contains a similar entry. *DT* 183 is also similar.

JY68. Wusexian 五色莧 (amaranth of various colours)

It is used to boil mercury.

Collation: *ZL juan* 29 contains a similar entry. *DT* 198 is also similar.

JY69. Dongguamanhui 冬瓜蔓灰 (ash from the vine of the white gourd)

It can be used for boiling mercury and cinnabar or for tempering copper and tin.

Collation: The original text reads 'breaking copper and tin', but is amended to follow the texts in *ZL juan* 27 and *DT* 192. With the amendment the three texts are similar.

Items restored from outside the Qiangong jiageng zhibao jicheng

JY70. Jin 金 (gold; RP 1)

Chu 楚 gold occurs in (the rivers) Hanjiang 漢江 and Wuxi 五溪, sometimes in the shape of melon seeds with a blue-greenish tint. In the case of *tianshengya* 天生芽 (gold nugget) it is also known as *huangya* 黃牙. When it is made by fixing cinnabar and mercury it can be a profitable proposition, but is unsuitable for ingestion, because it contains the poisonous *qi* of gold.

Collation: This item comes from ZL *juan* 4. DT gives much more detail under two separate entries in DT 1 on *fujin* 鍍金 (gold nugget) and DT 3 on *shanze shujin* 山澤熟金 (probably *shanjin* 山金 (pure gold)).

JY71. Yin 銀 (silver; RP 2)

[It] occurs in Luoping 洛平 (in modern Gansu province) and Lushi xian 盧氏縣 (in modern Henan if not in modern Hubei province). It is of a brown colour, but when broken apart the inside is white. It is found in lead mines and is sometimes shaped like a bamboo shoot. It can be made to undergo transformation. It is also [variously] called *ziranya* 自然牙, *shengyan* 生銚 and *ziranyan* 自然銚.⁸⁴ It serves only commercial purposes. Because silver within lead is poisonous in nature, it is unsuitable for ingestion. It can be used to congeal mercury.

Collation: This item comes from ZL *juan* 4. It is somewhat similar to DT 2 on *shengyin* 生銀 (native silver; RP 2b).

JY71. Lishi 理石 (a variety of gypsum; RP 52)

Changlishi 長理石 can be ingested.

Collation: This item comes from ZL *juan* 4. It is also similar to DT79.

JY72. Yanxian 鉛鹹 (native lead)

There is no silver in lead. [In fact *qianyin*] is [only] refined lead. Occurring in Jiazhou 嘉州 (in modern Sichuan province), in the steep banks of the Longtuo 龍拖 (in Gansu province) and in Lizhou 利州 (in Anhui province), it is the very essence of *yanjing* 鉛精 (galenite lead) and deeply possesses the form of transformation. Known as *zibeiyan* 紫背鉛, it is capable of breaking *jingangzuan* 金剛鑽 (diamond). *Caojieyan* 草節鉛 is native lead from Jiazhou before being refined. It is brittle and breaks [easily], and when burnt it emits smoke with the smell of sulphur. *Xinzhouyan* 信州鉛 (native lead from Xinzhou) and *Lushiyan* 盧氏鉛 (native lead from Lushi xian 盧氏縣) are inferior in quality. Their impurities must first be removed before they can be used. *Yinpingyan* 陰平鉛 (native lead from Yinping) occurs in Jianzhou 劍州 (in modern Nanping xian, Fujian province). It is the progenitor of iron. *Yanhuanghua* 鉛黃花 (lead tetroxide) together with mercury heated [first] in a gentle and [then] a strong fire, after removing the impurities floating on top, can be roasted to form the colour of *huangdan* 黃丹 (minium, the red triplumbic tetroxide of lead). *Diaojuqian* 釣腳鉛 (a kind of lead ore) occurs among sands in streams in mountain caves of Yazhou (in Sichuan province). It is about the size of the soap bean, shaped like a tadpole and is black in colour.

Collation: This item comes from ZL *juan* 5. DT has it in eight different entries, but with greater details. See DT16 *qianyin*, DT17 *baiqian*, DT19 *caojieqian*, DT20 *Xinzhouqian*, DT21 *Lushiqian*, DT22 *Yinpingqian*, DT23 *qianhuanghua* and DT 18 *diaojuqian*, all with the word *qian* 鉛 replacing its synonym *yan* 鉛 for lead. It is interesting to note that the text in JY 72 agrees sometimes with one version of the DT and at others with another version of DT. For example, Lizhou is given in a version other than

the Daoist Canon and the Japanese transcribed versions of the *Danfang jianyuan*. The latter two say Hezhou instead.

JY73. *Zirantong* 自然銅 (iron pyrites)

This can be ingested. It occurs deep inside silver and copper mine pits in Yanshan xian 鉛山縣, Xinzhou 信州 prefecture. It is formed after many years by the *qi* of copper and iron ores. It is like horse dung. Its colour is deep purple. The genuine one is bitter and astringent in taste. People nowadays regard [the term] *dacashi* 大礫石 as iron pyrites. They are mistaken.

Collation: This item comes from ZL *juan* 5. DT 13 is similar, but gives the more commonly used synonym Qianshan 鉛山 for Yanshan.

JY74. [Mi]cu 米醋 (rice vinegar)

It (can be used to) boil the Four Yellow [minerals] (i.e. sulphur, realgar, orpiment and arsenious oxide) and to dissolve various (alchemical or pharmaceutical) ingredients, [including] cinnabar. *Danfan* 膽礬 (copper sulphate) and [zuo]wei [左]味 (vinegar) [have similar properties].

Collation: This item comes from ZL *juan* 26. DT 153 puts *kujiu* 苦酒 *danfan* 膽礬 (copper sulphate), *zuowei* 左味 (vinegar) and *micu* 米醋 (rice vinegar) under a single item saying that each (of them can be used to) boil the Four Yellow [minerals] (i.e. sulphur, realgar, orpiment and arsenious oxide), and to dissolve various [alchemical or pharmaceutical] ingredients [including] cinnabar. This enables the missing words in the last sentence of the text in ZL to be restored.

JY75. *Zisu* 紫蘇 (Perilla nankinensis, Decne)

Zisu oil softens *zhu[sha]* (cinnabar) and gold and smoothen the Eight Minerals.

Collation: This item comes from ZL *juan* 28. In DT 156 it is called *Zisuyou* 紫蘇油 and is put together with *Jushengyou* 荳勝油 (sesame oil) under a single item. The two are said to soften the Five Metals and smoothen the Eight Minerals.

Item probably mistaken as originating from the Danfang jingyuan

JY76. Jin 金 (gold)

There are twenty types of gold. As for *Xionghuangjin* 雄黃金 (realgar gold), *cihuangjin* 雌黃金 (orpiment gold), *cengqingjin* 曾青金 (stratified variety of malachite gold), *liuhuangjin* 硫黃金 (sulphur gold), *tuzhongjin* 土中金 (earth gold), *shengtiejin* 生鐵金 (cast iron gold), *toushijin* 鑰石金 (zinc-copper alloy gold), *shazijin* 砂子金 (mercury gold), *tulushazijin* 土碌砂子金 (malachitemercury gold), *jinhushazijin* 金母砂子金 (mercury gold), *baixijin* 白錫金 (tin gold), *heiyangjin* 黑鉛金 (lead gold), and *zhushajin* 硃砂金 (cinnabar gold)—all of these fifteen types (are false). Only the five types, namely *huandanjin* 還丹金 (cyclically transformed elixir gold), *shuizhongjin* 水中金 (gold recovered from water), *guazijin* 瓜子金 (gold nugget), *qingfujin* 青鉄金 (alluvial gold) and *caoshajin* 草砂金 (coarse cinnabar gold) are genuine. All others are false.

4

Partial restoration, collation and translation of lost alchemical texts

**The last curtain on Chinese alchemy: *Gengxin yuce* 庚辛玉冊
(Precious Secrets of the Realm of Geng and Xie, i.e. metals and minerals)⁸⁵**

The *Gengxin yuce*, a work of the Ming prince Zhu Quan 朱權 (1378–1448), was the last significant Chinese alchemical writing. Though the complete text of the book is no longer extant, a number of quotations from it are given in Li Shizhen's 李時珍 *Bencao gangmu* 本草綱目 (the Great Pharmacopoeia). Other fragmentary passages from it also occur elsewhere. Li Shizhen says that the *Gengxin yuce* consisted of 541 items listed under seven sections, namely: (1) metals and inorganic substances; (2) numinous sprouts (lingmiao 靈苗); (3) plants with active principles or remarkable properties; (4) (birds with) feather and (animals with) hair; (5) (creatures with) carapaces and (those with) hides; (6) edible substances and potable liquid; and (7) iatro-chemicals and alchemical apparatus.⁸⁶ Also according to Li Shizhen most of the items came from earlier works, comprising of the *Waidan bencao* 外丹本草 (Pharmacopoeia of Operative Alchemy) by Cui Fang 崔昉, the *Zaohua zhinan* 造化指南 (Guide to the Creation of Things) by Tuxiu Zhenjun 土宿真君, the *Danfang jianyuan* 丹方鑒源 (The Mirror of Alchemical Process: a Source Book), the *Baozanglun* 寶藏論 (Discourse on the Precious Treasury of the Earth) by Xuanyuan Shu 軒輊述 and the *Dantaiu* 丹臺錄 (Discourse on the Alchemical Laboratory) by Qingxiazi 青霞子. Of these sources only the complete text of the *Danfang jianyuan* still exists and forms the subject matter of Chapter 3 earlier. The others are already lost and only fragmentary quotations from them are found in later works, for instance the *Bencao gangmu*. The *Wuli xiaoshi* 物理小識 (Small Encyclopaedia of the Principles of Things) compiled by Fang Yizhi 方以智 in 1643 and the Japanese pharmacopoeia *Kō Yamato honzō betsureku* 廣大和本草別錄 (Records of the Expanded Japanese Pharmacopoeia) also contain a few quotations from the *Gengxin yuce*. More quotations are contained in Inō Jakusui's 稻生若水 *Shobutsu ruisan* 庶物類纂 (Things Categorised and Compiled), compiled in 1747, but all of them are derived directly from the *Bencao gangmu*. Thirty-three items have been collected so far. They are given in this chapter in translation with annotation.

The *Gengxin yuce* had been the subject of the attention of Joseph Needham since the two of us first embarked together on the study of the history of Chinese alchemy in 1958. During my numerous visits overseas over the years I searched for it in libraries whenever the opportunity arose, but with no success. In 1990 Nakayama Shigeru 中山茂 and I visited the Beijing Library, together with Bo Shuren 薄樹人. With the help of Bo Shuren, I searched for the *Gengxin yuce* there, but again without success. In the year 2000 Liu Dun

劉鈍 drew my attention to a book by Yao Pinwen that claims the author saw a book with the title *Gengxin yuce* at the Beijing Library. In 2002, Chang Chia-feng 張嘉鳳 helped me to look for the book again at the same library, but without result. Later in the same year I visited Beijing and heard from Liu Dun that the book could not be located. Hopefully interested scholars will be able to meet the challenge again and have the opportunity to make a full-scale study of this interesting work in the future (Ho Peng Yoke, 2002).

Introduction

After its heyday in the Tang period, alchemy continued to flourish in Song China (960–1279). However, as the result of elixir poisoning that caused the death of no less than six Tang emperors and many high officials Song alchemists exercised more caution by searching for antidotes or by replacing minerals with substances from the vegetable kingdom, if not by changing their approach altogether by turning to psycho-physiological alchemy (neidan 內丹).⁸⁷ Joseph Needham refers to the period from early Tang to the end of Song as the silver age of alchemy in China.⁸⁸ Practical alchemy went into decline with the Mongol conquest. However, the tantalising idea of an elixir that could give physical immortality lingered on.⁸⁹ After the overthrow of the Mongols in 1368 there were some signs of revival in science in general, found, curiously enough, mostly among the works of several members of the royal family. Unfortunately, the seeds fell on stony ground in an unfavourable political climate and a real revival did not occur. One of these works was the *Gengxin yuce* by Zhu Quan (1378–1448), the seventeenth son of Zhu Yuanzhang 朱元璋 (1328–98), founder of the Ming dynasty (1368–1644).⁹⁰ The *Gengxin yuce* is the last significant Chinese text on practical alchemy that we know of, although it only survives in fragments quoted in later works. Other works after the time of Zhu Quan mainly deal with either psycho-physiological alchemy or sexual techniques (*fangzhongshu* 房中術) and refer to practical alchemy only in a rudimentary manner, if at all.

Historical background of the author

The first Ming emperor Zhu Yuanzhang had twenty-six sons. His fifth son Zhu Su 朱棣 (1361–1425), who held the feudatory title Zhou Dingwang 周定王, wrote the *Jiuhuang bencao* 救荒本草 (Famine Relief Pharmacopoeia) in 1406. The author of *Gengxin yuce*, Zhu Quan was his seventeenth son and was given the title Ningxianwang 寧獻王, abbreviated to Ningwang 寧王 in 1391. Zhu Youdun 朱有燾 (1379–1439), a son of Zhu Su, wrote a medical treatise entitled *Xiuzhenfang* 袖珍方 (Handy Prescriptions). Zhu Gaochi 朱高熾 (1378–1425), who reigned as the emperor Renzong 仁宗 for only one year in 1425, wrote the *Tianyuan yuli xiangyifu* 天元玉曆祥異賦 (Essays on Astrological and Meteorological Presages), an illustrated compendium in colour dealing with solar-halo phenomena. It was never printed, but Cambridge University Library has a MS copy. A grandson of Zhu Gaochi, namely Zhu Zaiyu 朱載堉 (1536–1611), was well versed in calendar calculation, mathematics and music. In 1584 he wrote the *Lüxue xinshuo* 律學新說 (A New Account of the Science of the Pitch-Pipes) that contains the formula he invented for equal temperament.⁹¹

Why the Ming royalty took to science certainly deserves a special study in its own right. But for Zhu Quan it seems to be mainly political. His interest in alchemy did help him to prolong his life, not by the ingestion of an elixir, but by proving that he no longer had any worldly ambition, so that the reigning emperor could write him off as a potential threat and spare his life. The family feud among the Ming royalty tells the story below.

Zhu Yuanzhang survived his eldest son, the Crown Prince Zhu Biao 朱標 (1355–92) and made the second son of the latter, Zhu Yunwen 朱允炆 (1377–1402?) his new heir. Zhu Yunwen then succeeded his grandfather as emperor Huidi 惠帝. Shortly afterwards, Zhu Di 朱棣 (1360–1424), the fourth son of Zhu Yuanzhang, rebelled against his nephew and assumed the throne as emperor Chengzu 成祖 (reigned 1402–24). The fate of Zhu Yunwen was not definitely established. He was probably killed in a fire that destroyed his palace, but there were rumours of his escape. Zhu Di suspected that some of his own brothers might plot against him. Zhu Su, for example, was under suspicion. It is tempting to speculate whether the interest of Zhu Su in literature and natural history was a cover for his political activities, but our attention must return to Zhu Quan.

Two years after he received the title Ningxianwang, Zhu Quan took up residence at his principedom in Daning 大寧, which comprised modern Pingquan xian 平泉縣, Hebei province, Chaoyang xian 朝陽縣, Liaoning province and Zhaowudameng 昭烏達盟 in the Autonomous Region of Inner Mongolia. Zhu Quan had earlier built in Daning one of the four fortresses to guard the northern border of the Ming empire. His headquarters was in the new fortress north of modern Pingquan xian and was guarded by a garrison of some 80,000 men and 6,000 army vehicles. His skill as a tactician and the bravery of his soldiers had earned the respect of the other princes. When Zhu Di staged his rebellion against his nephew Zhu Yunwen, he would very much have liked to get Zhu Quan on his side, while Zhu Yunwen likewise feared that this uncle would join forces with his other rebellious uncle. In the year 1399 Zhu Yunwen summoned Zhu Quan to Nanjing, the capital. When the latter did not comply and stayed put in Daning, Zhu Yunwen relieved him of the post as commander of the northern garrison. Meanwhile Zhu Di went to Daning under the pretext of seeking protection from the royalist army that was pursuing him. Zhu Quan fell for the ploy and let in his half-brother Zhu Di. Within a few days he lost control of both his stronghold and his men to the latter. He accompanied Zhu Di back to Beiping (modern Beijing) and helped to draft official documents and prepare a summons of war against Zhu Yunwen. It is said that Zhu Di promised to give him half the empire when he became emperor.

In 1402 Zhu Di overthrew Zhu Yunwen and became emperor Chengzu. He did not fulfil his promise to Zhu Quan. Zhu Quan made several requests to be transferred to another fief in central China, first to Suzhou 蘇州, then to Qiantang 錢塘, but was refused and was given the choice of several other places instead. He picked Nanchang 南昌, and in 1403 he was officially granted investiture in the place of his choice. However, shortly afterwards he heard news of an impending investigation on a charge of defamation and witchcraft against him. No evidence to support the charge was found, but Zhu Quan read the signs. As an indication to the emperor that he had already lost interest in politics he built a secluded study where he could spend his time in music and writing. Thus he managed to survive through the reign of Chengzu.

Chengzu died in 1424. The next year Zhu Quan petitioned the new emperor Renzong to be transferred to another fief. His request was denied. Renzong only reigned for one

year. During the reign of emperor Xuanzong 玄宗 (reigned 1426–35) Zhu Quan incurred the displeasure of the emperor by his unreasonable requests and extravagant behaviour. He apologised to the emperor on being rebuked. However, although his apology was apparently accepted, he began to feel that his dealings with government officials were not being accorded the same warmth and courtesy as might be expected for a noble of his rank. Thereafter he diverted his interest to Daoism and alchemy. He styled himself Quxian 瞿仙, Danqiu xiansheng 丹邱先生 and Hanxuzi 涵虛子, all of which have a Daoist nuance. Another style he adopted, namely Daming qishi 大明奇士, reflected on his achievements as a scholar.

Although having had little success in politics, Zhu Quan is remembered as a scholar of extensive knowledge, ranging from Daoism to Buddhism, from literature and poetry to history, from music and drama to astronomy, and from medicine to alchemy. Some fifty titles of works ascribed to him are known, but only a small fraction of them received wider circulation by being included in collections or reproduced in modern editions. Among his works that are still extant is the famous *Taihe zhengyinpu* 太和正音譜 (Register of Proper Tones in a Reign of Peace and Prosperity), which deals with *zaju* 雜劇 (northern lyrical drama) and *sanju* 散劇 (short lyrical pieces). The *Shenqi mipu* 神奇秘譜 (The Secret Music Book for the Lute) is another of his works that still survives. Most of the other works are either totally or partially lost, being reproduced in fragments in compendia or other collections. The *Gengxin yuce* is one of those that only survives in fragmentary form (pending further investigation of Yao Pinwen's remark mentioned earlier).

The *Gengxin yuce* did not find a place in the Daoist Canon, the most likely reason being political. The compiler of the Canon would not like to take the risk of incurring the displeasure of the reigning emperor by including the work of a prince who had lost favour. On the other hand, one motive of Zhu Quan in indulging in Daoism and in writing was to show the reigning emperor that he had lost all political ambition. In this respect the *Gengxin yuce*, being about the attainment of physical immortality, could well have contributed in some other way to prolonging the life of its author, enabling him to survive several Ming emperors.

Translation of restored fragmentary text of the *Gengxin yuce*

[Abbreviations: BG=Li Shizhen's *Bencao gangmu* of 1596

GY=*Gengxin yuce*

RL=Read and Liu (1936), by item number

RP=Read and Pak (1936), by item number

ZY=*Zhongyao da cidian* (Jiangsu Xinyi Xueyuan ed.)]

GY1. *Qinglanggan* 青琅玕 (malachite; RP 32)⁹²

It occurs among the cliffs in Nanhai 南海 (i.e. islands along the south-eastern and southern coast of China). It is produced by the influence of the *qi* of Yin and Yang. It looks like a pearl, but is red in colour.

Collation: This item comes from BG *juan* 8 and is repeated in *Shobutsu ruisan*, jade section *maki* 17.⁹³

GY2. *Dansha* 丹砂 (cinnabar; ZY 1834, RP 43)

Cinnabar of the best quality occurs in the mountain caves at [the confluence of] Wuxi 五溪 (Five Streams) where it receives the *qi* of the true south. Next comes cinnabar found in the mountains in Mayang 麻陽 (north of modern Zhijiang xian in Hunan province) and in the mountains adjoining the Five Streams. Cinnabar found in Yunnan province, Persia, and around the West Lake is lustrous and pure, and can also be used. A type of cinnabar produced in Liuzhou 柳州 (in modern Liuzhou, Guangxi province) resembles that found in Chen[zhou] 辰州 (modern Yuanning xian, Hunan province), but is in lumps and round like the pods of the *Gleditschia senensis* plant and is unsuitable for medicinal use. The raw cinnabar found in Shangzhou 商州 (in modern Shang xian, Shaanxi province) and Qianzhou 黔州 (in modern Xuancheng xian, Anhui province) and cinnabar produced in Xuanzhou 宣州 (also in modern Xuancheng xian, Anhui province) and Xinzhou 信州 (in modern Shangrao xian, Jiangxi province) all contain poisonous *qi* and the *qi* of gold, silver, copper and lead. These should not be ingested.

Collation: This item comes from BG *juan* 9.

GY3. *Lingsha* 靈砂 (sulphuret of mercury, black sulphide of mercury; RP 48)

Lingsha is the most efficacious substance. Controlling (*zhi* 制) sulphur and mercury results in a [new] form. This is the basis of the elixir (*dan ji* 丹基). [The procedure] takes over the normal process of nature, exploiting the secrets of the *Yin* and *Yang* [cosmological forces]. It brings about transformation within the *wuxing* 五行 (variously rendered as Five Elements, Five Phases, and Five Agents), resulting in the Nine-fold Cyclically transformed [Elixir] (*jiuzhuan* 九轉 [*dan* 丹]). The residual of the sublimate in the reaction vessel (*ding* 鼎) is the *qingjindan tou* 青金丹頭 and the sublimate is *lingsha*. There are three varieties of *lingsha*. That prepared over 10 days at the hottest month of the year (*yi fu shi* 一伏時) is known as *jinding lingsha* 金鼎靈砂; that which has undergone nine cyclical changes of heating is known as *jiuzhuan lingsha* 九轉靈砂; and that which is prepared over 30 days, the Earth number (*dishu* 地數) is the prolonged heated *lingsha* of the physician.⁹⁴ All of them should be first boiled with vinegar and sprinkled with mulberry ash before administered orally

Collation: This item comes from BG *juan* 9.

GY4. *Buhuimu* 不灰木 (asbestos; RP 56)⁹⁵

Asbestos is a *Yin* mineral produced in the northwest region inhabited by the tribal people. Those produced in Lizhou 黎州 (in modern Guangyuan xian, Sichuan province) or in Maozhou 茂州 (in modern Mao xian, Sichuan province) are of good quality. In shape asbestos bears markings that look like needles and literally resembles a piece of wood, but is smokeless when put in the fire.

Collation: This item comes from BG *juan* 9.

GY5. *Yangqishi* 陽起石 (asbestos tremolite, silicate of lime and magnesia, actinolite; ZY 1076, RP 75)

Asbestos tremolite is a *Yang* mineral. That found in Jianjinshan 鍊金山 mountain in Qizhou 齊州 (in modern Licheng xian, Shandong province) is superior. That with the appearance of an arrow dart has great [medicinal] potency, but that looking like the tooth of a dog is weak. When placed on a mass of snow and found to disappear quickly, the substance is genuine.

Collation: This item comes from BG *juan* 10.

GY6. *Taiyi* [Yu]yuliang 太一[禹]餘糧 (brown hematite; ZY 3483, RP 80)

Brown hematite is a *Yin* mineral. Wherever it occurs it piles up in layers, showing a deep purple colour. The yellow earth found within it is called *shihuang* 石黃. Its nature is hot (*re* 熱) in the extreme. During the winter months snow first melts at places where brown hematite occurs.

Collation: This item comes from *BG juan 10*.

GY7. Kongqing 空青 (malachite, large hollow variety; ZY 3062, RP 82)

The large hollow variety of malachite is a *Yin* mineral. It occurs in Shangrao 上饒 (near modern Shangrao xian, Jiangxi province). That resembling stalactites is of superior quality when it is in large pieces, with a lustrous purple colour. Next in quality is that found in Yandao 嚴道 (near modern Ya'an xian, Sichuan province and Beidaishan 北代山 mountain). It emerges from the gold pits and continues to produce itself without ending. Hence it can be used for making elixir. That which is as large as a fist and is shaped like an egg is hollow inside and contains an oily liquid. [This liquid] has an instant effect when used to cure blindness. That found in copper pits is also of good quality and is suitable for use [as a material] for painting. There are other varieties such as the *yangmeiqing* 楊梅青 and the *shiqing* 石青. They are of the same substance, only differing in fineness and coarseness in *qi*. For transmutation the stratified variety of malachite (*cengqing* 曾青) is the best, the large hollow variety (*kongqing* 空青) comes next, followed by the *yangmeiqing* variety.

Collation: This item comes from *BG juan 10* and is also repeated in *Shobutsu ruisan* mineral section, *maki 21*.

GY8. Tesheng yushi 特生礬石 (coloured arsenolite; RP 89)

Coloured arsenolite is a *Yang* mineral. It occurs in mountain valley water. After having been taken out and washed it looks like alum. That with transverse markings on the surface is superior in quality. It is used in the subduing of fire (*fu huo* 伏火) and the control (*zhi* 制) of cinnabar and mercury. In appearance it is rather like *fangjieshi* 方解石 (calcite; RP 54), but the genuine substance when put in water will prevent it from freezing. Specimens found in gold pits are known as *woxue yushi* 握雪礬石 (fine flaked arsenolite; RP 90).

Collation: This item comes from *BG juan 10* and is also reproduced in *Shobutsu ruisan* mineral section *maki 24*.

GY9. Mosuoshi 摩挲石 or *Posuoshi* 婆娑石 (unidentified green pebbles of foreign origin; RP 94)⁹⁶

Mosuoshi is a *Yang* mineral. It occurs in Sanfoqi 三佛齊 (west coast of Sumatra). South of the seas is a mountain rising up into a peak resplendent in many colours. The rocks shine like flame and the water in the mountain flows with the speed of an arrow. Boatmen draw near the rocks and strike with a knife or an axe to collect this mineral. When burnt it emits the smell of sulphur. The good quality ones look like yellow dragon teeth and are hard and heavy. It is used for making the [reaction vessel of the] *kui* 匱 [type] for the Five Metals or for subduing (*fu* 伏) the Three Yellow [minerals] (*sanhuang* 三黃).⁹⁷

Collation: This item comes from *BG juan 10* and is repeated in *Shobutsu ruisan* mineral section, *maki 26*.

GY10. Shehan 蛇含 (pisiform clay iron ore, or modular pyrites; RP 112)⁹⁸

Pisiform clay iron ore is naturally a kind of mineral. It is said that when a snake hibernates it holds a piece of earth in its mouth, and after hibernation this piece of earth

turns into a yellow mineral. This saying is absolutely without basis. Some people have dug snake pits looking for it, and have not substantiated this saying.

Collation: This item comes from *BG juan 10*.

GY11. *Huarushi* 花乳石 (dolomite; RP 96)

Huarushi is a Yin mineral. It occurs in the mountain valleys in Daizhou 代州 (in modern Dai xian, Shanxi province). It has many colours and can be used to make [reaction vessel of the] *kui* 匱 [type] for containing medicine in place of cinnabar. It also occurs in Sichuan (province) at Wenshan 汶山 (in modern Mao xian) and Peng xian 彭縣 (in modern Peng xian).

Collation: This item comes from *BG juan 10* and is also reproduced in *Shobutsu ruisan* mineral section, *maki 26*.

GY12. *Shiliuhuang* 石硫黃 (sulphur; ZY 1260, RP 128)

There are two varieties of sulphur. *Shiliuhuang* 石硫黃 [the pure and granular variety] occurs in mountains in Nanhai 南海 (i.e. the islands along the south-eastern and southern coast of China) and the Ryukyu islands 琉球島. *Tuliuhuang* 土硫黃 [the coarse type] occurs in the Guang[dong and Guangxi provinces] in the south. The good variety does not emit any sound when bitten. Imported *woliuhuang* 倭硫黃 (Japanese sulphur) is also of good quality. People nowadays mix [sulphur] with saltpetre to produce beacon fire and smoke. [Thus sulphur] has become an important item in the military inventory.

Collation: This item comes from *BG juan 11* and is repeated in *Shobutsu ruisan* mineral section, *maki 48*.

GY13. *Xuncao* 薰草 (*Lysinadia foenundraecm*; ZY 5152; *Ocimum basilicum*, L.; RL 134a)

Also known as *Huanglingcao* 黃零草, it subdues (*fu*) the Three Yellow [minerals] (sulphur, realgar and orpiment).

Collation: This item comes from *BG juan 14*.

GY14. *Diqian* 地錢 (ground ivy or field balm, *Nepeta glechoma*, Bth.; RP 132)

Diqian is a Yin 陰 plant. It grows in the regions of Jing 荆 and Chu 楚 (area comprising modern Hunan, Anhui, Jiangxi, Henan, most of Hubei provinces), the confluence of the Yangzi and the Huaihe rivers, and in Fujian and Zhejiang provinces. It is often found growing in between bricks in palace courtyards, in monasteries and in temples. Its leaves are round like coins, spreading out to cover the ground surface. It has a fragrance resembling *xixin* 細辛 (*Aristolochia sieboldi*, Miq.; RL 587), but is never seen flowering.

Collation: This item comes from *BG juan 14* and is also quoted in *Zhiwu mingshi tukao* 植物名實圖考, p. 586.2.

GY15. *Denglongcao* 燈籠草 (Chinese lantern or winter cherry, *Physalis alkekengi*, L.; RL 116)

Denglongcao is grown everywhere, but those found in Sichuan and Shaanxi (provinces) are the largest. Its leaves resemble those of *longkui* 龍葵 (common nightshade, *Solanum nigrum*, L.; RL 120) and are edible when young. The flowers produce fruits during the fourth and the fifth (lunar) months, and each fruit is supported by four leaves like a lantern. (People in) Hubei (province) call it *suanjiang* 酸漿.

Collation: This item comes from *BG juan 16*.

GY16. *Dijiao* 地椒 (*Geum japonicum*, Th.; RL 429)

Dijiao, also known as *shuiyangmei* 水楊梅, generally grows in shady and moist places near the roadside. It is also found growing in barren farms. It is a luxuriant plant, with

shoots and leaves resembling those of the chrysanthemum, and yellow flowers bloom at the tips of the branches. Its fruit looks like the cayenne pepper, but is not red in colour. It controls and subdues (*zhifu* 制伏) the Three Yellow [minerals] (sulphur, realgar and orpiment) and *baifan* 白礬 (potash alum; RP 131) as well as controls (*zhi* 制) cinnabar and *fenshuang* 粉霜 (purified calomel; RP 46).

Collation: This item comes from BG juan 16.

GY17. *Zaoxiu* 蚤休 (*Paris polyphylla*, SM.; RL 685)⁹⁹

Zaoxiu is a *Yang* 陽 plant.

Collation: This item comes from BG juan 17B.

GY18. *Guijiu* 鬼臼 (umbrella leaf, *Diphylleia cymosa*, Michx.; RL 520; *Dysosme versibellis* (Hance); ZY 3485)

Also known as *hanhe* 旱荷, *guijiu* is a *Yin* plant.

Collation: This item comes from BG juan 17B.

GY19. *Huoyancao* 火焰草 (*Cuscuta chinensis*; ZY 4123 and 4125; dodder, *Cuscuta japonica*, Chois.; RL 156)

Huoyancao is another name for *tusizi* 兔絲子; 菟絲子, which is a *Yang* plant. It grows in gardens that have been lying unattended and on unused roads. When the seeds fall to the ground and germinate roots will first appear, but as the plant climbs to another plant, its roots break away on their own. It has no leaves, but its flowers are white with a tint of pink colour and have a strong fragrance. It bears yellow fruits resembling grains, but smaller in size. Those found on the stalk of a tree are of the best quality. One is reminded of the abundance of this plant in the burial ground of Mencius (in Zouxian, Shandong province), which is particularly useful as a medicine. The juice [extracted from the fruit] subdues (*fu* 伏) the Three Yellow [minerals], (sulphur, realgar and orpiment) and also mercury, besides combining (*jie* 結) coarse cinnabar.

Collation: This item comes from BG juan 18 A.

GY20. *Yangti* 羊蹄 (yellow dock, *Rumex crispus*, L.; RL 584; *Rumex japonicus*, Houtt., *Rumex nepdensis* Spr.; ZY 3685)

Yangti is also known as *Yangti dahuang* 羊蹄大黃.

Collation: This item comes from BG juan 19.

GY21. *Fukui* 堇葵 (fringed water lily or floating heart, *Limnanthemum nymphaeoides*, Hoffm. et Link.; RL 170; *Hymphoides peltatum* (Gmel.) o. Ktze.; ZY 3685)

Fukui producing yellow flowers is called *xingcai* 荇菜, and that producing white flowers is called *baipin* 白蘋 or *shuijingcao* 水鏡草. The 'floating bubbles' (*paozi* 泡子) are also called 'water turtles' (*shuibie* 水龜). Although there are several varieties their uses are similar. The stem, the leaves, the roots and the flowers of this plant can all be used to subdue (*fu*) sulphur, to boil cinnabar and to control (*zhi*) alum.

Collation: This item comes from BG juan 19.

GY22. *Tongquancao* 通泉草 (cliff maidenhair, *Adiantum monochlamys*, Fat.; RL 799)

Tongquancao is also called *changshengcao* 長生草. It grows mainly in used roads and mounds, and in the wilderness. Its leaves resemble those of *diding* 地丁 (dandelion).¹⁰⁰ One stalk shoots out in the middle giving yellowish white flowers, (covering) the plant like snow. (The flowers) also look like cooked wheat. After being plucked they remain for a whole year without withering. The roots of the plant reach out to the source of underground water. Hence it got the name *Tongquan[cao]* ('communicating-with-the-spring plant'). It is commonly known as *touchuanghua* 透豬花.

Collation: This item comes from BG juan 20.

GY23. *Xiangtiancao* 向天草 (roof pine, *Cotyledon fimbriate*, Turoz.; RL 469)

Xiangtiancao grows in cracks. Its stem resembles that of a lacquer tree, being round and covered with thorns. White hair grows at the back of its leaves. It is very poisonous. When burnt to ashes, then dissolved in water and used as a hair wash it will make all the hair fall out immediately. If it gets into the eyes by mistake it will cause blindness. When the plant is ground the juice extracted from it can combine (*jie*) coarse cinnabar and subdue (*fu*) orpiment, realgar, cinnabar, *shu* 朮 (the *Atractylis* plant) and potash alum.

Collation: This item comes from BG juan 21.

GY24. *Dijin* 地錦 (thyme-leaf spurge, *Euphorbia thymifolia*, Th.; RL 325)

Dijin is also known as *jiangbancao* 醬辦草.

Collation: This item comes from BG juan 20.

GY25. *Boguying* 鵝鴝英 (*Taraxacum mongolicum*, Hand.-Hazz.; ZY 5130, dandelion, *Taraxacum officinale*, Web.; RL 48)

Boguying is a synonym for *pugongying* 蒲公英 and is also called *huanghua diding* 黃花地丁. The leaf of the *diding* resembles a small lettuce. The flower is like that of a large *xuanfu* 旋窩 (hedge bindweed, *Catystegia sepium*, R. Br.; RL 155). Each branch protrudes upwards about 3 to 4 inches. When cut it yields a white juice. The flowers are collected during the second lunar month, while the roots are taken during the third lunar month. It can control (*zhi*) mercury and subdue (*fu*) the Three Yellow [minerals]. That which produces purple flowers is called *dadingcao* 大丁草 and occurs in (mountains, such as) Taihangshan 太行山 (in Henan, Hebei and Shanxi provinces) and Wangwushan 王屋山 (in Shanxi province). It also occurs in Chenzhou 辰州 (in modern Huaiyang xian, Henan province), where it is called *xiaojincao* 饒金草. It can be used for forging (*duan* 鍛) cinnabar, (i.e. heating it to a high temperature). A variety that bears no flower is called *didancao* 地膽草. It can also be used to subdue (*fu*) the Three Yellow [minerals] and *pishuang* 砒霜 (arsenic; RP 91).

Collation: This item comes from BG juan 27.

GY26. *Haodingcao* 鵝頂草 (pigweed or goosefoot, pink variety; also lamb's quarters, pink variety; *Chenopodium alum*, L.; RL 561a)

Haodingcao is also called *hongxin huidi* 紅心灰薺 and is a Yin plant. Ground into a pulp it can be used to boil *fenshuang* 粉霜 (purified calomel; RP 46), to subdue (*fu*) *fanshi* 礬石 (potash alum; RP 131), to combine (*jie*) coarse cinnabar, to control (*zhi*) sulphur, and to subdue (*fu*) mercury, orpiment and arsenic.

Collation: This item comes from BG juan 25.

GY27. *Xiutiancao* 羞天草 (Big rooted calendium, *Alocasia macrorrhiza*, Schott.; RL 705)

Xiutiancao, a synonym for *Haiyu* 海芋, is a Yin plant. It occurs beside mountain streams in deep valleys in the region of the [Yangzi] Jiang River and Guang [dong and Guangxi provinces]. Its leaves are extremely large and can be used for protection against the rain. They are of a purple-green colour. Its flower looks like the lotus. Both the root and the leaf are poisonous. The plant can be used for heating *fenshuang* (purified calomel) and cinnabar to a high temperature (*duan* 鍛). The smaller variety is called *yeyu* 野芋.

Collation: This item comes from BG juan 17B.

GY28. *Toushangen* 透山根 (?)¹⁰¹

Toushangen is found in Wudu(shan) 五都山 mountain (in modern Minzhu xian, Sichuan province). Its juice is used to transform iron instantaneously into gold by projection (*dian* 點). It is extremely poisonous. A person taking it by mistake will be dissolved into a purple liquid. Again there is the *jinyingcao* 金英草 (?), which occurs in Sichuan province and is similar in appearance to the *machixian* 馬齒莧 (purslane, *Portulaca oleracea*, L.; RL 554), but is red in colour. Rubbed on iron it turns the latter into gold. It is also extremely poisonous and is fatal when taken by mouth. [The victim] is dissolved into a purple liquid.

Collation: This item comes from *BG juan* 17B; repeated in *Shobutsu ruisan* metal section *maki* 6. *Wuli xiaoshi*, *juan* 7, p. 10a says ‘*Toushangen* resembles *manqing* 蔓菁 (rape-turnip, *Brassica rapa depressa*; RL 477), but is purple in colour and contains the *qi* of gold.’ This is repeated in *Shobutsu ruisan*, minerals section, *maki* 4.

GY29. *Shiyangliu* 石楊柳 (?)¹⁰²

Shiyangliu contains the *qi* of silver.

Collation: This sentence comes from *Wuli xiaoshi*, *juan* 7, p. 10a and is repeated in *Shobutsu ruisan*, minerals section, *maki* 4.

GY30. *Machixian* 馬齒莧 (purslane, *Portulaca oleracea*, L.; RL 554)

Machixian contains the *qi* of mercury.

Collation: This sentence comes from *Wuli xiaoshi*, *juan* 7, p. 10a and is repeated in *Shobutsu ruisan*, minerals section, *maki* 4.

GY31. *Aihao* 艾蒿 (common mugwort, *Artemisia vulgaris*, L.; RL 9), *su* 粟 (short millet) and *mai* 麥 (wheat).

Mugwort, short millet and wheat contain the *qi* of lead and tin.

Collation: This sentence comes from *Wuli xiaoshi*, *juan* 7, p. 10a and is repeated in *Shobutsu ruisan*, minerals section, *maki* 4.

GY32. *Suanya* 酸芽 (?); *sanyesuan* 三葉酸 (Indian sorrel, *Oxalis corniculata*, L.; RL 367)¹⁰³

Suanya, (also known as) *sanyesuan*, contains the *qi* of copper.

Collation: This sentence comes from *Wuli xiaoshi*, *juan* 7, p. 10a and is repeated in *Shobutsu ruisan*, minerals section, *maki* 4.

GY33. *Yaowangcao* 藥王草 (a fictitious plant?)

Yaowangcao grows in the Songshan 嵩山 mountain (in Henan province). Only one leaf grows on each stem, like the leaf of the *Fuqiang* 浮薑 (*Monochoria korsakowii*, Reg. et Macck.; ZY 2707). In summer the plant bears small white flowers and looks pretty when grown in a pot.

Collation: This item comes from *Kō Yamato honzō betsureku*, *maki* 1, p. 22. This is probably another fictitious plant. Chen Zangqi 陳藏器, quoted in *BG juan* 21, mentions a plant with the same name *yaowang* 藥王 as a synonym of *xuchangqing* 徐長卿 (*Gynanchum paniculatum*, (Bge.) Kitag.; ZY 3897). However, its description indicates a different plant from that in the *Gengxin yuce*.

The above represents the fragmentary texts from the *Gengxin yuce* that have been assembled so far. It is not possible to have a good understanding of the *Gengxin yuce* when only about 6 per cent of the text itself is available. However, we can also gain further understanding of its original content from the sources quoted by the original text itself. One of the sources is the *Danfang jianyuan* that we have already studied in Chapter 3. The others, though existing only in fragments, would provide additional references.

These are given in the sections that follow. Although the final curtain in Chinese alchemy was drawn with the *Gengxin yuce*, it was only an end of a small part in the episode of universal chemistry, bringing Chinese alchemy to a fitting conclusion in order to make way for the introduction of modern chemistry to China during the nineteenth century.

***Dijingtu* 地鏡圖 (Earth Mirror Charts), a lost manual on mining and geobotanical prospecting¹⁰⁴**

Introduction

Among the many Chinese books that have become lost during the passage of time but survive in fragments through being quoted in later writings is a curious early sixth-century book entitled *Dijingtu*, the authorship of which is obscure. Regarded merely as a book on magic, it escaped the attention of modern scholars until Needham pointed out its other nature as a manual on mining and geobotanical prospecting.¹⁰⁵

The name of this book first appeared in the Bibliographical Treatise in the *Suishu* 隋書 (History of the Sui Dynasty), under an explanatory note after the title of another book, the *Qiankunjing* 乾坤鏡. The note says,

[Among the manuals of] Liang 梁 (502–556), the *Tianjing* 天鏡, the *Dijing* 地鏡, the *Riyuejing* 日月鏡, and the *Siguijing jing* 四規鏡經, each in one *juan*, and the *Dijingtu*, in six *juan*, are no longer extant.¹⁰⁶

Among these five early sixth-century titles, the *Tianjing* (Heaven Mirror), the *Dijing*, and the *Dijingtu* were quoted in the texts of the Tang and the later dynasties, while the other two, namely the *Riyuejing* (Sun and Moon Mirror) and the *Siguijing jing* (Classic of the Four Compasses Mirror) were already completely lost. During the early part of the seventh century passages from the *Dijingtu* had already been quoted by Yu Shinan 虞世南 in his *Beitang shuchao* 北堂書鈔 (Written Notes in the North Hall), and by Ouyang Xun 歐陽詢 in his *Yiwen leiju* 藝文類聚 (Categorised Collection on Arts and Literature). In the second half of the same century quotations from the *Dijingtu* appeared in the Buddhist work *Fayuan zhulin* 法苑珠林 (Forest of Pearls from the Garden of the Buddhist Law). At the turn of the next century Xu Jian 徐堅 incorporated some sections of *Dijingtu* in his *Chuxueji* 初學記 (Encyclopaedia for Entry into Learning). Other quotations appeared in the *Kaiyuan zhanjing* 開元占經 (Prognostication Classic of the Kaiyuan Era) written by Qutan Xida 瞿曇悉達 in the year 729, the *Taiping yulan* 太平御覽 (Imperial Survey of the Taiping Era), edited by Li Fang 李昉 c.983, and the *Shilei fuzhu* 事類賦注 (Commentary to Fu Poems on Categorised Affairs), compiled by Wu Shu 吳淑 during the tenth century.¹⁰⁷ Then at the beginning of the Ming dynasty Tao Zongyi 陶宗儀 (c.1316–1402) collected fragments of this book in his *Shuofu* 說郛 and towards the end of that dynasty Li Shizhen 李時珍 also made numerous quotations from it in his *Bencao gangmu* 本草綱目 (The Great Pharmacopoeia). Quotations from the *Dijingtu* also appeared in many of the other compendia, for example, the *Yuanjian leihan* 淵鑑類函 (Classified Dictionary) and the *Gezhi jingyuan* 格致鏡源 (Mirror Source Book for the Investigations of Things).

During the last three centuries at least three further attempts were made to collect fragments of the *Dijingtu* from the works mentioned earlier. Wang Mo 王謨, who obtained the degree of *jinshi* 進士 in 1778, reconstructed the text from *Beitang shuchao*, *Yiwen leiju*, *Chuxueji*, *Taiping yulan* and *Shilei fuzhu*, together with two items that appear to have come from another book called the *Ruiyingtu* 瑞應圖 (Charts of Auspicious Responses). Wang Mo's version is included in the *Han-Tang dili shuchao* 漢唐地理書鈔 (Written Notes on Han and Tang Geography).¹⁰⁸ Hong Yixuan 洪頤煊 (1765–1833), a younger contemporary of Wang Mo, compiled another version of the *Dijingtu* from the *Beitang shuchao*, *Yiwen leiju*, *Fayuan zhulin*, *Chuxueji*, *Kaiyuan zhanjing*, *Shilei fuzhu* and *Taiping yulan* in 1811. This version is found in the *Jingdian jilin* 經典集林 (Forest of Collected Classics and Canons).¹⁰⁹ The most accurate version appears to be that by Ma Guohan 馬國翰 (1794–1857), found in the *Yuhan shanfang jiyishu* 玉函山房輯佚書 (Collected Lost Books from the House at Yuhan Mountain). Ma collected his material from *Beitang shuchao*, *Yiwen leiju*, *Chuxueji*, *Taiping yulan* and *Shuofu*.

Translation and annotation of the text¹¹⁰

[Abbreviations:

BG=Bencao gangmu

BT=Beitang shuchao

CX=Chuxueji

DJ=Dijingtu

FY=Fayuan zhulin

FZ=Shilei fuzhu

KZ=Kaiyuan zhanjing

SF=Shuofu (Wanweishan tang 宛委山堂 edition)

TY=Taiping yulan

YL=Yiwen leiju]

An asterisk * indicates that the entry is not found in Ma Guohan's version.

DJ1

Before approaching a famous mountain, observation of abstinence for 50 days is necessary. If one gets there leading a white cockerel and one pint (*sheng* 升) of salt, the spirit of the mountain will be greatly pleased, and consequently magic mushrooms, rare medicinal plants and precious jade will be revealed. At a distance of one hundred paces before reaching the mountain, one should utter [the words] '*linlin yangyang*' 林林央央. This is the name of the chief [spirit] of the mountain. One knowing this name can [use it to] keep away the multitude of evil [spirits].

Collation: This passage comes from the YL *juan* 7 and TY *juan* 38. The latter gives the name of the chief spirit of the mountain as Lin Bing 林兵. Wang Mo and Hong Yixuan both quote only from YL and give a homophon for the Chinese character *sheng* 勝, meaning 'to win' instead of that used in capacity measurement. The Chinese character *sheng* 升 expressing capacity could well be a copyist error for *jin* 斤 that represents weight. Hence the character for 'pint' seems to be a misprint for that meaning 'pound'.

More accurately *jīn* is catty and the modern catty is about one and one-third pound. However, weights and measures vary with time, and it is not possible to know the exact modern equivalent of the weights in the text. The terms pound and ounces are used here for easier reading.

DJ2

To look for gold, jade, precious swords, copper and iron one should select a day [within a cycle] containing the *xin* 辛 (celestial stem). One should wait until the rain is over, or the break of dawn in the morning following the fall of dusk, or the arrival of midnight to look at them. In the case of jade a white luminescence would be seen, in gold [the luminescence would be] red, in copper yellow and in iron black.

Collation: This passage comes from *YL juan* 83 and is also quoted by Wang Mo and Hong Yixuan.

DJ3

To look for jade, if one sees a beautiful woman carrying a candle and performing [some sort of] worship, one should follow her movement without being noticed and then find out where she came from or where she is going to. On exploring the neighbourhood one will discover a beautiful jade within the rocks.

Collation: This passage comes from *YL juan* 80 and *TY juan* 872. Hong Yixuan gives as sources *CX juan* 25, *YL juan* 80 and *TY juan* 870 and his version includes the word 'night' and hence the text would read 'if one sees a beautiful woman in the night carrying a candle...' Wang Mo quotes only from *YL*.

DJ4

Jade that is a thousand years old moves about among the different states. Where it stays the state is inundated by water for three days and there is fog and mist [obscuring] the sun.

Collation: The text comes from *YL juan* 2 and *TY juan* 15, but in the former the word for jade (*yu* 玉) is wrongly represented by the word for king (*wang* 王); it also appears in the versions by Hong Yixuan and Wang Mo, but the latter quotes only from *YL*.

DJ5

The seminal essence (*jīng* 精) of jade mineral is present among rocks. Wet rocks in the mountain immersed in surrounding water show its presence. Its *qi* is pure and ascending and is bluish white and rotates in a ball of luminescence. The place [of such an occurrence] is always wet.

Collation: This comes from *CX juan* 27 and *TY juan* 805; Hong Yixuan quotes only from *TY*, and Wang Mo only from *CX*. There is some slight variance between these two versions.

DJ6

Look for a place without frost among mountains and streams that have much dew and beautiful jade will be [found] underneath.

Collation: This passage comes from *TY juan* 12 and is also mentioned by Wang Mo and Hong Yixuan, but the latter also quotes another source in *KZ juan* 100. There is no mention of this item in *KZ juan* 100, but in *KZ juan* 101 where it is quoted as coming from the *Dijing*.

DJ7

During the second lunar month (i.e. in early spring) when drooping [leaves or branches] first grow in trees and plants the presence of beautiful jade is indicated.

Collation: This item comes from *TY juan* 12 and is also mentioned by Hong Yixuan and Wang Mo, but unlike the other two versions Ma Guohan gives the word *guang* 光 instead of *xian* 先. Ma's version is amended to follow the other two, which appear to be more accurate in this instance. *BG juan* 8 quotes that during the second lunar month when plants glow and droop, they indicate the presence of jade [provided later]. It also mentions that the seminal essence of jade is like a beautiful woman.

DJ8

During the fifth lunar month (i.e. in summer) when extraordinarily thick but non-juicy leaves and drooping branches are present in trees and plants jade in the ground below is indicated.

Collation: This item comes from *TY juan* 22 and is also mentioned by Wang Mo and Hong Yixuan.

DJ9

During the eighth lunar month (i.e. in autumn) when only one single tree or plant has drooping leaves or branches, beautiful jade is definitely indicated. [Leaves and branches] withering after the eighth lunar month also indicates the presence of jade.

Collation: This item comes from *TY juan* 25 and is also mentioned by Wang Mo and Hong Yixuan.

DJ10

During the twelfth lunar month (i.e. in winter) when only one of the trees and plants has drooping leaves and branches beautiful jade is indicated below.

Collation: This item comes from *TY juan* 27 and is also mentioned by Hong Yixuan, but missed out by Wang Mo.

DJ11

Green jade appears in the form of a woman.

Collation: This passage comes from *TY juan* 911 and is also mentioned by Hong Yixuan and Wang Mo, the former quoting another source from *YL*. Ma Guohan points out the corrupt text in *SF juan* 60, paragraph no. 2 on this same passage.

DJ12*

Yellow jade appears in the form of fire or a white mouse.

Collation: This passage is not given by Ma Guohan and Hong Yixuan. It is taken only from Wang Mo quoting from *TY juan* 911.

DJ13

Gold appears in the form of fire or a white mouse.

Collation: This passage comes from *YL juan* 80, *TY juan* 911 and *SF juan* 60, paragraph no. 3; it also appears in Hong Yixuan and Wang Mo. Hong says that this item also comes under *YL juan* 95 besides *juan* 80, while Wang uses only *YL* as source. See also *BG juan* 8.

DJ14

To observe the *qi* of gold one should select a day that falls within either the *geng* 庚 or the *xin* 辛 (day-cycle), when its *qi* resembles a human being.

Collation: Ma Guohan gives the reference incorrectly as *BT juan* 150, but Hong Yixuan and Wang Mo both give it correctly as *BT juan* 151. Hong Yixuan has a word *sui* 歲 (year) after the word *ri* 日 (day), but this is not found in the other two versions.

DJ15

The *qi* of gold is red. When there are over 1,000 or 10,000 *jin* of gold the *qi* is bright and large as a mirror coiling round the gold itself and then grows bigger, being red at the top and blue-green at the base.

Collation: This passage comes from *CX juan* 27, *TY juan* 811 and *SF juan* 60, paragraph no. 12 and is also given by Hong Yixuan and Wang Mo, the former quoting from *CX* and *TY* but the latter only from *CX*. The text originally says, 'the *qi* of gold is red and yellow', but since in *DJ* 2 there is already a statement saying that the *qi* of gold is red, it looks very likely that a word *jin* 金 (metal) should come after the word *huang* 黄 (yellow) so that *huangjin* becomes 'gold'. Another interpretation for the quantity *qian wan jin* 千萬斤 of gold is 'ten million *jin*'.

DJ16

When there is between 100 and 300 *jin* of gold its seminal essence (*jing*) resembles a goat.

Collation: This passage comes from *YL juan* 94 and also appears in the restorations by Hong Yixuan and Wang Mo, but the former wrongly writes *qing* 清 (pure) for *jing* 精 (seminal essence).

DJ17

A treasure of gold transforms into a green snake.

Collation: This item comes from *YL juan* 96 and is also given by Hong Yixuan and Wang Mo.

DJ18

[The seminal essence of] white silver takes the form of a cockerel.

Collation: This item comes from *YL juan* 83 and *TY juan* 812; the latter says 'The seminal essence of silver appears in the form of a white cockerel.' Wang Mo gives the same version as Ma Guohan, quoting from *YL. BG juan* 8, *Yuanjian leihan, juan* 362 and *Gezhi jingyuan, juan* 34 all quote *TY*, although Wang Mo does note the alternative version in *YL*.

DJ19

The *qi* of silver is true white in the night and flows on the ground. If one sweeps the substance with the hand to spread it and finds it regrouping again, this is silver. Where there is *cong* 蔥 (*Allium fistulosum*, L. or Chinese small onion) in a mountain there is [also] silver below it and there appears faintly a true white [luminescence]. Where there is loadstone in a mountain copper or gold is present below.

Collation: This passage comes from *YL juan* 83, *TY juan* 812 and *SF juan* 60, paragraph no. 13; also given by Hong Yixuan and Wang Mo. See also *BG juan* 8, *Yuanjian leihan, juan* 362 and *Gezhi jingyuan, juan* 34.

DJ20

The origin of bronze vessels can be seen from the shape [of their *qi*], which is luminous to the sight. The shape of [the *qi*] of a vessel from [the state of] Qi 齊 resembles an ox; that from Chu 楚 resembles a horse; that from Yue 越 resembles a toad; that from Song 宋 resembles a white dog; that from Qin 秦 resembles a piglet; and that from Yan 燕 resembles a hog.

Collation: This passage comes from *TY juan* 756, 896 and 900, *BT juan* 150 and *SF juan* 60, paragraphs no. 1 and no. 11; it is also given by Hong Yixuan and Wang Mo, the former quoting from *BT juan* 151, *YL juan* 93, *TY juan* 756, 896 and 900 and *FZ juan* 21.

In the versions of Hong and Wang the word *yan* 焉 [there, in it, at it, in that situation] is given as *ma* 馬 (horse). The first sentence would then read, ‘which is like looking at a luminous horse’. A commentary in *BT juan* 151.2a says that the word *qi* in the original text has been mistakenly read as *qi* 器 (vessel).

DJ21

When grass has elegant yellow stalks there is a bronze vessel below.

Collation: This passage comes from *TY juan* 813; also given by Hong Yixuan and Wang Mo both quoting *TY*.

DJ22

Under observation the *qi* of bronze money resembles a blue-green cloud.

Collation: This passage comes from *YL juan* 83, *TY juan* 833 and *SF juan* 60, paragraph no. 6; it also appears in Hong Yixuan quoting from *YL juan* 66, *TY juan* 836 and *FZ juan* 10, and in Wang Mo quoting only from *TY*.

DJ23

In observing [the seminal essence of] [coin] money, when its quantity exceeds 10 million [its *qi*] would look like a carriage, when its quantity comes to a 100,000 its seminal essence would resemble a piece of unornamented wood and when it amounts to less than 10,000 [its *qi*] covers the ground like an earthen jar.

Collation: This passage comes from *TY juan* 833; it is also given by Hong Yixuan quoting from *TY juan* 836, but missed by Wang Mo. Instead of the word *su* 素 (unornamented), Wang Mo gives *suo* 索 (rope) making the sentence incomprehensible, so that it should be regarded as a misprint.

DJ24

When green grass has elegant red stalks there is lead below.

Collation: This passage comes from *TY juan* 812 and *SF juan* 60, paragraph no. 14; it is also given by Hong Yixuan and Wang Mo, both quoting the same source in *TY*.

DJ25

If one wishes to know the location of a treasure one can use a large mirror and observe its reflection in the night. A reflection in the mirror looking like [a source of] light indicates the presence of [some precious] object below [the ground].

Collation: This item comes from *TY juan* 717 and *SF juan* 60, paragraph no. 15; it is also given by Hong Yixuan and Wang Mo, both quoting from *TY*.

DJ26

In the art of [interpreting the *qi* as] observed among the hundreds of households, a red *qi* indicates the presence of immense wealth; a white *qi* warns that the family concerned will be unable to keep its wealth; a black *qi* reveals that weapons are hidden within that house and a blue-green *qi* tells the presence of silver, which is treasure from the earth.

Collation: This passage is from *TY juan* 180; it is also given by Hong Yixuan and Wang Mo, both quoting from *TY*, but both giving the two words *yu qi* 玉其 instead of *wubing* 五兵 changing the clause ‘a black *qi* reveals that weapons are hidden within that house’ to ‘a black *qi* reveals that jade is hidden within (or “beneath” according to another version) that house’.

DJ27

If a yellow *qi* is observed in the people’s home it shows the presence of a *nie* (*mu*) 孽(木) or the gardenia tree (*zhizi* 梔子). If a white *qi* lingers over a mountain a luminous dragon is residing there.

Collation: This passage comes from *TY juan* 15, *YL juan* 89 and *SF juan* 60, paragraph no. 5; it is also given by Hong Yixuan and Wang Mo, the former quoting from *TY juan* 15 and *juan* 959 and *YL juan* 89. The seeds of the gardenia tree produce a yellow dye. Wang Mo gives a homophon for *zhi* 支 in *zhizi*.

DJ28

When one observes the tiles of the roof and discovers that they are the only ones that are not covered with frost [one can tell that] treasure is kept under that roof.

Collation: This comes from *TY juan* 14 and *juan* 802; it is also given by Hong Yixuan quoting from *KZ juan* 101 and *FY juan* 37 besides *TY*, but omitted by Wang Mo.

DJ29

Whenever treasures are [hidden] within city walls and earthen walls they change the trees [nearby]. One can observe signs from the affected trees from broken or dead branches pointing towards one particular direction, indicating the position of the [hidden] treasure. Gold treasure often transfigures into a coiled serpent. On encountering such an object one should remove a shoe or one's wearing apparel to throw at it [in order to capture it]. If it is then immersed in water the treasure will appear [in its original form]. If one forgets the location of a hidden treasure, one may place a large copper basin containing water over the suspected area. If the shadow of a human being is seen [in the water] it indicates the presence of the treasure right underneath that spot.

Collation: This passage comes from *TY juan* 802; it is also given by Hong Yixuan and Wang Mo, the former quoting *FY juan* 37 and *TY juan* 802, while the latter quotes only from *TY*.

DJ30

A treasure [hidden] in old burial ground causes changes in the trees. Hence a treasure lies near a tree with broken or dead branches, which [also] point towards the [hidden] spot. If [these branches] point south the treasure is eight feet [to the south] away from the tree, and if [they point] east the treasure is six feet [to the east] away from the tree.

Collation: This passage comes from *TY juan* 953 and *SF juan* 60, paragraph no. 4; also given by Hong Yixuan and Wang Mo, both quoting from *TY*.

DJ31

One who walks under the sun and the moon without casting a shadow is a holy immortal. By forming physical union with the void [a holy immortal] casts no shadow in the sun and the moon, leaves no footprints stepping on snow, and casts no shadow by a fire.

Collation: This passage comes from *TY juan* 388; it is also mentioned by Hong Yixuan and Wang Mo both quoting from *TY*.

DJ32

When a state is peaceful and well governed and its territory expanding, trees will grow on water.

Collation: This passage is from *TY juan* 873; it is given by Wang Mo, who thinks that it appeared to come from the *Ruiyingtu*, but it is not given by Hong Yixuan.

DJ33

When a state is well governed and the ruler happy, trees will suddenly become bigger on their own.

Collation: This passage comes from *TY juan* 873; it is given by Wang Mo quoting also *TY* but omitted by Hong Yixuan.

DJ34

When the *qi* of material resources accumulates in a mountain the *cong* plant (*Allium fistulosum*, L.) flourishes.

Collation: This passage comes from *SF juan* 60, paragraph no. 7; but is omitted by both Hong Yixuan and Wang Mo.

DJ35

Gold comes out in moving sand.

Collation: This passage comes from *SF juan* 60, paragraph no. 8; it is omitted by both Hong Yixuan and Wang Mo.

DJ36

There is little mineral deposit in a broken hill.

Collation: From *SF juan* 60, paragraph no. 9; omitted by both Hong Yixuan and Wang Mo.

DJ37

Accumulated jade becomes more lustrous.

Collation: This paragraph comes from *SF juan* 60, paragraph no. 10; it is omitted by both Hong Yixuan and Wang Mo.

DJ38

When the Celestial Drums (*tiangu* 天鼓) show movement, the cross-bows of the king will be put to action and there will be alarm over the country.

Collation: This passage comes from *SF juan* 60, paragraph no. 16; but is omitted by both Hong Yixuan and Wang Mo. For the Celestial Drums, see Ho Peng Yoke (1966), p. 86. Another source says that it refers to the *Hegu* 河鼓 constellation, see *BT juan* 150. Movement refers to scintillation and unlike their Western counterparts, Chinese astronomers did not have any notion of 'fixed' stars. As its title implies, the *Dijingtu* should concern itself with things pertaining to the earth. This item, however, refers to the stars. It could have originated from another book on astronomy, such as the *Tianjing* 天鏡 (Heaven Mirror), but was somehow mistaken as a quotation from the *Dijingtu*, perhaps by Tao Zongyi, the compiler of the *Shuofu*, and later copied by Ma Guohan.

DJ39*

Qi resembling a drifting cloud seen [above] rocks is the seminal essence of precious pearls and jade (*zhuyu* 珠玉).

Collation: This is not given by Ma Guohan; it comes from *TY juan* 8 and *FZ juan* 2, quoted by Hong Yixuan and Wang Mo (using only *FZ*). The term *zhuyu* normally refers to pearls and jade and also means 'rounded jade'. Here it should refer to the latter, since pearls are not minerals found among rocks.

DJ40*

There must be gold in a mountain where *jiu* 韭 (*Allium adorum*, L.) grows.

Collation: This passage is not given by Ma Guohan and Wang Mo; Hong Yixuan quotes from *FZ juan* 37. *BG juan* 8 also refers to this passage but gives *xie* 薤 (*Allium bakeri*, Regel) instead of *jiu*.

DJ41*

The seminal essence of a bronze vessel appears in the form of a horse.

Collation: This passage is given only by Wang Mo, quoting from *YL*.

DJ42*

Money as a substance by itself is useless for alleviating hunger and cold. These [coins and bullion] are hoarded because they are imperishable. It has been the practice from past to present [to hoard them] because of this reason. Money is also convenient when used in small market places for transaction of goods, far better than having to break up large bullion into smaller pieces [for bartering]. Other than these, money has no further use whatsoever. Only grains and textiles are basically [of greatest importance] for the army and the people. Although money may be hoarded it should not [be regarded as] the most important treasure in time of an emergency.

Collation: This passage is given only by Wang Mo, quoting from TY.

Zaohua zhinan 造化指南 (Guide to the Creation of Things)

The *Zaohua zhinan* is attributed to the Daoist adept Tuxiu zhenjun 土宿真君, about whom little is known. There was a belief that he lived during or even before the fourth century, because Ge Hong 葛洪 (283–343) was said to have written a commentary to a book with a similar title. Li Shizhen, however, was of the opinion that the author was probably an alchemist or magician-technologist (*fangshi* 方士) in the time of the Song and Yuan.¹¹¹ Internal textual evidence supports the views of Li Shizhen. The probable period for the writing of this book was the first half of the fourteenth century. In the *Bencao gangmu* the name Tuxiu zhenjun is also given as Tuxiu kunyuan zhenjun 土宿昆元真君, which should probably read Tuxiu hunyuan zhenjun 土宿混元真君. The full text of this book is no longer extant. The following gives a translation of its remnants.

[Abbreviations:

BG=*Bencao gangmu*

RP=Read and Pak (1936)

RL=Read and Liu (1936)

ZH=*Zaohua zhinan*]

ZH1. Qian 鉛 (lead; RP 10)

Lead is the progenitor of the Five Metals. Hence it receives the names ‘Prison Warden’ or the ‘Captor of the Five Metals’, referring to its ability to subdue (*fu* 伏) the Five Metals and to cause the death (*si* 死) of the Five Minerals. *Cihuang* 雌黃 (orpiment; RP 50) is the progeny of gold. Within it contains the *qi* of lead and hence [lead] is the progenitor of the Yellow Metal (i.e. gold). Lead is found in silver mines, and hence [lead] is the progenitor of the White Metal (i.e. silver). Copper is found mixed with Xin[zhou] 信州 lead, and hence [lead] is the progenitor of the Red Metal (i.e. copper). Lead has the same *qi* as tin, and hence it is the progenitor of the Blue-Green Metal (i.e. tin). Cinnabar is subdued (*fu*) by lead, but its death (*si*) is caused by sulphur. Sulphur has an affinity (*lian*) for lead, but is subdued (*fu*) by *nao* [sha] 礶砂 (sal ammoniac; RP 126). Iron has an affinity for *ci* [shi] 磁[石]; 慈[石] (magnetite; RP 76), but its death is caused by lead. *Xiong* [huang] 雄[黃] (realgar, RP 48) has an affinity for lead, but its death is caused by *wuzhi* 五脂 (the five siliceous clays; RP 57). Hence *jingong* 金公 (i.e. lead) undergoes the most

number of changes. It first changes to *hufen* 胡粉 (white lead; RP 12); second it changes to *huangdan* 黃丹 (minium; RP 13); third it changes to *mituoseng* 密陀僧 (litharge; RP 14); and fourth it changes into [*qian*] *baishuang* [鉛]白霜 (lead acetate; RP 11).

Collation: This passage comes from BG *juan* 8.

ZH2. Xi 錫 (tin; RP 15)¹¹²

Tin is produced by the influence of the *qi* of *Taiyin* 太陰, which, when left by itself will turn into *pi[shi]* 砒石 (arsenic; RP 91) after 200 years. Arsenic after 200 years will produce tin. Tin is endowed with the *qi* of *Yin* and hence its natural disposition is soft. When it is left unmoved for 200 years to receive the *qi* of *Taiyang* 太陽 it turns into silver.

Collation: This passage comes from BG *juan* 8.

ZH3. Tie 鐵 (iron; RP 20)

Iron receives the *qi* of *Taiyang* 太陽. At the very beginning *lushi* 鹵石 (rock salt) is produced. After 150 years it turns into *cishi* 磁石; 慈石 (magnetite), [which], after 200 years of gestation, gives birth to iron. After another 200 years [iron], if not mined and refined, it would become copper, which [given time], would become silver, and which [in turn] would [eventually] become gold. Hence iron, gold and silver share the same origin. One can verify this by finding fragments of iron when one breaks a piece of magnetite. Iron is endowed with the *qi* of *Taiyang* and is not mixed with the *qi* of *Yin*. Hence it is dry (*zao* 燥) and impure. Its nature is mutually agreeable (*xiangde* 相得) with tin.

Collation: This passage comes from BG *juan* 8.

ZH4. Dansha 丹砂 (cinnabar; RP 43)

Cinnabar receives the *qi* of *Blue-Green Yang* 青陽. At the beginning a mineral is formed. After 200 years it turns into cinnabar. The 'Blue-Green Girl' (*qingnu* 青女) (i.e. cinnabar) becomes pregnant and after 200 years lead is formed. [Lead] after another 200 years becomes silver, which after another 200 years on getting the *qi* of *Taihe* 太和 turns into gold. Hence, of all gold, there is none better than that coming from cinnabar. Cinnabar can be subdued (*fu*) by one of [the following, namely] *yindijue* 陰地厥 (moonwort, *Botrychium ternatum*, Sw; RL 801), *digupi* 地骨皮 (matrimony vine; *Lycium chinense*, Mill.; RL 115), *cheqiancao* 車前草 (plantain, *Plantago major*, L.; RL 90), *mabiancao* 馬鞭草 (vervain, *Verbena officinalis*, L.; RL 147), *zaojia* 皂莢 (soap bean, *Gleditsia sinensis*, Lam.; RL 387), *shiwei* 石韋 (*Polypodium lingua*, Sw.; RL 810), *jueming* 決明 (foetid cassia, *Cassia tora*, L.; RL 379), *qumai* 瞿麥 (pink *Dianthus superbus*, L.; RL 547), [*Tian*] *nanxing* [天]南星 (Jack-in-the-pulpit, *Arisaema Thunbergii*, B1.; RL 709), *baifuzi* 白附子 (*Jatropha Janipha*, Lour.; RL 29), *wutou* (Chinese 烏頭 aconite, *Aconitum Fischeri*, Reich.; RL 523), *sanjiaosuan* 三角酸 (Indian sorrel, *Oxalis corniculata*, L.; RL 367), *ouhe* 藕荷 (Indian lotus; RL 542), *sangshen* 桑椹 (mulberry fruit), *diyu* 地榆 (burnet, *Sanguisorba officinalis*, L.; RL 460), *zihexhe* 紫河車 (*Paripolyphylla*, Sm.; RL 685) and *diding* 地丁 (i.e. *huanghua diding* 黃花地丁, which is identified in RL 48 as dandelion, *Taraxacum officinale*, Web.). Lead regards cinnabar as its son and [here the principle of] mutual production operates. [Cinnabar] subjects itself to transformation.

Collation: This item comes from BG *juan* 9.

ZH5. Shuiyin 水銀 (mercury; RP 44)

The leaf of the Indian lotus (*heye* 荷葉), the leaves and resin from the pine tree, *gujingcao* 谷精草 (pipewort, *Eriocaulon australe*, R. Br.; RL 701), *xuancao* 萱草 (yellow

day lily, *Hemerocallis fulva*, L.; RL 679), *jinxingcao* 金星草 (polypody, *Polypodium hastatum*, Th.; RL 809), *wasong* 瓦松 (roof pine; *Cotyledon fimbriata*, Turcz. var. *ramosissima*, Maxim; RL 469), *xiakucuo* 夏枯草 (Carpenter weed, *Brunalla vulgaris*, L.; RL 122), *rendong* 忍冬 (honeysuckle, *Lonicera japonica*, Th.; RL 75), *langdangzi* 琅君子 (henbane seeds, *Hyoscyamus niger*, L.; RL 114), *yanlaihong* 雁來紅 (*Amarantus gencticus*, L.; RL 557b), *matixiang* 馬蹄香 (*Asarum Blumei*, Duch.; RL 586), *dujiaolian* 獨腳蓮 (umbrella leaf, *Dipylleia cymosa*, Michx.; RL 520) and *shuicigu* 水慈菇 (=cigu 慈菇, arrowhead, *Sagittaria sagittifolia*, L.; RL 781) can all fix (zhi) mercury.

Collation: This item comes from BG juan 9.

ZH6. *Xionghuang* 雄黃 (realgar; RP 49)

[Tian]nanxing 天南星 (Jack-in-the-pulpit), *dihuang* 地黃 (*rehmannia glutinosa*, Lib.; RL 107), *woju* 萵苣 (Lettuce, *Lactuca saliva*, L.; RL 39), *wujiapi* 五加皮 (*Acanthopanax sphinosum*, Miq. bark; RL 234), *ziheche* 紫河車 (Paris *polyphylla*, Sm.; RL 685), *diyu* 地榆 (burnet; RL 460), *wuyeteng* 五葉藤 (probably *wulianmei* 烏菝葜, also known as *wuyemei* 五葉莓, *Vitis japonica*, Th.; RL 285), *huangqin* 黃芩 (Skullcap, *Scutellaria baicalensis*, Georg.; RL 140), *baizhi* 白芷 (*Angelica anomala*, Pall.; RL 207), *danggui* 當歸 (*Angelica polymorpha*, Maxim, var. *sinensis*, Oliv; RL 210), *dijin* 地錦 (thyme-leaf spurge; RL 325), *echangcao* 鵲腸草 (=echangcai 鵲腸菜, chickweed, *Stellaria aquatica*, Scop.; RL 552), *kushen* 苦參 (sophora, *Sophora flavescens*, Ait.; RL 409), *ebushicao* 鵲不是草 (sneeze weed, *Centipeda minima*, Kuntse; RL 22, if not pennywort, *Hydrocotyle rotundifolia*, Roxb; RL 223), *yuansang* 圓桑 (?; 'round mulberries') and the fat of hedgehog (*weizhi* 蜚脂) are all capable of fixing realgar.

Collation: This item comes from BG juan 9.

ZH7. *Cihuang* 雌黃 (orpiment; RP 50)

Orpiment is a Yang mineral. When the *qi* is deficient what is formed is *ci[huang]* (orpiment) and when [the *qi*] is sufficient what is formed [then] is *xiong[huang]* (realgar). The congealing [of *qi*] into minerals takes 500 years. Nature follows the way of the husband-and-wife [relationship] and hence the [minerals formed] are called *ci[huang]* (literally the Female Yellow substance) and *xiong[huang]* (literally the Male Yellow substance). *Xiongqiong* 芎藭 (hemlock parsley, *Conioselinum univittatum*, Turcz.; RL 216), *dihuang* 地黃 (*Rehmannia glutinosa*, Lib.; RL 107), *duzhou* 獨帚 (broom plant, *Kochia scoparis*, Schrad.; RL 562), *yimu[cao]* 益母[草] (Siberian motherwort, *Leonurus sibiricus*, L.; RL 126), *yangbushicao* 羊不食草 (azalea, *Rhododendron sinense*, Sw; RL 203), *diyu* 地榆 (burnet), *Wujiapi* 五加皮 (*Acanthopanax sphinosum*, Miq. bark; RL 234), *wasong* 瓦松 (roof pine; RL 469) and the juice of the *donggua* 冬瓜 (white gourd, *Benincasa cerifera*, Savi.; RL 56) can all fix and subdue (*zhifu*) [orpiment]. Also orpiment turns black when it meets lead and *hufen* 胡粉 (lead carbonate; RP 12).

Collation: This item comes from BG juan 9.

ZH8. *Luganshi* 爐甘石 (zinc-bloom, Smithsonite; RP 59)

This substance is an absolutely wonderful ingredient for projection (*dianhua* 點化). The Daoist Trinity in the Nine Heavens honoured it with the name Master Lu.¹¹³ Zinc-bloom can only be formed after having been nourished by the *qi* of gold and silver for 40 years. After boiling with weeds and arsenic it can be used for projection. Its efficacy is not inferior to the Three Yellow [minerals] (i.e. sulphur, realgar and orpiment).

Collation: This item comes from BG juan 9.

ZH9. *Zhongru* 鍾乳 (stalactites; RP 63)

Stalactites occur in *Yang* caves, being congealed from the *qi* of *Yang*. When it is subdued (*fu*) it can be used to soften (*ru* 乳) the Five Metals. It can be subdued by [any one of the following substances, namely] *maimendong* 麥門冬 (black leek, *Liriope spicata*, Lour.; RL 684), *dusuan* 獨蒜 (probably *suan* 蒜, garlic; *Allium sativum*, L.; RL 671), *jiushi* 韭實 (leek seeds, *Allium odorum*, L.; RL 670), *hucong* 胡蔥 (onion, *Allium Cepa*, L.; RL 664), *husui* 胡荽 (coriander, *Coriandrum sativum*, L.; RL 217) and *maoeryan[jing]cao* 貓兒眼[睛]草 (wartweed, *Euphorbia helioscopia*, L.; RL 324).

Collation: This item comes from BG *juan* 9.

ZH10. *Cishi* 慈石 (magnetite; RP 76)

Iron receives the *qi* of *Taiyang*. At the very beginning stones are formed. After 150 years [and receiving the *qi* of *Taiyang* the stone] turns into magnetite and after another 200 years of pregnancy [magnetite] becomes iron.

Collation: This item comes from BG *juan* 10.

ZH11. *Kongqing* 空青 (malachite, large hollow variety; RP 82)

When copper receives the *qi* of Purple *Yang* it produces [*tong*]lu [銅綠] (basic acetate of copper and also an artificial carbonate of copper; RP 9), which becomes *shilu* 石綠 (malachite, fine granular form; RP 84) after 200 years. Copper is found in them from the very beginning. *Cengqing* 曾青 (malachite, stratified variety; RP 83) and *kongqing* (the large hollow variety of malachite), being the two *qing* 青 (blue-greens), represent the attainment of the *Dao* 道 by *shilu* 石錄 (the fine granular form of malachite).¹¹⁴ All these are minerals. After another 200 years receiving the *qi* of Blue-Green *Yang*, [*kongqing*] will change into *toushi* 鑄石 (an alloy of zinc and copper).

Collation: This item comes from BG *juan* 10.

ZH12. *Cengqing* 曾青 (malachite, stratified variety; RP 83)

The stratified variety of malachite occurs in copper mines, and represents the attainment of the *Dao* by *shilu* (the fine granular form of malachite). Its surface has the correct colour of the east (i.e. blue-green). It can be used to prepare the great elixirs. For projection (*dianhua*) its efficacy ranks with the Three Yellow [minerals] (i.e. sulphur, realgar and orpiment).

Collation: This item comes from BG *juan* 10.

ZH13. *Pishi* 砒石 (arsenic; RP 91)

Arsenic is fixed (*zhi*) by using grass (or perhaps coarse cinnabar). It is refined until the golden flower[-like impurities] are removed. Made into a liquid it transforms copper and dries (*gan* 乾) mercury. The following substances are capable of subduing arsenic, [namely] *qingyan* 青鹽 (blue-green common salt; RP 115), *haodingcao* 鶴頂草 (pigweed or goosefoot; RL 561a), *xiaoshi* 硝石 (saltpetre; Epsom salts; RP 125), *suan* 蒜 (garlic), *shuiliao* 水蓼 (water pepper, *Polygonum Hydropiper*, L. *forma aquaticum*, Mak.; RL 574), *changshan* 常山 (Sichuan varnish, *Orixa japonica* Th.; RL 353), *yimu[cao]* 益母[草] (Siberian motherwort; RL 126), *duzhou* 獨帚 (broom plant; RL 562), *shuilu* 水律 (=shuili 水梨, water chestnut, *Trapa natans*, L.; RL 243), *changpu* 菖蒲 (*Acorus gramineus*, Ait.; RL 704), *sanjiaosuan* 三角酸 (Indian sorrel; RL 367), *ebushicao* 鵝不食草 (sneeze weed; RL 22), *boling* 菠薐 (spinach, *Spinacia oleracea*, L.; RL 563) and *woju* 萵苣 (lettuce; RL 39).

Collation: This item comes from BG *juan* 10.

ZH14. *Xiaoshi* 硝石 (saltpetre; RP 125) [Another name for it is] *yanxiao* 鹽硝.¹¹⁵

Saltpetre is produced in response to the saltish *qi* of the sea. It is the most efficacious substance in Heaven and Earth. It can be cold or hot, smooth or rough, pungent or bitter and sour or saltish. Being left in the ground a thousand years will not alter its colour. It brings the seventy-two minerals into aqueous solution. It controls the plants, softens and smoothenes the Five Metals and fixes and refines the Eight Minerals. It cannot be left out even in the preparation of the Great Elixirs.

Collation: This item comes from *BG juan 11*.

ZH15. *Naosha* 礞砂 (sal ammoniac; RP 126)

[A synonym of *naosha* is] *tougu jiangjun* 透骨將軍 (Bone-Penetrating General). Sal ammoniac by nature penetrates matter. The Five Metals rely upon it as their vanguard, thus explaining its synonym.

Collation: This item comes from *BG juan 11*.

ZH16. *Pengsha* 礬砂 (borax, sodium biborate; RP 127)

Zhimu 知母 (*Anemarrhena asphodeloides*, Bge.; RL 675), *ebushicao* 鵝不食草 (sneeze weed; RL 22), *yuntai* 芸薹 (Chinese coiza, *Brassica campestris*, L. var. *oleifera*, DC.; RL 473), *zisu* 紫蘇 (*Perilla nankinensis*, Decne.; RL 135), *zengdai* 氈帶 (made of *pu* 蒲, a kind of rush; see *BG juan 38*) and *heshouwu* 何首烏 (*Polygonum multiflorum*, Th.; RL 576) can all subdue (*fu*) borax. When it is forged (*duan*) with arsenic changes will occur.

Collation: This item comes from *BG juan 11*.

ZH17. *Shuixian* 水仙 (water nymph, *Narcissus tazetta*, L.; RL 662)

Its juice can be extracted to subdue mercury, to boil realgar, and for resisting fire (*juhuo* 拒火)

Collation: This item comes from *BG juan 13*.

ZH18. *Tuxixin* 土細辛 (*Asarum blumei*, Duch.; RL 586)

The leaves of the *tuxixin* plant are round like those of the *mat[cao]* 馬蹄[草] (water shield, *Brasenia peltata*, Pursh.; RL 540), and leaves with a purple colour on the underside are preferable. The plant occurs in Jiangnan (south of the Yangzi River, especially the provinces of Jiangsu and Anhui), Jing[zhou] (Hunan province and parts of Hubei and Guizhou provinces), Hu[bei province], [Si]chuan [province], Shaan[xi province], Min (Fujian province) and Guang[dong and Guangxi province]. The natural juice taken from this plant can subdue (*fu*) sulphur and arsenic and fix (*zhi*) mercury.

Collation: This item comes from *BG juan 13*.

ZH19. *Qingxiang* 青葙 (prince's feather, *Celosia argentea*, L.; RL 558)

The plant resembles the *jiguanhua* 雞冠花 (cockscorn, *Celosia cristata*, L.; RL 559), and so do the leaves. When broken a milky juice appears. It grows in rivers and lakes and in artificial ponds south of Jing(zhou) (in Hunan province and part of Hubei and Guizhou province). Extracted in the fifth month of the lunar calendar its juice can be used to fix (*zhi*) realgar and sulphur, to boil orpiment and to refine (*lian*) cinnabar.

Collation: This item comes from *BG juan 15*.

ZH20. *Kuyao* 苦蕒 (thistle, *Cnicus chinensis*, Maxim; RL 28)

The larger type of *kuyao* is called *kuji* 苦蕒. Its leaves resemble those of *dihuang* 地黃 (*Rehmannia glutinosa*, Lib.; RL 107), taste bitter and grow white hair at the early stage. The stem is [also] hairy. White flowers grow in abundance. It bears small hard fruits. One variety that bears neither flowers nor fruits is called *didancao* 地膽草 because its juice has a bitter taste like the gallbladder. The plant grows everywhere in wet places. The alchemist uses it.

Collation: This item comes from *BG juan 15*.

ZH21. *Xuancao* 萱草 (yellow day lily, *Hemerocallis fulva*, L.; RL 679)

[*Xuancao* is also known by the name] *lujian* 鹿劍.

Collation: This item comes from *BG juan 16*.

ZH22. *Difu* 地膚 (broom plant, *Kochia scoparia*, Schrad.; RL 562)

[*Difu*] is also known by the name *Qianxin jinü* 千心姦女.

Collation: This item comes from *BG juan 16*.

ZH23. *Cheqian* 車前 (plantain, *Plantago major*, L.; RL 90)

[*Cheqian*] can subdue (*fu*) sulphur, congeal (*jie*) coarse cinnabar, subdue the Five Alums (different coloured potash alum and vitriol) and *fenshuang* 粉霜 (purified calomel; RP 46).

Collation: This item comes from *BG juan 16*.

ZH24. *Sanbaicao* 三白草 (lizard's tail, *Saurus loureiri*, Decne.; RL 633)

Its flowers and roots collected during the third month of the lunar calendar are capable of fixing (*zhi*) realgar.

Collation: This item comes from *BG juan 16*.

ZH25. *Zeqi* 澤漆 (*Euphorbia helioscopia*, L.; RL 324)

Zeqi is *maoeryanjingcao* 貓兒眼睛草.

Collation: This item comes from *BG juan 17A*.

ZH26. *Guijiu* 鬼臼 (umbrella leaf; *Diphylleia cymosa*, Michx.; RL 520)

[Some other names for *guijiu* are] *dujiaolian* 獨腳蓮 [and] *duhecao* 獨荷草.

Collation: This item comes from *BG juan 17B*.

ZH27. *Shegan* 射干 (blackberry lily, *Belamcanda chinensis*, Lem.; RL 653)

[*Shegan* is also known by the names] *guishan* 鬼扇, *xianrenzhang* 仙人掌 and *zijinniu* 紫金牛. *Shegan* is also another name for *bianzhu* 扁竹. The leaf is not symmetrical in shape but looks [rather] like the palm seen from the side. So is the stem, which is green in colour. One variety gives purple flowers, another yellow flowers and another blue flowers. The plant grows mainly in the plains in Jiangnan (i.e. modern Jiangsu and Anhui province), Hu[nan] province, Hubei provinces], [Si]chuan [province] and Zhe[jiang province]. Collected during the eighth month of the lunar calendar, its juice may be used for boiling realgar, for subduing (*fu*) orpiment, for fixing (*zhi*) cinnabar and for resisting fire.

Collation: This item comes from *BG juan 17B*.

ZH28. *Wanggua* 王瓜 (cucumber, *Thladiantha dubia*, Bge.; RL 67)

[Another name for *wanggua* is] *shigucao* 石姑草.

Collation: This item comes from *BG juan 18A*.

ZH29. *Qiancao* 茜草 (madder, *Rubia cordifolia*, L.; RL 88)

[*Qiancao* is also known by the names] *xuejianchou* 血見愁 and *fengchecao* 風車草.

Sibucan 四補草 [refers to the part without] the roots of *qiancao*, which is also known as *xitianwangcao* 西天王草, *siyuejinyangcao* 四岳近陽草, *tietacao* 鐵塔草 and *fengcheercao* 風車兒草.

Collation: This item comes from *BG juan 18B*.

ZH30. *Rendong* 忍冬 (honeysuckle or woodbine, *Lonicera japonica*, Th.; RL 75)

[Other names of *rendong* include] *tonglingcao* 通靈草 [and] *mitongteng* 蜜桶藤]

Mitongteng is a Yin plant. The juice extracted from it can subdue (*fu*) sulphur and fix (*zhi*) mercury. Hence came the name *tongling[cao]* ('numinous plant').

Collation: This item comes from *BG juan* 18B.

ZH31. *Xingcai* 荇菜 (fringed water lily or floating heart, *Limnanthemum nymphoides*, Hoffm. et Link.; RL 170)

[*Xingcai* is also known as] *shuijingcao* 水鏡草.

Collation: This item comes from *BG juan* 19.

ZH32. *Chiqin* 赤芹 (*Corydalis ambigua*, Chain et Sch.; RL 487)

Chiqin grows in the shady part of a gorge, in ponds and marshes, and between rocks near the water. In appearance it looks like red peony. Its leaves are deep green in colour [on the upper surface, but] red in colour on the lower surface. The stem and the leaves resemble those of *qiaomai* 蕎麥 (buckwheat, *Fagopyrum esculentum*, Moench.; RL 564). It bears pretty red flowers, while its hard seeds also resemble those of buckwheat. Its roots look like a spider, and when chewed in the mouth give a very sour, bitter and astringent taste. The shoots are collected during the third and fourth month of the lunar calendar by people in Jianghuai (i.e. Jiangsu and Anhui province) and eaten as vegetables. It is rarely found in the south. It grows most abundantly in mountains [such as the] Taihang Mountains (in Henan and Shanxi provinces) and the Wangwu Mountains (also in Henan and Shanxi province).

Collation: This item comes from *BG juan* 26.

ZH33. *Jinzancao* 金簪草 (dandelion, *Taraxacum officinale*, Web.; RL 48)

Jinzancao is also called [*huanghua*] *diding* [黃花]地丁. Its flowers resemble hairpin heads and stands on one stalk looking like [the word] *ding* 丁. Hence its name.

Collation: This item comes from *BG juan* 26.

ZH34. *Li* 藜 (Pigweed or goosefoot, pink variety or lamb's quarters, pink variety, *Chenopodium album* L.; RL 561a)

[*Li* is also known as] *haodingcao* 鶴頂草.

Collation: This item comes from *BG juan* 27.

ZH35. *Hetun* 河豚 (globefish)

[The globefish] subdues *naosha* 礪砂 (sal ammoniac).

Collation: This item comes from *BG juan* 44.

***Waidan bencao* 外丹本草 (Pharmacopoeia of Operative Alchemy)**

Besides the *Danfang jianyuan* and *Zaohua zhinan*, Li Shizhen listed the *Waidan bencao* of Cui Fang 崔昉, the *Baozanglun* 寶藏論 (Discourse on the Precious Treasury of the Earth) by Xuanyuan Shu 軒輶述 and the *Dantailu* 丹臺錄 (Discourse on the Alchemical Laboratory) by Qingxiazhi 青霞子 as being quoted by Zhu Quan 朱權 in his *Gengxin yuce* 庚辛玉冊.¹¹⁶ These three texts are no longer extant in full. They are here partially restored from fragments also quoted in other works and translated with annotations added.

The art of alchemy was rather popular among the *literati* in eleventh-century China. Among the great scholars and well-known civil servants who took a fancy to it were Fan Zhongyan 范仲淹 (989–1052) and Su Dongpo 蘇東坡 (1036–1101), but there must have been other scholars and minor civil servants whose names were rarely mentioned. Cui Fang belonged to the latter category. We know something about him only through an alchemical compendium, the *Gengdaoji* 庚道集 (Collection of Procedures for Gold Making) from the Daoist Canon. In the year 1144 a certain recluse, of whom we know

precious little but who styled himself the Retired Scholar of Mengxuan 蒙軒, talked about the alchemical pharmacopoeia of Cui Fang and quoted the postscript in this compendium. According to him, Cui Fang came from eastern Shandong province. His style name (*zi* 字) was Huishu 晦叔 and his appellation (*hao* 號) Wenzhenzi 文真子. Towards the later stage of his life he styled himself the 'Retired Elder of the Culai 徂徠 Mountain'. He compiled a pharmacopoeia on the essentials of medicinal substances for the Great Elixir. Although the exact title of the pharmacopoeia is not mentioned here it seems that what is being referred to is the *Waidan bencao*. The postscript in the pharmacopoeia says,

During a *guiwei* 癸未 year in the Qingli 慶曆 reign-period [1043], [Cui] Fang accepted an appointment in Hunan to keep vigilant [watch] on the tribal people [inhabiting] the caves among the streams [and rivers that form the tributaries of the Yangzi River in western and south-western Hunan province]. The seat of office was in Wugang 武岡 district, three hundred *li* away from Changsha 長沙 in the northeast. At that time the previous minister Liu Chongzhi 劉沖之 was in charge of Tanzhou 潭州 prefecture. He had summoned [Cui] Fang [to appoint him] editor (*jianxiu* 監修) Whereupon [Cui Fang] proceeded on his transfer and stayed at the Qingyisi 青衣寺 temple. One day someone from the prefecture named Li Bi 李弼 visited him. The visitor was aged seventy-odd years, [but] had the red and tender complexion [of a young child]. They discussed mainly the art of making elixirs, and eventually [Li] presented [Cui] with a formula for making the 'Blue-Green Metal Elixir' (*qingjindan* 青金丹) of the holy immortal Master Wei 魏 [Boyang 伯陽]. [Cui] Fang read and verified both the procedure and the quantity [of the ingredients involved], but was not able to understand its hidden subtle meaning. [Li] Bi told [Cui] repeatedly that the latter would eventually succeed in carrying out [the experiment]. This experiment used two [parts of] sulphur and eight [parts of] mercury brought through nine cyclical changes in a Water-and-Fire reaction vessel (*shuihuoding* 水火鼎). [The elixir] should form naturally when this procedure is followed. Although [Cui] Fang was burdened with official duties, he often made use of his leisure hours to carry out the experiment accordingly. [However], after nine cyclical changes [the product] reverted to mercury. He then asked [Li] Bi, but received no reply. [Cui] Fang thought that the procedure was too profound and that he had failed to realize the Elixir because he could not comprehend the secret instructions of the holy immortals. Later [Cui] travelled on official duty and came to the Hengshan 衡山 mountain, where he visited Master Lan 藍, an adept [known for his expertise] on the nourishing of life, and sought his guidance. The Venerable Lan said, 'This most wonderful procedure is very easy to achieve. However, as you have not fully understood the writings of the holy immortals, the [quantity of] sulphur and mercury [used by you at different stages of the experiment] has not been correct. At the first cyclical operation put in two *liang*¹⁷ of sulphur, but the quantity must be decreased step by step [for every cyclical operation] until the sixth. At the seventh cyclical operation no sulphur is to be added [any

further]. As sulphur is an extremely *Yang* [substance] and mercury extremely *Yin*, they are mixed together every time in a reaction-vessel and heated by fire. Sublimation will only cease at the seventh cyclical change. At this point the substances are brought into submission (*fu*). Then after nine cyclical changes the product is placed in an outside combustion chamber (*wailu* 外爐) to be warmed by a gentle glowing fire. This involves a separate firing process. After the firing, sulphur disappears, but the mercury itself is transformed into a precious elixir.' It was then that [Cui] Fang began to understand what Li Bi had said before. Hence he bowed to thank (the Venerable Lan] again and again. Ever since he received guidance from the Venerable Lan, [Cui] Fang never failed whenever he performed the experiment. First and foremost, the elixir brings perpetual life; secondly, it can bring relief to people [in need]; and lastly, it can enrich one's family. Observe that one must do charity in fairness and never be avaricious. Holy immortality will thereby be attained.¹¹⁸

In the *Gengdaoji* compendium the above postscript is followed immediately by a poem attributed to the holy immortal Wei (Boyang). This poem is in turn followed by a commentary written by Master Lan. Nothing much is known about the adept Venerable Master Lan. In *juan* 48 of his *Lishi zhenxian tidao tongjian* 歷世真仙體道通鑑 (A History of True Immortals who Embodied the Way through the Ages) Zhao Daoyi 趙道一 mentions an adept by the name Lan Fang 藍方, who was styled Yuandao 元道 and who flourished during the time of the Song emperor Renzong 仁宗 (reigned 1023 to 1063). In *juan* 50 of the same book he also mentions Lan Qiao 藍喬, who ingested an elixir during the time of the emperor Huizong 徽宗 (reigned 1101 to 1125). Of course there was also Lan Caihe 藍采和, the most distinguished of them all as a member of the famous Eight Immortals (baxian 八仙 in popular Chinese folklore. However, there is no tangible evidence to link the Venerable Lan with any of these three personalities. The poem with its commentary elucidates the gradual decrease of the quantity of sulphur used in each successive step and therefore seems to have come directly from Cui Fang's pharmacopoeia. It reads

When the Blue-Green Metal you will compound,
Follow the Old precepts: those rules are sound.
In the reaction-vessel, actuate
The hidden fires; begin with Two-and-Eight.
First cyclical operation is through.
Now comes the second—greatest care is due—
For at this crossroads caution is repaid:
Take heed—no alternation may be made.
A transformation. back and forth. takes place:

A marvel to behold proceeds apace.
 Now at the third, a warning we must make.
 Less sulphur—only half, in fact—to take.
 At the fourth, maintain with the greatest care
 One ounce of this *Yang* substance, pure and rare.
 At the fifth change, this stuff is used again;
 Only three-quarters, though, we must maintain.
 Now comes the sixth—a rule we must announce:
 To add, at this, no more than half an ounce.
 At the seventh, new marvels will be brought:
 The Dragon, in the chamber, will be caught.
 Now at the eighth, let the quintessence be;
 Let none be added: this we must decree.
 At the ninth change, no secrets are concealed;
 A *huandan* 還丹 elixir—*fanyang* 范陽—is revealed.
 This sacred food is known to the elect;
 Fed to the dead, this drug will resurrect.
 In each cyclical change, please be aware,
 The firing process must be done with care.
 In each process, let no one raise a doubt,
 Five pounds of charcoal must be used throughout.
 To converse the luminous cinnabar
 So that it resists fire, thrusts it afar—
 Lead is needed for this desired end.
 Mark well the true proportions of this blend:
 One ounce of cinnabar, two ounces lead—
 No other formula will serve instead.
 Melt them until they turn as white as snow;
 From mixtures such as this rewards will flow.
 Make offerings to Heaven and to Earth.
 For of those riches you will have no death,
 Practice charity, for thanks must be repaid
 For the sacred elixir you have made,
 Through whose potency, out of the mundane,
 Immune from death, you ever will remain.¹¹⁹

The rest of what we know about Cui Fang's *Waidan bencao* comes directly from Zhu Quan's *Gengxin yuce*. Li Shizhen does not include the *Waidan bencao* in the bibliographies listed in *juan* 1 of the *Bencao gangmu*, thus suggesting that all his

quotations from the *Waidan bencao* originated from the *Gengxin yuce*. These quotations are translated and reproduced below:

[Abbreviations:

BG=*Bencao gangmu*

RL=Read and Liu (1936)

RP=Read and Pak (1936)

WD=*Waidan bencao*]

WD1. *Luganshi* 爐甘石 (zinc-bloom, Smithsonite; RP 59)

Take two *jin* of copper and one *liang* of zinc-bloom. Heat them together and they form one-and-a-half *jin* of *toushi* 鋤石 (an alloy of zinc and copper). Is it not that [the alloy] is derived from stones and minerals?

Collation: This passage comes from *BG juan 9* and is also present in *Wuli xiaoshi, juan 7*, p. 23a. The latter does not include the question ‘Is it not that the alloy is derived from stones and minerals?’ suggesting that this could have been a remark added by Li Shizhen himself.

WD2. *Wumingyi* 無名異 (pyrolusite, manganese oxide; RP 61)

Wumingyi is a *Yang* mineral.

Collation: This item comes from *BG juan 9*.

WD3. *Daizheshi* 代赭石 (red hematite; RP 78)

Daizhe[shi] is a *Yang* mineral. It occurs together with *Taiyi yuliang* 太一餘糧 (brown hematite) among mountain gorges. It is ground into a red [pigment] that can be used for [putting punctuation] marks (or writing notes) on books and also for painting over metals to produce a richer red colour.

Collation: This item comes from *BG juan 10*.

WD4. *Jinyashi* 金牙石 (iron pyrites; RP 98)

Jinyashi is a *Yang* mineral. It occurs among the mountains in [Si]chuan and Shaan[xi provinces]. In appearance it resembles *milizi* 蜜梨子 (a kind of limestone; RP 62). That with golden dots is superior in quality.

Collation: This item comes from *BG juan 10*.

WD5. *Xiaoshi* 消石 (saltpetre; Epsom salts; RP 125)

Xiaoshi is a *Yin* mineral. This is not a kind of stone, but is obtained by the decoction of native salts. It is now called *yanxiao* 焰消. People of Shangcheng 商城 in Hebei (province) and those living along the banks of the [Yellow] River from [the former land of] Wei 衛 [State] (i.e. north Henan province) to Huai 懷 (region bordering the former States of Qi 齊 and Chu 楚, that is, Shandong province) produce it by refining native salts in solution that they collect from the ground. This is slightly different from *puxiao* 朴消 (crude Glauber’s salt; RP 123), and is not produced in the southern region [of China].

Collation: This item comes from *BG juan 11*.

WD6. *Tukui* 菟葵 (hare mallow, *Eranthis pinnatifida*, Maxim; RL 535)

Tukui is also called *leiwancuo* 雷丸草.

Collation: This item comes from *BG juan 16*.

WD7. *Jinxingcao* 金星草 (*Polypodiuxn hastatuin*, Th.; RL 809)

Jinxingcao fixes (*zhi*) the Three Yellow [minerals], cinnabar, mercury and potash alum.

Collation: This item comes from *BG juan* 20.

WD8. *Ruxiang* 乳香 (terebinth tree, *Pistacia Khinjuk*, Stocks; RL 313)

Ruxiang, when liquidised after being heated together with and brought under submission (*fu*) by *jiushi* 韭實 (leak seeds, *Allium odorum*, L.; RL 670), cong 蔥 (Chinese small onion, *Allium fistulosum*; RL 666) and *suan* 蒜 (garlic, *Alliua sativuin*, L.; RL 671) softens [the therapeutic or alchemical effects of] the Five Metals.

Collation: This item comes from *BG juan* 34.

WD9. *Zaojia* 皂莢 (soap bean tree, *Gleditschia sinensis*, Lam.; RL 387)

Zaojia is also known by the name *xuandao* 懸刀 ('hanging knife').

Collation: This item comes from *BG juan* 35B.

Three versions of *Baozanglun* 寶藏論 (Discourse on the Precious Treasury of the Earth)

There seems to be more than one alchemical text bearing the same title *Baozanglun*. The *Bencao gangmu* quotes five items from a *Xuanyuan Shu Baozanglun* 軒輊述寶藏論 and six items from a *Baozanglun* without mentioning its author. There was also a *Baozanglun* attributed to an adept who adopted the Daoist name Qingxiazi 青霞子 during the tenth century.¹²⁰ The Song pharmacopoeia *Chongxiu Zhenghe jingshi zhenglei beiyong bencao* 重修政和經史證類備用本草 (New Revision of the Pharmacopoeia of the Zhenghe Reign-Period: The Classified and Consolidated Armamentarium), compiled by Zhang Cunhui 張存惠 in 1249, lists seven items under *Qingxiazi Baozanglun* and eight items under *Qingxiazi*.

Reading 'Xuanyuan' as 'the Yellow Emperor' and the word 'shu' 述 as 'discourse' or 'narration', the three have been regarded as parts of the same text under the title *Baozanglun*, and attributed to Qingxiazi in the year 918.¹²¹ Zhao Kuanghua argues that there were two different versions of *Baozanglun*, one by Xuanyuan Shu of the tenth century and the other by Qingxiazi of the sixth century.¹²² However, the three texts of the *Baozanglun* bear no resemblance to one another. For example, a comparison of the two entries on gold and silver in the *Baozanglun* by Xuanyuan Shu (XS 1 and XS2) and by the anonymous writer (AB7 and AB8) clearly shows the superior quality of the former, indicating that Xuanyuan Shu could not be the anonymous writer. When a common authorship is not identifiable one has to assume that the texts were the product of more than one person. At best the anonymous author was another adept whom Zhao Kuanghua refers to as Qingxiazi, but we have no means for verifying this. Fragments of the three texts are given below:

Xuanyuan Shu Baozanglun 軒輊述寶藏論

The title of the *Xuanyuan Shu Baozanglun* itself gives rise to some unsolved problems. Xuanyuan is another name for the Yellow Emperor, Huangdi, but it can also be a surname. 'Xuanyuan Shu' can either mean 'according to what the Yellow Emperor said' or it can be a personal name. Hence 'Xuanyuan Shu Baozanglun' can be interpreted either as 'Discourse of the Yellow Emperor on the Contents of the Precious Treasury of the Earth' or as 'The Discourse of Xuanyuan Shu on the Precious Treasury of the Earth'.

Unfortunately we have not been able to trace the name Xuanyuan Shu in Daoist or other writings. Zhao Daoyi 趙道一 records that an adept by the name Xuanyuan Ji 軒輊集 lived in the late Tang period, in the middle of the eighth century, and also mentions another adept with the name Xuanyuan Miming 軒輊彌明 of the early ninth century.¹²³ However, evidence to prove the existence of Xuanyuan Shu is still pending. Li Shizhen's style of writing does suggest that Xuanyuan Shu was the name of the author of the *Baozanglun* that he quoted.

[Abbreviations: BG=*Bencao gangmu*

RL=Read and Liu (1936)

RP=Read and Pak (1936)

ZL=*Chongxiu Zhenghe jingshi zhenglei beiyong bencao*

XS=*Xuanyuan Shu Baozanglun*]

XS1. Jin 金 (gold; RP 1)

There are twenty varieties of gold together with five more varieties from foreign countries. *Huandanjin* 還丹金 (cyclically transformed elixir gold) occurs in pits where cinnabar is obtained. It contains cinnabar giving it a red colour. It is a rare and priceless substance for use in compounding the elixir for oral administration. *Fujin* 伏金 (alluvial gold) occurs in the Five Streams (consisting of five rivers between modern Hunan and Guizhou province occupied by minorities tribal people) and the River Han. The larger ones are as large as melon seeds, while the smaller ones are of the size of wheat kernels. In nature it is mild and non-toxic. *Shanjin* 山金 (pure gold, 'mountain gold') occurs embedded among rocks in mountains in Jiao[zhou] 交州 (northern Annam), [the provinces of] Guang[dong and Guangxi], and Nanshao 南韶 (probably a misprint for Nanzhao 南詔, i.e. Yunnan province), *Matijin* 馬蹄金 (gold nugget, 'horse-hoof gold') is superior [among the various varieties of gold]. Two gold nuggets [could weigh up to] 1 pound (*hang*).¹²⁴ *Dujin* 毒金 ('poisonous gold') is *shengjin* 生金 ('raw gold'). It occurs in mountain rocks in Jiao[zhou] (northern Annam) and [the provinces of] Guang[dong and Guangxi]. Red in colour and highly toxic, without special preparations it is fatal [when administered orally]. It needs to be refined (*lian*) over ten times before its toxicity is removed. All the five varieties mentioned above are genuine gold. *Shuiyinyin* 水銀金 (mercury gold), *danshajin* 丹砂金 (cinnabar gold), *xionghuangjin* 雄黃金 (realgar gold), *cihuangjin* 雌黃金 (orpiment gold), *liuhuangjin* 硫黃金 (sulphur gold), *cengqingjin* 曾青金 (stratified variety of malachite gold), *shilujin* 石綠金 (fine granular malachite gold), *shidanjin* 石膽金 (blue vitriol gold), [*jin*] *musha*[*zijin*] 金母砂子金 (cinnabar gold), *baixijin* 白錫金 (tin gold) and *heiqianjin* 黑鉛金 (lead gold) are all made with chemicals. *Tongjin* 銅金 (copper gold), *shengtiejin* 生鐵金 (cast iron gold), *shutiejin* 熟鐵金 (wrought iron gold), *toushijin* 鑄石金 (zinc-copper alloy gold) together with those made from chemicals are fifteen types of false gold. They are both useless and poisonous. There are five varieties of gold that come from foreign countries, namely Persian *zimiamjin* 紫泥金 gold, Dongbian 東邊 (in modern Andong and Changbai bordering Korea) *qingjin* 青金 gold, Linyi 林邑 (north Annam) *chijin* 赤金 gold, *Xirongjin* 西戎金 (gold from western regions) and *Zhanchengjin* 占城金 (gold from south Annam).

Collation: This item comes from *BG juan 8*.

XS2. Yin 銀 (silver; RP 2)

There are seventeen varieties of silver together with another four varieties from foreign countries. *Tianshengya* 天生芽 ('Heaven born sprouts') silver occurs among rock crevices in silver mine pits and looks like disarranged silk. The red-coloured variety is superior. When put in the fire it gives a pale purple colour. That which looks like grass roots comes next in quality. The most remarkable one is that found embedded in black rocks. It occurs in lead-producing mountains in Leping 樂平 (near modern Tangyi xian, Shandong province) and Poyang (near modern Poyang xian, Jiangxi province). One of its synonyms is *longya* 龍牙; 龍芽 ('dragon's teeth'), another is *longxu* 龍鬚 ('dragon's beard'). [*Tianshengya*] is naturally occurring genuine silver, and being non-poisonous it forms the base of [many] elixirs. *Shengyin* 生銀 (silver nugget, 'raw silver') is found in pieces of diverse size among rocks and looks like hard tin. *Jinmushayin* 金母砂銀 (cinnabar silver) occurs in cinnabar mines in the Five Streams region (confluence of five rivers between modern Hunan and Guizhou province occupied by Minorities tribal people) and has a lustrous red colour. *Heiqiyanin* 黑鉛銀 (lead silver) acquires the *qi* of both the Son and the Mother. These four varieties [mentioned above] are genuine silver. Then there are *shuiyinyin* 水銀銀 (mercury silver), *caoshayin* 草砂銀 (coarse cinnabar silver), *cengqingyin* 曾青銀 (stratified malachite silver), *shiluyin* 石綠銀 (fine granular malachite silver), *xionghuangyin* 雄黃銀 (realgar silver), *cihuangyin* 雌黃銀 (orpiment silver), *danfanyin* 膽礬銀 (blue vitriol silver) and *lingcaoyin* 靈草銀 (numinous plants silver), which are all produced with chemicals. *Danyangyin* 丹陽銀 (Danyang silver), *tongyin* 銅銀 (copper silver), *tieyin* 鐵銀 (iron silver) and *baixiyin* 白錫銀 (tin silver) are all produced with chemicals by the method of projection (*dianhua*). These thirteen varieties are false silver. There are also four varieties from foreign countries, namely Sillá silver, Persian silver, Linyi (north Annam) silver, and Yunnan silver, all of which are of fine quality.

Collation: This item comes from *BG juan 8* and also appears in *Gezhi jingyuan juan 34*.

XS3. Tong 銅 (copper; RP 6)

There are ten varieties of the Red Metal 赤金 (copper), Danyang 丹陽 copper, Wuchang's *baimantong* 武昌白慢銅 copper, *yishengtong* 一生銅 copper and *shengyintong* 生銀銅 copper are all natural copper not produced by the process of smelting. They are non-toxic, and are suitable for making the *ding* 鼎 tripods and vessels. Persian *qing tong* 青銅 copper can be used for making mirrors. *Xinluotong* 新羅銅 (silver copper) can be used for making bells. *Shilu* 石綠 (granular malachite) copper, *shiqing* 石青 (azurite; RP 85) copper and *baiqing* 白青 (light-coloured azurite; RP 86) copper are all made by means of chemicals. *Tie* 鐵 (iron) copper is made from immersing [iron] in a solution of *kudan* 苦膽 (copper sulphate) until it turns red and then heated in a coal fire to become black and hard. *Xikeng* 錫坑 (tin pit) copper is soft and can be used for projection (*dianhua*).

Collation: This item comes from *BG juan 8*.

XS4. Zirantong 自然銅 (iron pyrites; RP 7)

Iron pyrites occur in pits together with *cengqing* 曾青 (stratified variety of malachite; RP 83) and *shilu* 石綠 (fine granular malachite) and look like roots of grass in a cold forest where the trees have lost their leaves. They are glossy and red in colour. Some are found in the walls of the pit. Another variety resembles cinnabar. The lustrous, hard and

angular ones with copper veins are particularly of fine quality. Another variety resembles tree roots, neither red nor glossy, but breaks easily into powder when handled. This is the finest type and occurs near mountains with copper [deposits].

Collation: This item comes from *BG juan* 8.

XS5. *Qian* 鉛 (lead; RP 10)

There are several varieties of lead. *Bosiqian* 波斯鉛 (Persian lead) is the best in the world for its hardness and whiteness. *Caojieqian* 草節鉛 (native lead) occurs in Jianwei 健為 (near modern Pengshan xian, Sichuan province) and is the essence of silver. *Xianyinqian* 啣銀鉛 is lead occurring in silver pits and has a variety of colours. Both [*caojieqian* and *xianyinqian*] are excellent. Lead from Shangrao 上饒 (near modern Shangrao xian in Jiangxi province) and Leping 樂平 (near modern Tangyi xian in Shandong province) is inferior to Persian [lead] and *caojie[qian]* lead. *Fubanqian* 負版鉛 lead, being the progeny of iron, is not to be used. *Woqian* 倭鉛 (Japanese lead) can hook (*gou* 鉤; 勾) gold.¹²⁵

Collation: This item comes from *BG juan* 8 and also appears in *Gezhi jianyuan*, *juan* 34 p. 23a.

XS6. *Tie* 鐵 (iron; RP 20)

There are five varieties of iron. *Jingtie* 荊鐵 coming from Dangyang 當陽 (near modern Dangyangxian in Hubei province) is purple in colour and is hard and [capable of being used for making] sharp (tools). Shangrao 上饒 (near modern Shangrao xian in Jiangxi province) comes next in quality. *Bintie* 鑛鐵 iron comes from Persia. It is hard and [is suitable for making] sharp [knives] to cut metal and jade. Iron from Taiyuan 太原 (in modern Shanxi province) and the Shushan 蜀山 Mountain (near modern Wenshang xian in Shandong province) is worthless. *Gangtie* 剛鐵 ('hard iron') occurs in mountain rocks [on islands] in the sea covered with pestilential vapours in the south-west. Resembling *zishiying* 紫石英 (amethyst; RP 41) in appearance, it is unaffected by water and fire and pierces pearls and cuts jade like cutting earth.

Collation: This item comes from *BG juan* 8.

XS7. *Luticao* 鹿蹄草 (*Pirola elliptica*, Nutt.; RL 204)

Luti[cao] occurs mainly on the plains and in deserted temples and courtyards in [the provinces of] Jiang[su and Jiangxi], Guang[dong and Guangxi]. It is very seldom found north of the Huai River (in Henan and Anhui provinces). It is also grown in Sichuan and Shaan[xi]. It is yellow in colour like the *jincai* 堇菜.¹²⁶ However, its leaves are fairly large, with a purplish colour on the lower surface. It bears green fruits like a large eggplant. It can [be employed to] fix (*zhi*) orpiment.

Collation: This item comes from *BG juan* 16 and also appears in *Zhiwu mingshi tukao*, p. 353.

XS8. *Zeqi* 澤漆 (wartweed, *Euphorbia helioscopia*, L.; RL 324)

Zeqi is [also known as] *maoeryanjingcao* 貓兒眼睛草.

Collation: This item comes from *BG juan* 17A.

XS9. *Machixian* 馬齒莧 (purslane, *Portulaca oleracea*, L.; RL 554)

[*Machixian* is also known as] *machi longya* 馬齒龍芽.

Collation: This item comes from *BG juan* 27.

XS10. *Li* 藜 (*Chenopodium album*, L., pink variety; RL 561a)

[*Li* is also known as] *haoding longya* 鶴頂龍芽, [because] its top is like a crane. It is collected together with its seeds during the eighth and the ninth month of the lunar calendar for use in alchemy.

Collation: This item comes from *BG juan 27*.

XS11. Chiqin 赤芹 (*Corydalis ambigua*, Cham. Et Sch.; RL 487)

Chiqin is *zijin* 紫堇. It grows on the shore. Its leaves resemble those of the red peony, green in colour, about three inches in length, and carry yellow spots on the upper surface. It has a bitter and astringent taste. Its juice can be used for boiling orpiment, fixing (*zhi*) mercury, subduing (*fu*) cinnabar, and capturing (*qin*) the Three Yellow [minerals] (i.e. sulphur, realgar and orpiment). It is given the name *qipincao* 起貧草 ('relieving-poverty' plant).

Collation: This item comes from *BG juan 26*.

Anonymous Baozanglun (AB)

AB1. Dansha 丹砂 (cinnabar; RP 43)

When cinnabar is subdued by plants and stays within the fire, it forms a liquid when the fire is intensified by blowing. It translates silver into gold by projection and similarly it translates copper into silver.

Collation: This item comes from *ZL juan 3*.

AB2. Yu 玉 (jade; RP 29)

Jade ingested by the enlightened one makes life everlasting and confers the ability on the body to raise itself to fly. One becomes not merely an earthly holy immortal. However, its *Dao* takes a long time to achieve. One has to ingest one or two hundred pounds of it before knowing the result. Black rice wine or *diyu* 地榆 (burnet; RL 460) can turn jade into an aqueous solution. One can also use *cong* 蔥 (Chinese small onion; RL 666) juice to dissolve it into a sticky paste. For ingesting one can make it into pills or heat it to a powder form. After taking it for more than 1 year one can get into water without getting wet.

Collation: This item comes from *ZL juan 3*, and also appears in *Tujing yanyi bencao* 圖經衍義本草, *juan 1*.

AB3. Xiaoshi 硝石 (saltpetre; RP 125)

Xiaoshi after being subdued by plants without losing weight softens and cuts gold, silver, copper and iron. It softens hard material immediately.

Collation: This item comes from *ZL juan 3*, and also appears in *Tujing yanyi bencao*, *juan 1*.

AB4. Cengqing 曾青 (malachite, stratified variety; RP 83)

Cengqing that withstands heating to form a paste can make mercury turn into silver and translate the Eight Minerals.

Collation: This item comes from *ZL juan 3*, and also appears in *Tujing yanyi bencao*, *juan 2*.

AB5. Xionghuang 雄黃 (realgar; RP 49)

Xionghuang when subdued by alchemical plant substances and prepared by heating into a liquid retains its colour of origin. When used together with the above alchemical substances that turn it to liquid, first it can be ingested, second it can translate copper into gold, and last it can turn silver to gold.

Collation: This item comes from *ZL juan 4*, and also appears in *Tujing yanyi bencao, juan 3*.

AB6. *Cihuang* 雌黃 (orpiment; RP 50)

Cihuang when having been subdued in fire without changing its colour of origin and turned into liquid by blowing to intensify the fire, translates silver into gold and copper into silver.

Collation: This item comes from *ZL juan 4*, and also appears in *Tujing yanyi bencao, juan 3*.

AB7. *Jin* 金 (gold; RP 1)

There are twenty types of gold: *Xionghuangjin* 雄黃金 (realgar gold), *cihuangjin* 雌黃金 (orpiment gold), *cengqingjin* 曾青金 (stratified variety of malachite gold), *liuhuangjin* 硫黃金 (sulphur gold), *tuzhongjin* 土中金 (earth gold), *shengtiejin* 生鐵金 (cast iron gold), *shutiejin* 熟鐵金 (wrought iron gold), *toushijin* 鑰石金 (zinc-copper alloy gold), *shazijin* 砂子金 (mercury gold), *tulushazijin* 土碌砂子金 (granular malachite gold), *jimmushazijin* 金母砂子金 (mercury gold), *baixijin* 白錫金 (tin gold), *heiyangjin* 黑鉛金 (lead gold), and *zhushajin* 硃砂金 (cinnabar gold), all of the above fifteen types (are false), only the five types, namely, *huandanjin* 還丹金 (cyclically transformed elixir gold), *shuizhongjin* 水中金 (gold recovered from water), *guazijin* 瓜子金 (gold nugget), *qingfujin* 青鈃金 (alluvial gold) and *caoshajin* 草砂金 (coarse cinnabar gold) are genuine and all the rest are false.

Collation: This item comes from *ZL juan 4*; it also appears in *Tujing yanyi bencao, juan 3* and *Gezhi jingyuan, juan 34*.

AB8. *Yin* 銀 (silver; RP 2)

There are seventeen types of silver: *zhenshuiyinyin* 真水銀銀 (mercury silver), *baixiyin* 白錫銀 (tin silver), *cengqingyin* 曾青銀 (stratified malachite silver), *shiluyin* 石綠銀 (fine granular malachite silver), *Danyangyin* 丹陽銀 (Danyang silver), *shengtieyin* 生鐵銀 (iron silver), *shengtongyin* 生銅銀 (copper silver), *liuhuangyin* 硫黃銀 (sulphur silver), *pishuangyin* 砒霜銀 (arsenic silver), *xionghuangyin* 雄黃銀 (realgar silver), *cihuangyin* 雌黃銀 (orpiment silver) and *toushiyin* 鑰石銀 (zinc-copper alloy silver). However, only *zhiyaoyin* 至藥銀 (elixir translated silver), *shanzeyin* 山澤銀 (silver nugget), *caoshayin* 草砂銀 (coarse cinnabar silver), *[jin]mushayin* [金]母砂銀 (cinnabar silver) and *heiyangyin* 黑鉛銀 (lead silver) are genuine. The rest are false. Among rock crevices in silver mine pits, silver that protrudes like fabric threads is known to the native as *laowengxu* 老翁鬚 (old man's beard). This is genuine native silver.

Collation: This item comes from *ZL juan 4*.

***Qingxiazi's Baozanglun (QB)*¹²⁷**

QB1. *Pishuang* 砒霜 (arsenic; RP 91)

Pishuang, on being subdued by [elixir] plant substances, does not change its colour, and when heated to a high temperature melts into a liquid. What is obtained (liquid) by adding more liquid can translate copper into silver by projection. Otherwise, it would be simply a waste of fuel (because) the product is of no use.

Collation: This item comes from *ZL juan 5*.

QB2. *Naosha* 礪砂 (sal ammoniac; RP 126)

Naosha, after being subdued by [elixir] plant substances and remaining in the fire without breaking, can translate and control various mineral drugs to cure women of prolonged coldness (*jiuleng* 久冷).¹²⁸ *Naosha* is the robber of the Five Minerals. That obtained from subduing by various mineral drugs together with *huishuang* 灰霜 (?) is not fit for use.

Collation: This item comes from ZL *juan* 5; it also appears in *Tujing yanyi bencao*, *juan* 5.

QB3. *Gong* 汞 (lead; RP 10)

Black lead, after being subdued by [elixir] plant substances, turns precious and can translate copper into silver by projection. Used to cast the *ding* 鼎 cauldron, it nourishes cinnabar and makes it stay in the fire. It also nourishes mercury and makes it stay in the fire and breaks up calomel while making it stay in the fire.

Collation: This item comes from ZL *juan* 5; it also appears in *Tujing yanyi bencao*, *juan* 5.

Qingxiazhi's *Dantaiu* 丹臺錄 (Discourse on the Alchemical Laboratory)

As we have seen above, Qingxiazhi was the Daoist name of the alchemist reputed to have written the *Baozanglun* around 918. In all, pre-modern Chinese texts mention nine titles said to be authored by a Qingxiazhi.¹²⁹ However, we know precious little about the real identity of this Daoist adept, and there is considerable uncertainty concerning the period when he actually lived. Chen Guofu 陳國符 has made a study of the works attributed to Qingxiazhi and concludes that there were two alchemists by the same appellation, one belonging to the operative alchemy (*waidan* 外丹) and the other to the psycho-physiological alchemy (*neidan* 內丹) school. For the former, Chen suggests the dates 521 to 600, and for the latter a date some 190 years later.¹³⁰ However, there may have been more than two alchemists adopting the same style name.

One of the best known of the works attributed to him is the *Taiqing shibiji* 太清石壁記 (Records in the Rock Chamber; a *Taiqing* Scripture). From the Bibliography Chapters of the *Xin Tangshu* 新唐書 (New History of the Tang Dynasty) we learn that:

The *Taiqing shibiji* in three *juan* was originally written by Su Yuanming 蘇元明 of the Jin dynasty (265–420) and recompiled during the Qianyuan 乾元 reign-period (758–759) by a certain anonymous officer from Qianzhou prefecture.¹³¹

The Bibliographical Chapters of the *Tongzhi* 通志 (Comprehensive History of Institutions), composed by Zheng Qiao 鄭樵 (1104–62) about the year 1150, attributes the *Taiqing shibiji* to Su Yuanming, and elsewhere states that Su Yuanming of the Jin dynasty flourished during the Taikang 太康 reign-period (280–90), and was known by his Daoist name Qingxiazhi 青霞子.¹³² Unfortunately the official dynastic histories and Daoist hagiographies do not seem to contain any biography or descriptions of either Su Yuanming or Qingxiazhi. The only source of information that we have so far comes from a

biography of Su Yuanming in the gazetteer *Luofushan zhi* 羅浮山志, where his name is given as Su Yuanlang 蘇元朗.¹³³

The text of the *Taiqing shibiji* that we now have comes from the Daoist Canon. It gives the name Chu Ze xiansheng 楚澤先生 (Chu Ze the teacher) as its compiler. We can find the three names Qingxiazhi, *Taiqing shibiji* and Chu Ze in the *Shiyao erya* 石藥爾雅 (Synonymic Dictionary of Minerals and Drugs) that Mei biao 梅彪 compiled in the year 806. In other words, our text should pre-date the year 806.¹³⁴ As a matter of fact, the text itself suggests that it was compiled about the time of Tao Hongjing 陶弘景 (452–536) from the following statement: ‘There lives in recent time a Zhenbai xiansheng 貞白先生, otherwise known as Tao Yinju 陶隱居, who has compiled (a book containing) prescriptions on the use of herbs.’¹³⁵

Zhenbai xiansheng and Tao Yinju, as we know, were the appellations and style names of Tao Hongjing. The book on the use of herbs could refer to Tao’s *Bencao jing jizhu* 本草經集注 (Collected Commentaries on the Pharmacopoeia Classic), which only survives in quotation. Our present text of the *Taiqing shibiji* could well be a work of the early sixth century. The sequence of the text and the repetition of several elixirs, known under identical names but with different methods of preparations, suggest that the compiler had incorporated material of earlier periods in his work, including probably the *Taiqing shibiji* of Su Yuanming, otherwise known as Qingxiazhi, of the late third century. Chen Guofu rejects this earlier date by reading the account in the *Luofushan zhi* as referring to one and the same person, who would then have lived for over 300 years.¹³⁶

The Daoist alchemical texts mentioned in the early twelfth century by Zheng Qiao and others thus probably owe their origin to more than one person under the same Daoist name Qingxiazhi between the third and the twelfth centuries. The Bibliographical Chapters of the *Songshi* 宋史 (History of the Song Dynasty), completed in 1345, list a *Dantai xinlu* 丹臺新錄 (New Records on the Alchemical Laboratory)¹³⁷, while the *Bencao gangmu* lists the reference Qingxiazhi’s *Dantailu* 丹臺錄, probably the same work. However, in the text the *Bencao gangmu* only gives the words ‘Qingxiazhi says’ before the quotations, which are presumably derived from the *Dantailu*. The *Chongxiu Zhenghe jingshi zhenglei beiyong bencao*, on the other hand, mentions Qingxiazhi without giving the book title *Dantailu*. Some of the items under the name Qingxiazhi in both the *Bencao gangmu* and the *Chongxiu Zhenghe jingshi zhenglei beiyong bencao* are identical, indicating a common source.

The *Bencao gangmu* gives four quotations that begin with ‘Qingxiazhi says’. Besides these four quotations, nine others beginning with *Qingxiazhi says* also appear in the Song pharmacopoeia *Tujing yanyi bencao* 圖經衍義本草 (Illustrated Dilations upon Pharmaceutical Natural History) and the *Chongxiu Zhenghe jingshi zhenglei beiyong bencao*. These are probably all the existing fragments of the *Dantailu*. The thirteen quotations are as follows:

[Abbreviations: BG=*Bencao gangmu*

DL=*Dantailu*

RL=Read and Liu (1936)

RP=Read and Pak (1936)

ZL=*Chongxiu Zhenghe jingshi zhenglei beiyong bencao*]

DL1. *Dansha* 丹砂 (cinnabar; RP 43)

Cinnabar by nature is imperishable. For a person whose *qi* is deteriorating (*shuai* 衰) whose blood is dissipating (*san* 散) whose body is getting exhausted (*jie* 竭) and whose bones are decaying (*ku* 枯), the Eight Minerals (namely stratified variety of malachite, large hollow variety of malachite, blue vitriol, sal ammoniac, white common salt, potash alum and saltpetre) can only give limited beneficial effects. If one wishes to attain physical immortality or to preserve one's life and bring tranquillity to the mind, it is necessary to ingest cinnabar. The Eight Minerals on seeing fire all turn to ashes, [but] cinnabar can subdue (*fu*) fire and turn into yellow silver. It can be heavy or light, can be supernatural and numinous, can be black or white in colour and can be pale or lustrous [in appearance]. For a person to lift 1 *hu* (about 57 kg) [of cinnabar] is a difficult task, but 10,000 *jin* (about 5,700 kg) [of it] in the fire rise rapidly and leave no trace for even demons and spirits to find.

Collation: This item comes from *Tujing yanyi bencao*, *juan* 1, p. 4. It also appears in *ZL juan* 3.

DL2. *Yunmu* 雲母 (mica; RP 39)

Prolonged ingestion of mica [helps the body to] resist heat and cold.

Collation: This item comes from *ZL juan* 3.

DL3. *Yu* 玉 (jade; RP 29)

Method of making potable jade (*yujiang* 玉漿): Take one *sheng* 升 of *yuxie* 玉屑 (jade fragments; RP 29a), one *sheng* of *diyucuo* 地榆草 (burnet, *Sanguisorba officinalis*, L.; RL 460), and one *sheng* of *daomi* 稻米 (glutinous rice; *Oryza Sativa*, L. var. *glutinosa*, Nats.; RL 746). Take also two *sheng* (pints) of dew in a copper container and heat the above with it until the rice is cooked. Then squeeze the juice from the cooked rice. The jade fragments have turned liquid, which is called *yuye* 玉液 ('jade liquid'). This is taken with good sweet wine in a glass, known as 'potable jade of the holy immortal' (*shenxian yujiang* 神仙玉漿).

Collation: This item comes from *ZL juan* 3; it is also in *BG juan* 8. The word '*sheng*', being a measure for capacity, could well be a misprint for '*jin*', a measure for weight, usually rendered as pound for easier reading. The modern '*jin*' is equivalent to 0.57 kg approximately.

DL4. *Shizhongru* 石鐘乳 (stalactites; RP 63)

[Stalactites] is a tonic for the marrow and promotes vitality.

Collation: This item comes from *ZL juan* 3.

DL5. *Cengqing* 曾青 (stratified variety of malachite; RP 83)

[The stratified variety of malachite] invigorates the body and mind.

Collation: This item comes from *ZL juan* 3.

DL6. *Zishiying* 紫石英 (amethyst; RP 41)

[Amethyst] lightens the body (meaning making one strong and vigorous) and fills the flesh (meaning making one youthful).

Collation: This item comes from *ZL juan* 3.

DL7. *Liuhuang* 硫黃 (sulphur; RP 126)

Sulphur disperses *pi* 癖 (chronic swelling of the spleen or addictions).

Collation: This item comes from *ZL juan* 4.

DL8. *Cihuang* 雌黃 (orpiment; RP 50)

Orpiment repels harmful emanations and removes noxious [influences].

Collation: This item comes from *Tujing yanyi bencao*, *juan 3*; it also appears in *ZL juan 4*.

DL9. Jin 金 (gold; RP 1)

According to the *Jinye huandan lun* 金液環丹論 (Discourse on the Potable Gold Cyclically Transformed Elixir), gold [by itself] is not sufficient for prolonging life. Gold cures *leng* 冷 ('cold') and removes *feng* 風 ('wind').¹³⁸

Collation: This item comes from *ZL juan 4*; it also appears in *BG juan 8*.

DL10. Yin 銀 (silver; RP 2)

According to the *Jinye huandan lun* silver cures cold and removes wind.

Collation: This item comes from *Tujing yanyi bencao*, *juan 3*; it also appears in *ZL juan 4* and *BG juan 8*.

DL11. Cishi 慈石 (magnetite; RP 76)

Hair on the magnetite cures ailments of the *shen* 腎 (the kidneys, including the male reproductive organ).

Collation: This item comes from *ZL juan 4*. Hair must refer to particles on the surface of the magnet due to attraction. These are magnetites.

DL12. Yangqishi 陽起石 (asbestos tremolite; RP 75)

Asbestos tremolite cures ailments of the *shen* (the kidneys, including the male reproductive organ).

Collation: This item comes from *ZL juan 4*.

DL13. Konggongnie 孔公孽 (stalactites; RP 64)

Stalactites lighten the body (meaning making one strong and vigorous) and fills the flesh (meaning making one youthful).

Collation: This item comes from *Tujing yanyi bencao*, *juan 4*; it also appears in *ZL juan 4* and *BG juan 9*.

5

General discussions

Repeating the remarks that began the introduction, before the birth of modern science it was difficult to differentiate between natural philosophy and mystic science. When a rational explanation was found for something that was regarded as natural magic, the latter became natural philosophy. A classical example is the phenomenon of magnetic attraction. The *Dijingtu* had long been regarded as a book devoted entirely to magic. This is apparent from the majority of entries, with the exceptions of *DJ* 35, which mentions gold coming out from moving sands, and *DJ* 42, which concerns the value of money. However, as we shall see, it is possible to find within the text knowledge that lends itself to rational explanation, such as the use of certain plants as indicators of metal. But first let us deal with the magical aspect.

‘Sympathy’ and ‘like-attracts-like’ in magic

As mentioned above, most of the text in the *Dijingtu* seems to belong to the realm of magic. *DJ* 1 gives the procedure for venturing into the mountains to look for precious minerals and medicinal plants. This is certainly not the first time that such ritual is mentioned. During the fourth century Ge Hong had devoted a whole chapter of his *Baopuzi neipian* to elaborating the necessary precautions the prospector or the devotee should take for his personal safety and to ensure success when doing this.¹³⁹ Presumably abstinence, one of these preparations, served as a form of purification, considered a necessary step to take before setting out. Similarly, the white dog, white cockerel and white salt probably also symbolised purity. In *DJ* 20 we read that the *qi* 氣 of a bronze vessel of the state of Song appeared like a white dog, and in *DJ* 18 we read that (the seminal essence of) white silver appeared in the form of a cockerel. Perhaps the principle of *sympathy* or *like-attracts-like* finds its application in such cases.

In *DJ* 2 a day falling within a cycle containing the *xin* 辛 celestial stem is recommended as a propitious day for examining precious objects, most being metals. In *DJ* 14 the propitious day to observe the *qi* 氣 of gold is said to be one in a cycle containing either the *geng* 庚 or the *xin* celestial stem. Here we see the theory of *wuxing* 五行 and the principle of *sympathy* at play. *Geng* and *xin* are both *metal xing* 金行, *geng* being *Yang* and *xin* being *Yin*. What better time is there to look at metals than on a *metal* day? When the observation is performed at night, as in *DJ* 2, what better choice is there than a *xin* day-cycle that is in harmony with the *Yin qi* of the night?

Natural transmutation and transfiguration

According to the Greek theory of the Four Elements all kinds of substances were composed of the Four Elements, each in different proportions. Aristotle said that there were two exhalations emitted by the earth under the influence of the sun. One of the exhalations came from the moisture in the earth and was a sort of moist vapour while the other came from the earth itself and was hot, dry, smoky and highly inflammable. Metals were formed from the former and minerals and rocks from the latter. Variation of these exhalations in the course of time would change the proportions of the Elements in the substances and hence one metal could transmute into another. This pneumatic concept of the Greeks had its parallel in China. To the Chinese the universe was filled by *qi*, whose state of rest and motion gave rise to the two cosmological forces *Yin* and *Yang*. From these two forces were derived four *xing* 行, namely *Water* (*shui* 水) when the *qi* has attained the maximum state of rest (i.e. *Yin* is at its maximum); *Metal* (*jin* 金), when the *qi* of *Yin* enters into a state of rest; *Wood* (*mu* 木), when the *qi* of *Yang* enters the state of motion; and *Fire* (*huo* 火) when the state of motion is at its maximum. These four *xing* congealed in different proportions giving rise to the *xing* of *Earth* (*tu* 土) that gave material form to all matter. The *qi* above the earth changed cyclically according to the change of seasons. This could alter the proportions of the different *xing* in the composition of substances, resulting in transmutation.¹⁴⁰

The *Zaohua zhinan* has a statement concerning the natural transmutation of tin in ZH2. Tin is produced by the influence of the *qi* of *Taiyin* 太陰. When left by itself, this *qi* will turn into arsenic after 200 years and after a further 200 years the arsenic will produce tin. Tin is endowed with the *qi* of *Yin* and hence its natural disposition is soft. When it is left unmoved for 200 years to receive the *qi* of *Taiyang* 太陽 it turns into silver. Of cinnabar ZH 4 says that it receives the *qi* of *Blue-green Yang* 青陽. At the beginning a mineral is formed, and after 200 years this turns into cinnabar. Cinnabar, on becoming 'pregnant', forms lead after 200 years and after another 200 years lead becomes silver. Finally, after another 200 years of receiving the *qi* of *Taihe* 太和, this silver forms gold. ZH 11 mentions that when copper receives the *qi* of *Purple Yang* 紫陽 it produces basic acetate of copper, which then becomes malachite in the fine granular form after 200 years. In the *Gengxin yuce*, item GY 1, there is a reference to malachite saying that it is produced by the influence of the *qi* of *Yin* and *Yang*. However, this natural process takes a considerable time—at least a few hundred years, too long for us mere mortals to wait for. Chinese alchemists believed that ways could be found to hasten this process in the laboratory. The Chinese idea of mineral transformation pre-dated the *Gengxin yuce* by at least one-and-a-half millennium.

Joseph Needham quotes from the *Huainanzi* 淮南子 (The Book of Master Huai):

When the *qi* of the central regions (the main-lands) ascends to the Dusty Heavens (*aitian* 埃天), they give birth after 500 years to *jue* 碓 (an unknown mineral, probably realgar). This in its turn produces yellow metal [gold], and yellow metal after 1000 years gives birth to a yellow dragon. The yellow dragon, entering into hiding, produces the yellow

springs. The dust of the yellow spring ascends and turns into yellow clouds. *Yin* and *Yang* beat upon one another to produce peals of thunder and flash out as lightning. Thereupon [rain] descends and the running streams flow to unite in the yellow sea.¹⁴¹

This quotation is followed by four further accounts concerning the *qi* of the eastern, southern, western and northern regions. Needham also points out that Dubs was of the opinion that this doctrine went back to the fourth century BC to the time of Zou Yan. In the fourth century AD, Ge Hong in his *Baopuzi neipian* refers several times to transformations. Two of his statements are

The manuals of the holy immortals say that cinnabar produces gold. Hence gold can be made from cinnabar and gold is generally abundant beneath deposits of cinnabar in the mountains.¹⁴²

Resin from pine and *arbor vitae* having seeped into the ground turns into *filling* 茯苓 after one thousand years.¹⁴³

The *Huainanzi*, as we have just seen, employs the association of the five *xing* with different cardinal points, colours and numbers to describe the process of transformation. This is illustrated in the table below:

<i>Xing</i>	<i>Cardinal point</i>	<i>Colour</i>	<i>Number(s)</i>
<i>Earth</i>	Centre	Yellow	5 and 10
<i>Wood</i>	East	Blue-green	3 and 8
<i>Fire</i>	South	Red	2 and 7
<i>Metal</i>	West	White	4 and 9
<i>Water</i>	North	Black	1 and 6

Each *xing* can exist in a state of *Yin* or *Yang* as indicated by the number. Odd numbers are *Yang* and even numbers *Yin*. The cardinal point north is associated with *Yin* and south with *Yang*. In the *Gengxin yuce* the quality of minerals seems to be determined by this type of correlation. For example, cinnabar is said to be a *Yang* mineral, and hence item YC2 in the *Gengxin yuce* says that the best cinnabar mineral occurs in mountain caves [at the confluence of] the five streams of Wuxi where it receives the *qi* of the true south.

Natural transformation was supposed to be possible not only among non-living things, but also between non-living and living things, and among the living. Traditional Chinese novels and stories abound with examples of transfiguration. In the *Dijingtu*, DJ 3 and DJ 11 talk about jade appearing in the form of a woman, and DJ 4 infers that a thousand-year-old jade is mobile. DJ 13, DJ 14, DJ 15, DJ 16, DJ 17 and DJ 29 refer to the various forms gold can take, namely, fire, a white mouse, a human being, a mass of luminescence, a goat and a green snake or coiled serpent and DJ 17 uses the word *hua* 化 (to transform) explicitly. DJ 18 and DJ 19 give the forms silver may take, that is, as a cockerel or white cockerel and as a flowing mass of white substance. DJ 20, DJ 22 and DJ 23 tell about the various forms bronze objects (namely vessels and coins) can assume,

such as an ox, a horse, a toad, a white dog, a piglet, a hog, a blue-green coloured cloud, a carriage, a piece of unornamented wood and an earthen jar.

Fictitious plants and animals

It has been noted above that some of the Chinese plant names we come across have not been identified. Indeed it is likely that some of them could never be, because they seem to belong to the fictitious flora and fauna of popular Chinese belief. *Toushangen* 透山根 (GY28) looks like one of them, and GY 33 seems to be another example. They are among those directly concerned with alchemy, with the efficacy of conferring immortality to humans or turning base metal into gold. However, the stories about them often carry a warning about the adverse effects of the plant. *Toushangen* and *jinyingcao* 金英草 are said by the *Gengxin yuce* to be able to translate iron into gold, but are both extremely poisonous, the person who takes either of them suffering an instant death with the body dissolving into a purple liquid. The *Chunzhu jiwen* 春渚紀聞 (Records of Things Heard at Spring Island), written by He Wei 何蓮 about AD 1005, contains an interesting passage about a certain plant that could translate iron into gold, but at the same time it would also dissolve human body into either a pool of blood or liquid. It says,

Fajian 法堅, a monk in Lin'an 臨安 (modern Hangzhou, Zhejiang province), said that a certain traveller from Xi[zhou] 徽州 (in Anhui province) once passed through a secluded mountain and saw a snake with a very swollen belly. It was crawling slowly in the grass until it came across a certain plant that it bit into pieces and rubbed its belly against. In a moment the swelling disappeared and the snake went away. Mistaking it for a medicinal plant, the traveller collected it and put it in a box. He then stayed at an inn for the night. [He heard] groaning from next-door, suggesting that his neighbour was lying in bed [in pain]. He called to make enquiries and found that [this neighbour] was troubled by a swollen abdomen. He immediately took the plant, boiled it in a pot [to make] a cupful of medicine and gave it [to the patient] to drink. After a while he heard no further groaning from the next room. Thinking that he had cured [his fellow traveller] he went back to sleep. He woke up before dawn and heard the sound of dripping water coming from the next room. He called out, but received no answer. Holding a candle he went to investigate and saw only a skeleton lying in the bed—the blood and flesh of the body of his neighbour had dissolved into a liquid [that was dripping onto the floor.] The traveller quickly collected his belongings and decamped without ceremony. The next morning the owner of the inn came to his room and saw nothing. He did not know why the occupant had left. He then cleaned the pot before cooking rice in it and found that the pot had turned into gold.¹⁴⁴

Metal indicators and geobotanical prospecting

What we cannot find a rational explanation for is magic, but when we have succeeded in finding that explanation magic becomes science. Geobotanical prospecting is a case in point. We now know that the appearance of plants is influenced by the presence or absence of certain metallic elements in the ground. Plants vary greatly in their ability to accumulate these elements. The elements are absorbed by the plants from the subsoil and are accumulated in the leaves, which eventually fall to the ground and decay, returning the less soluble elements to the surface layer and the more soluble elements to the subsoil. Hence, if the subsoil is rich in a certain element, the plants that grow on it will absorb this element and deposit it on the top soil, and the process will carry on until other plant species may not be able to tolerate the concentration of such an element, and as a result only the right species of plants can survive and flourish. Modern research has shown, for example, that gold is accumulated in the plants *Equisetum arvense* and *palustre*, that copper is accumulated in the plants *Poeycarpaea spirostylis*, *Viscaria aipina* and *Melandrium dioecium*, that zinc is accumulated by *Viola calaminaria* and *Thiaspi* spp., that *Holosteum umbellatum* indicates intercellular droplets of mercury when grown in soil rich in mercury and so on. Geobotanical prospecting is put to practical use in the case of certain metals such as copper, nickel and tin.¹⁴⁵

The Chinese have a long tradition in the use of plants as ore indicators. At least in one case we have records to show that the method was put to practical use. The *Bencao tuijing* 本草圖經 (Illustrated Pharmacopoeia) written c.1070 by Su Song 蘇頌 describes a method for recovering mercury from the plant *machixian* 馬齒莧 (*Portulaca oleracea*), a kind of purslane, by pounding, drying and autolysis. The Chinese tradition of using plants as metal indicators went further back in time than the *Dijingtu*. The *Shanhaijing* 山海經 (Classic of the Rivers and Seas), written before the first century BC, associates gold with the *huitang* 蕙棠 plant (?), perhaps a kind of orchid or *ocimum* (basil), if not something else, while Zhang Hua 張華 in the third century mentioned that hematite was found below where smartweed (*liao* 蓼) grew in abundance.¹⁴⁶ In the *Dijingtu* we find at least four entries that use plants as metal indicators. In *DJ* 19 and *DJ* 40 two different species of *Allium* are used to indicate deposits of silver and gold respectively, while in *DJ* 21 and *DJ* 24 the yellow and the red colour of some species of grass are used to indicate the presence of bronze and lead. This tradition persisted right down to Ming times. Items *GY* 28 to *GY* 32 in the *Gengxin yuce* provide the following information:

Toushangen 透山根 (?) is found in Wudu(shan) 五都山 mountain (in modern Sichuan province). Its juice is used to transform iron instantaneously into gold by projection (*dian* 點) It is extremely poisonous. A person taking it by mistake will be dissolved into a purple liquid. Again there is the *jinyingcao* 金英草 (?), which occurs in Sichuan and is similar in appearance to the *machixian* 馬齒莧 (purslane), but is red in colour. Rubbed on iron it turns the latter into gold. It is also extremely poisonous and is fatal when taken by mouth. [The victim] is dissolved into a purple liquid. *Shiyangliu* 石楊柳 (?) contains the *qi* of silver. *Machixian*

(purslane) contains the *qi* of mercury. *Aihao* 艾蒿 (short millet and wheat) contains the *qi* of lead and tin. *Suanya* 酸芽 (perhaps Indian sorrel, *Oxalis corniculata*, L.; RL 367, also known as *sanyesuan* 三葉酸) contains the *qi* of copper.

Towards the end of the sixteenth century Li Shizhen quoted some of these examples in his *Bencao gangmu*. It would be interesting to examine scientifically the plants used by the Chinese as metal indicators. Unfortunately, it is difficult to identify with certainty many, although not all, of the Chinese plant names. In Europe the idea of plants as mineral indicators was totally unknown until the eighteenth century. It was only with the publication of J.F.Henckel's *Flora Saturnisans* in 1760 that we first encounter the idea of geobotanical prospecting.

Classifications of alchemical and medicinal substances

Following the tradition set by the *Shennong bencaojing* 神農本草經 (The Pharmacopoeia of the Heavenly Husbandman), Chinese pharmacopoeia classified medicinal substances into three categories, namely *shangpin* 上品 (upper rank), *zhongpin* 中品 (middle rank) and *xiapin* 下品 (lower rank). Substances in the upper rank were considered to be non-toxic and beneficial to people by nourishing life (*yang ming* 養命) and prolonging the human life span when taken over an extended period. In medical prescriptions these substances played the role of the Sovereign (*jun* 君) Substances of the middle rank were also non-toxic and would act as a tonic. They played the role of Minister (*chen* 臣) Substances of the lower rank were considered to be mostly toxic, but useful for combating the illness itself. In medical prescriptions they played the role of Adjutant (*zuo* 佐). There was an analogy in Chinese medical prescriptions in which one of the constituents played the role of the Sovereign and the others the roles of Minister and Adjutant.¹⁴⁷ In the *Cantongqi wuxianglei miyao* 參同契五相類秘要 (Arcane Essentials of the Similarities and Categories of the Five Substances in the Kinship of the Three) these three terms are used in the same context for alchemical formulae. Another alchemical text, the *Yin Zhenjun jinshi wuxianglei* 陰真君金石五相類 (The Similarities and Categories of the Five Substances among Metals and Minerals by the Deified Adept Yin) of unknown date and authorship says,

Sulphur also leads to the goal of becoming a holy immortal, albeit not a very distinguished one. When using sulphur, one abides by the principle of the similarities and categories of substances, whether externally or internally, as a Ministerial (*chen*) or an Adjutant (*zuo*) [elixir ingredient], and for energy or strength. The operator knowing this secret will become an everlasting immortal of the average sort, but he who ignores it will end up as a dead alchemist.¹⁴⁸

This tradition of classification was abandoned by Li Shizhen and was not followed by Zhu Su 朱橚, a half-brother of Zhu Quan 朱權, when he wrote his *Jiuhuang bencao* 救荒本草 (Famine Relief Pharmacopoeia) in 1406, or by the compilers of botanical

monographs on edible wild plants that followed. I have shown above that in the tenth century Dugu Tao had already classified alchemical and medicinal substances into twenty-five different groups in his *Danfang jianyuan*, showing a departure from the tradition of the *Shennong bencaojing*. Apart from knowing from Li Shizhen that the *Genxin yuce* consisted of seven sections and that no reference on rankings are found in the fragmentary text available to us, one can only make a guess that Zhu Quan had probably followed his half-brother Zhu Su in abandoning the tradition of ranking of alchemical and medicinal substances set by the *Shennong bencaojing*.

In his *Waidan bencao*, as we have seen earlier, Cui Fang classifies minerals and plants into the two categories of *Yin* and *Yang*. For example, saltpetre is a *Yin* mineral, while pyrolusite, red hematite and iron pyrites are *Yang* minerals. The *Zaohua zhinan* discusses *Yin* and *Yang* minerals and refers to honeysuckle as a *Yin* plant. Following this tradition the *Genxin yuce* makes the following classification:

<i>Yin</i> minerals	Asbestos, brown hematite, large hollow variety of malachite, dolomite
<i>Yang</i> minerals	Asbestos tremolite, coloured arsenolite, unidentified green pebbles of foreign origin
<i>Yin</i> plants	Ground ivy, umbrella leaf, a pink variety of pigweed, big rooted caladium
<i>Yang</i> plants	<i>Paris polyphylla</i> , Sm., dodder

It appears that this classification is closely connected with that found in the pharmacopoeia. For example, in the pharmacopoeia, asbestos and the large hollow variety of malachite are referred to as *dahan* 大寒 (extremely cold), while coloured arsenolite is *dare* 大熱 (extremely hot). This is just another way of referring to the former as *Yin* in nature and the latter as *Yang*.

Development of Chinese alchemy

The development of alchemy in China was inspired by the profound belief of the feasibility of attaining longevity and material immortality through the ingestion of elixirs. At first, during the Zhou, Qin and Early Han periods, the emphasis was on the search (*qiu* 求) for an elixir, and early texts speak about the herb of immortality or the medicine of immortality. In the Early Han period the alchemists were striving to make gold artificially, while the systematic handling of chemical change to produce inorganic substances can be traced to the fifth century BC. During the Han period a few people consumed inorganic substances and elixir preparations made from them hoping to enhance their vitality or to prolong their lifespan. This practice became popular by the time of the Three Kingdoms period. Hence there were two closely linked traditions, one of them was macrobiotic pharmaceutical-botanical and the other chemical-metallurgical, to use the terms employed by Needham. By the end of the Han period, the second century AD, these two traditions completely coalesced and Chinese alchemists began to experiment with metals and minerals to prepare elixirs by the process of heating or effecting chemical changes (*lian* 煉).¹⁴⁹

A third tradition acted as catalyst to the union of the two traditions above. This was the tradition of Chinese medicine. The earliest Chinese pharmacopoeia that we have, the

Shennong bencaojing, compiled in the second century AD, but containing some much earlier material, includes many inorganic and organic substances that were supposed to bring longevity when ingested over time. This tradition, as we have already seen from the discussions earlier, was continued in later pharmacopoeia. Thus, Needham speaks of three strands out of which the typical elixir alchemy of the mediaeval Chinese was woven: (1) the pharmaceutical—botanical tradition of the herb or plant of immortality; (2) the metallurgical—chemical tradition of making of artificial gold and (3) the medical—mineralogical tradition of the therapeutic uses of inorganic and metallic substances. The fusion of these three strands was certainly completed during the first century AD.

Alchemical texts from the time of Wei Boyang 魏伯陽 in the second century AD until the middle of the Tang dynasty in the eighth century indicate bold experimentations with diverse metals and minerals by Chinese alchemists. Some of the raw materials used, such as lead, mercury and arsenic are highly poisonous. It is noteworthy that some of the famous alchemists, such as Ge Hong, Tao Hongjing, Sun Simiao 孫思邈 (581–682) and Meng Shen 孟詵 (621–718) were also eminent physicians in their own right. They also included minerals in their medical prescriptions, but far more conservatively in quantity than in their elixir formulae. Perhaps the idea was that if one were to become a holy immortal one's body should be able to withstand the administration of a heavy dosage of such minerals and this could be built up by taking smaller dosages. Their elixir formulae and their medical prescriptions seemed to be composed under the same principles. Nothing can be more illuminating than the following words of Yan Guanglu 顏光祿 that Li Shizhen quotes in his *Bencao gangmu*:

In all the recipes of the immortals contained in Daoist writings, including those on the ingestion [of elixir substances], the way to abstain from cereals, how to attain longevity and avert [the natural process of] ageing, and even those concerning the wonders of preparing elixirs by sublimation and working with the minerals and the marvels of ascending to the clouds and ethereal transformation into [immortals with] wings, are all dependent on the use of medicinal substances. The principle of employment of these substances is one and the same as that used in the pharmacopoeia.¹⁵⁰

With their knowledge of alchemy the Chinese alchemists also produced many medical prescriptions, called *fangyao* 方藥, of their own. Some of these prescriptions must have circulated among the common people. We can read in Chinese novels about the miraculous efficacy of the medicine used by the Daoists and even by Buddhist monks. Many *fangyao* prescriptions found their way into the Daoist Canon, providing yet another example of the close relation between Chinese alchemy and Chinese medicine. Their common aim has always been to prolong human life—the only difference between them was the relative length of time involved.

Mercury and lead were among the most common raw materials used in elixir preparation. Other toxic substances, an example being arsenic, were employed not infrequently.¹⁵¹ We read about the early demise of a number of Chinese emperors resulting from their attempt to prolong their own lives indefinitely by consuming elixir

preparations containing these toxic ingredients. Many high officials, the rich, scholars, and the alchemists themselves, especially the more competent and dedicated ones, met the same fate.¹⁵² The number of elixir poisoning cases during the Tang dynasty became so alarmingly great that the alchemists were forced to be more cautious in their approach. Many of them turned from operative alchemy (*waidan* 外丹) to psycho-physiological alchemy (*neidan* 内丹). Among those who remained faithful to operative alchemy some sought after antidotes for the symptoms caused by elixir poisoning, some considered that these symptoms should be completely ignored and some took a safer course by looking for raw material for elixir preparation in the vegetable kingdom. Falling victim to their own beliefs the first two categories of operative alchemists were gradually reduced in number with time, and after the Song dynasty what remained were mostly those who experimented mainly with organic substances. The trend of paying more attention to plants than minerals continued right through the Yuan dynasty to the time of the Ming when Zhu Quan wrote the *Gengxin yuce*. The emphasis on plants can be seen from the two alchemical texts written during this period discussed in Chapter 2, namely the *Chunyang Lü Zhenren yaoshizhi* and the *Xuanyuan Huangdi shuijing yaofa*. Soon after these botanical alchemical texts came the botanical pharmaceutical monograph *Jiuhuang bencao* 救荒本草 in 1406, to be followed in the next two centuries by three further similar writings, namely the *Yecai pu* 野菜譜 (Treatise of Wild Vegetables) by Wang Pan 王磐 (fl. 1526–66), the *Rucao pian* 茹草篇 (Book on Edible Herbs) by Zhou Lüjing 周履靖 in 1597, and the *Yecai bolu* 野菜博錄 (Encyclopaedia of Wild Vegetables) of Bao Shan 鮑山 in 1622. The very title of the *Waidan bencao* itself suggests the close connection between operative alchemy and pharmaceutical material. Li Bi 李弼 and his disciple Cui Fang may perhaps be regarded as among the initiators of the long movement away from elixir making towards the preparations of organic and inorganic substances for medicinal purposes. This took place in China some five centuries before Paracelsus. We find operative alchemists for the next few centuries after Li Bi and Cui Fang gradually continuing to produce alchemical writings with botanical and pharmaceutical interest and writers and composers of pharmacopoeia incorporating Daoist alchemical writings in their own works. These two parallel streams finally coalesced in Zhu Quan's *Gengxin yuce*, and as a result Chinese operative alchemy lost its identity, being subsumed in the pharmacopoeia.

A typical example of this fusion is Li Shizhen's *Bencao gangmu*. After the Song period the whole of indigenous science in China entered a state of decline, and alchemy was no exception. Zhu Quan's *Gengxin yuce* qualifies as the most comprehensive Chinese alchemical compendium ever written and represents the final curtain drawn on Chinese alchemical literature since no major work on the subject was written thereafter.

Intercultural contact

Alchemy did not develop in splendid isolation in China. It should be looked upon as part of the world enterprise of early chemistry that resulted in the birth of modern chemistry in Europe. Needham demonstrates that the great adventure of proto-chemistry and alchemy was really one single movement, despite having separate foci of origin.¹⁵³ In the years 139 BC and 115 BC the Chinese emperor Wudi 武帝 twice despatched Zhang Qian

張騫 on official missions to West Asia. After visiting Bactria and Sogdiana, Zhang returned to China, and as a result of his travel the so-called Old Silk Route was established. There must have been earlier contact between China and her Western neighbours before the time of Zhang Qian judging from his report on the observation of already existing trade routes between Sichuan and India through Yunnan, Burma or Assam.

Needham also points out that there existed from ancient times a trans-Asian continuity, greatly enhanced after Alexander's conquest (320 BC) and further facilitated after Zhang Qian's diplomatic and commercial expeditions, and that most likely the two foci of aurification and aurifaction, centred primarily on Chang'an and Alexandria, had essentially independent origins. There were, however, mutual influences once they developed. Among many ideas that went from China to the West was the root of the name *chymeia*, which had been unconvincingly attributed variously to Egyptian, Greek and Hebrew origin. Merchants along the Old Silk Route must have talked about the art of making gold in China—*jin* or *kiem*, *kim*, *kum*, etc. according to different dialects—written by the same character in Chinese. Later on, with the opening of the sea routes between Arabia and East Asia, this same term for gold had an influence on the Arabic word '*alkimiya*'. Thus, according to Needham, the name of the Chinese 'gold art', crystallised in the syllable *jin* (*kiem*), spread over the length and breadth of the Old World, evoking first the Greek terms for chemistry and then, indirectly or directly, the Arabic one.¹⁵⁴ Of course, the diffusion of knowledge was never all one-way-traffic. The process of distillation, for example, was one of the ideas that went eastward, although it was modified along the way.¹⁵⁵

In the fifth century European learning began its long slumber of the Dark Ages that lasted until the tenth century. In the meantime, considerable developments in science, particularly in mathematics and medicine, had taken place in India. Through the conquests of Alexander, early scientific contact with the Hellenistic cultural area was established. As mentioned earlier, trade routes between India and China existed even before the time of Zhang Qian in the second century BC. Cultural contact between these two countries increased with the introduction of Buddhism about AD 65. Faxian 法顯 (334–420) set out for India in AD 399 on his famous pilgrimage, returning to the Chinese capital in AD 414 after having visited Central Asia and many parts of India. Another well-known pilgrimage is that of the monk Xuanzang 玄奘 (596–664) who spent 16 years in India, between 629 and 645, collecting Buddhist sutras. Many Indian monks also went to China. Scientific and technological knowledge travelled in both directions.¹⁵⁶ In the Daoist Canon we can find record of a certain Indian monk who could identify saltpetre using the flame test during the seventh century.¹⁵⁷

By the eighth century merchants, mostly Chinese, Arabs and Persians, were plying the land and sea routes between China and Arabia. The Tang capital Chang'an (modern Xian) had become the busiest and most cosmopolitan city in the world, where Arabs, Indians, Japanese, Koreans, Persians, Syrians and people of other nationalities congregated. Even Nestorian Christians had established themselves there.¹⁵⁸ It is not at all surprising that scientific and technological knowledge should flow in all directions. First, Muslim sailors could have adopted the marine compass used by the Chinese for navigation and later the knowledge was passed on to Europe.¹⁵⁹ Chinese alchemical knowledge also went to the Muslim World along with trade, not just the term for

alchemy, but also that for saltpetre, which was known as ‘Chinese snow’ (*thalj al-Sīn* or *thalj Sīnī*).

Needham finds many striking parallels with Chinese alchemy in the Jābirean corpus, a vast collection of hundreds of books and tractates on alchemy and other works written between the last half of the ninth and the first half of the tenth century by a number of unknown authors, but all using the name of Jābir ibn Hayyan (c.721–817).¹⁶⁰ These parallels include the primary alchemical ingredients, the concept of immortality and panacea, relation between alchemy and chemotherapy, the use of the *Luoshu* 洛書 magic square, etc. Let us look at the Jābirean views on the transmutation of metals that had such a great influence on alchemy itself. Jābir considered mercury as the metal *par excellence*, because in liquid form it showed the least amount of impurities of the Earth Element. Sulphur was chosen by Jābir as the next ingredient because of its gold-like yellow colour, its changeability and its combustibility. It could hardly be a coincidence that mercury and sulphur were also the two most popular substances already used by Chinese alchemists several centuries earlier. For example, they are mentioned in the (*Zhouyi*) *Cantongqi* 周易參同契 (Kinship of the Three Basing on the Book of changes), the earliest book extant on alchemical theory written in the second century AD.¹⁶¹ Jābir regarded the different metals to be composed of various amounts of mercury and sulphur, and that if one could only mix the right proportion of mercury and sulphur gold could be produced. The Greeks were searching for a substance that could promote the transmutation of base metal into gold. This substance was believed to look like a dry powder, and was known as *xerion*, from the Greek word for ‘dry’. The Arabs called it *al-iksr*, from which came the word ‘elixir’. The elixir was thought to have a dry, earthy property. In Europe it was later called the philosopher’s stone. The elixir was also believed to be a cure-all for all kinds of illnesses and to have the power of giving immortality. Hence it was also called the elixir of life. This concept of immortality and elixir originated in China and probably went to the Muslim World in the eighth century and from there eventually into Europe in the eleventh and the twelfth centuries.

Let us return to a period about a century earlier when Dugu Tao compiled his *Danfang jianyuan* to look at maritime trade, particularly concerning commodities of medicinal value, between the Arab World and China. As mentioned earlier, merchants played an important role as transmitters of scientific and technological knowledge. Since the main aim of merchants has always been profit, one can assume that they would be interested in hearing about a more expeditious way of acquiring gold than by trade. They would therefore be expected to have at least heard about alchemy, even if they might not be well acquainted with the art itself. By the time of Dugu Tao in the tenth century, the Muslim world had already learned about many medicinal products from China. The ‘Father of Pharmacy’ in the Muslim world, al-Bīrūnī (973–1051) in his *Kitāb al-Šaydanah* took into account a good number of such products originating from China. Extracts from his book are contained in Appendix II. For the moment our attention will turn to the imports into China from the Arab World.

As we have noted, maritime trade between China and the Arab World flourished during the eighth century. By the ninth century many Arabs, including Persians, had come to settle in the ports along the coasts of modern Guangdong, Fujian and Zhejiang provinces. The merchants among them sold exotic West Asian plants and marine products. During the thirteenth century Zhao Rukuo 趙汝适 mentioned the imports from

the Arab world in his *Zhufanzhi* 諸蕃志 (Records of Foreign Peoples). Among them were pearl, ivory, rhinoceros horn, terebinth, ambergris, nutmeg, benzoin, aloe vera, myrrh, dragon's blood, asafoetida, seal's kidney, gardenia and rose water.

The mohar, a variety of the *Pinctada martensii* species of saltwater mollusc found in the Persian Gulf, is renowned for the high quality of its pearls. Ivory and rhinoceros horn probably came from Africa and went to China via the Arab world. *Chongxiu Zhenghe jingshi zhenglei beiyong bencao* (juan 16) quotes from several sources including the *Bencao shiyi* 本草拾遺 (Additions to Materia Medica) by Chen Zangqi 陳藏器, written between 713–41, and the ninth-century *Haiyao bencao* 海藥本草 (Materia Medica of Countries beyond the Seas) by Li Xun 李珣, a Persian immigrant, in its account on ivory.¹⁶²

The rhinoceros is mentioned in the *Shennong bencaojing*, and Ge Hong refers to the magical power of its horn in his *Baopuzi neipian* (juan 17). *Bencao gangmu* (juan 51A), besides quoting the above also contains a statement by Li Shizhen saying that the horn is an antidote for all poison.

Ruxiang 乳香, the terebinth tree (*Pistacia terebinthus*), mentioned both in *DT* 150 and in *JY* 49 earlier, first appeared in the *Bencao shiyi*. Li Xun gave a detailed account of it in his *Haiyao bencao* and mentioned its use by the alchemist. It is believed to be indigenous to Persia. The mastic tree (*P. lentiscus*) and turpentine tree, or terebinth (*P. terebinthus*), produce sweet-smelling gums used in medicine.¹⁶³

Ambergris, known in China as *longxian* 龍涎 or *longxianxiang* 龍涎香 (*Physeter catodon*, L.) is thought to form as a protective substance against the intestinal irritation caused by the indigestible horny portions of the squid and cuttlefish on which the whale feeds. When fresh ambergris is soft in consistency, black in colour and has a disagreeable odour. When exposed to sun, air, and seawater, however, it hardens, its colour fades to a light grey or yellow and it develops a subtle and pleasant fragrance. It was highly valued as a perfume, a medicine and as a spice for food and wines. It was first mentioned by Duan Chengshi 段成式 in AD 863 in his *Youyang zazu* 酉陽雜俎 (Miscellaneous Offerings from Youyang), but appeared in the pharmacopoeia only in 1765 in the *Bencao gangmu shiyi* 本草綱目拾遺 (Additions to the Great Pharmacopoeia) by Zhao Xuemin 趙學敏.

Nutmeg, *roudoukou* 肉豆蔻, consists of the seed of the *Myristica fragrans*, Houtt. It is used to flavour certain food and the Romans used it as incense. It was first mentioned in China in the sixth century by Tao Hongjing. *Chongxiu Zhenghe jingshi zhenglei beiyong bencao* contains a statement that it came from the South Seas, implying that it arrived via maritime trade.

Anxixiang 安息香 (*Styrax bezoin*, Dryand.), is one of about a hundred species of the genus *Styrax*, shrubs and trees of the family *Styracaceae*. It produces a resin known as storax used in incense. It first appeared in the *Tang xinxiu bencao* 唐新修本草 (Tang Pharmacopoeia) of Su Jing 蘇敬, and both the *Youyang zazu* and the *Haiyao bencao* refer to its origin as being Persia.

The *Bencao tujing* 本草圖經 (Illustrated Pharmacopoeia) mentions that *luhui* 蘆薈; 蘆香 or (*aloe vera*, L.) came from Persia. Its juice is used as an ingredient in cosmetics and in medicine as a purgative and as a treatment for burns. Li Xun in his *Haiyao bencao* also referred to its Persian origin.

Myrrh (*Commiphora murrha*, Engl.) exudes as a fluid from resin ducts in the tree bark when the bark splits naturally or is cut in tapping. Upon exposure to air, myrrh hardens

slowly into globules and irregular lumps called tears, which are then collected from the trees. Myrrh came from the Arabic *murr* (bitter), and from which was derived the Chinese term *moyao* 沒藥 —mo medicine.¹⁶⁴ Both the *Haiyao bencao* and the *Bencao tujing* mention its Persian origin.

Dragon's blood, a kind of red resin obtained from the fruit of several palms of the genus *Daemonorops*, known in Chinese as *qilinjie* 麒麟竭 or *xuejie* 血竭 (*Daemonorops draco*, B1.) is mentioned in the *Tang xinxiu bencao* as well as many others, including the *Haiyao bencao*. Dugu Tao mentions it in DT 93 and *Chongxiu Zhenghe jingshi zhenglei beiyong bencao* (juan 13) also refers to its use in alchemy, quoting from the *Taiqing fulian lingsha fa* 太清伏煉靈砂法. It is used in colouring varnishes and lacquers.

Asafoetida, known to the Chinese as *awei* 阿魏, features in JY44. *Bencao gangmu* (juan 34) notes that it is first mentioned in the *Tang xinxiu bencao* and that Persia was one of the countries of its origin according to the *Bencao tujing*. It is a gum resin prized as a condiment for flavouring food in India and Iran.

Wannaqi 腦納脐 (*Callorhinus ursinus*, L.) refers to dried follicles of the beaver. *Chongxiu Zhenghe jingshi zhenglei beiyong bencao* (juan 18) quotes from several sources including the eighth-century *Bencao shiyi* and the ninth-century *Haiyao bencao* in its account on the *wannaqi*.

Zhizihua 梔子花 (*Gardenia jasminoides*, Ellis) is cape jasmine, the fragrant species of gardenias sold by florists. Gardenias have white or yellow tubular flowers, evergreen leaves, and large, berrylike fruits containing a sticky, orange pulp. *Zhizi* 梔子 is first mentioned in the *Shennong bencaojing*. *Chongxiu Zhenghe jingshi zhenglei beiyong bencao* (juan 13) quotes from several sources. As mentioned both in JY 51 and in DT 201 it found its use in alchemy.

Rose water is known in Chinese as *qiangwei shui* 薔薇水 or *qiangwei lu* 薔薇露. *Bencao gangmu* (juan 18A) says that the water exuded from this flower had an extraordinary fragrance. Like some of the other substances listed by Zhao Rukuo, it was not used by the alchemists and is not included in their writings.

However, Zhao Rukuo did miss out some of the alchemical substances that came to China from the Arab World. One example is sal ammoniac, with the Chinese name *naosha* 硃砂 that was derived from the Arabic *nūshādir* and features in DT 35, JY 30, ZH 15 and QB2. *Bencao gangmu* (juan 11), quotes the *Tang xinxiu bencao* as saying that sal ammoniac came from the western foreign countries and the *Rihuazi bencao* 日華子本草 (Pharmacopoeia of Master Rihua), which calls it *diyan* 狄鹽, namely, salt of western tribal people. The *Danfang jianyuan* mentions *bosi baifan* 波斯白礬, Persian purified potash alum in DT44. Tao Hongjing referred to *tesheng yushi* 特生礬石 (coloured arsenolite), given here in DT 74, as originating from the western regions outside China.¹⁶⁵ Another example is *mituoseng* 密陀僧 (litharge) mentioned in ZH1. The Chinese term itself originated from the Arabic *mudār sanj* if not the Persian *martā sang*. Again, *Bencao gangmu* (juan 8) quotes the *Tang xinxiu bencao* as pointing out that litharge came from Persian and that the terms *mituo* 密陀 and *meiduo* 沒多 came from the language of the *hu* 胡 foreign people. The Chinese sources can only tell part of the story of intercultural exchange between China and the Arab World round about the time of Dugu Tao. Appendix II gives some idea about the transmission of things Chinese to the Arab World at that time.

Appendix I

Beyond the Daoist Canon: proto-chemistry in the pharmacopoeia

Comparing the proto-chemical and alchemical writings of China and the Hellenic world, Joseph Needham finds parallels between the works of Bolus of Mendes and Liu An's 劉安 *Huainan wanbishu* 淮南萬畢術 (The Ten Thousand Infallible Arts of the Prince of Huainan), between the writings of Zosimus of Panopolis and Ge Hong's *Baopuzi neipian* 抱朴子內篇 (Inner Chapters of the Book of the Preservation-of-Solidarity Master), and so forth. He also compares the techniques of aurification, or the making of false gold, in both culture-areas.¹⁶⁶ Noting the chronological precedence for China, he suggests many parallels in content, from the procedures to the substances and symbols used.¹⁶⁷ The use of the different terms 'proto-chemistry' for the Graeco-Egyptian world and 'alchemy' for China is deliberate, because material immortality attained by the aid of chemical knowledge played hardly any part in the former but was central in the latter.¹⁶⁸

As we have seen, the Daoist Canon is the most important, though not the only source for the study of Chinese alchemy, a subject that eventually received the greatest amount of attention by Needham in the SCC series judging by the number of physical volumes (four) devoted to it. The early history of Chinese chemistry, however, was not confined entirely to the pursuit of the elixirs and the transmutation of base metal into gold. Beyond the Daoist Canon, we find Jia Sixie 賈思勰 describing in his *Qimin yaoshu* 齊民要術 (Important Arts for the People's Welfare), written between AD 533 and 544, many processes used in industrial chemistry, such as the preparation of dyes, ink and essential oils, making of wine and vinegar, and the recovering of salt from brine by crystallisation. The *Wulei xianggan zhi* 物類相感志 (On the Natural Responses of Things according to their Categories) by the eleventh-century monk Zanning 贊寧 and a later work *Gewu cutan* 格物蟲談 (Simple Discourses on the Investigations of Things), often mistakenly ascribed to him or to Su Dongpo 蘇東坡, contain many results of alchemical interest. For example, the former mentions that rust on copper vessels is removed by itself when placed in vinegar, malachite (*cengqing* 曾青) rubbed on iron gives it the red colour of copper and so on. We can also find monographs on wine making, such as the *Beishan jiujiing* 北山酒經 (Wine Classic of the North Mountain), written by Zhu Hong 朱熹 in 1117, and Su Dongpo's *Dongpo jiujiing* 東坡酒經 (Dongpo's Wine Classic). There were books written on perfumes and incenses, such as the four books bearing the same title *Xiangpu* 香譜 (Book of Fragrances), written separately by Shen Li 沈立, Hong Chu 洪芻, Chen Jing 陳敬 and Xiong Penglai 熊朋來, and the similarly named *Xiang Cheng* 香乘 (Records of Perfumes) by Zhou Jiazhou 周嘉胄. Much information on industrial chemistry can be found in the *Tiangong kaiwu* 天工開物 (The Exploitation of the Works of Nature), written by Song Yingxing 宋應星 in 1637.¹⁶⁹ Besides, the pharmacist and the physician had also to acquaint themselves with the alchemical properties and preparations of many

products used in medicine. It has already been pointed out that Chinese alchemy was from the very beginning iatrochemistry, and the Chinese did not have to wait for a Paracelsus or a John of Rupescissa (fl. 1325 to 1350) to tell them that the true business of alchemy was not to make gold but to make medicines.¹⁷⁰ Chinese pharmacopoeia constitute a rich source of information on the alchemy and proto-chemistry of both inorganic and organic substances. This chapter is a by-product of venturing into the pharmacopoeia to collect fragments of alchemical texts used in the previous chapters. It summarises the knowledge on the proto-chemistry of stones and minerals as contained in Chinese pharmacopoeia.

As already mentioned in Chapter 1, throughout its long history China has produced a vast number of pharmacopoeia. It is also noted that some of the Daoist alchemists, like Tao Hongjing 陶弘景 and Sun Simiao 孫思邈, were also great physicians, and that the pharmacopoeia sometimes merely quoted the use of substances for alchemical purposes from the Daoist alchemists, for example from Dugu Tao's *Danfang jianyuan* 丹方鑒源. However, Chinese pharmacopoeia also contain much alchemical material that is not found in the Daoist alchemical texts available to us. The *Chongxiu Zhenghe jingshi zhenglei beiyong bencao* 重修正和經史證類備用本草 (New Revision of the Pharmacopoeia of the Zhenghe Reign-Period: The Classified and Consolidated Armamentarium), for example, quotes from many Daoist alchemical treatises, such as the *Qingxiazhi* 青霞子, discussed earlier, and the *Ma Ming xiansheng jindanzhi* 馬明先生金丹訣 (Ma Ming's Explanations of the Golden Elixir) that are no longer extant in their original form.

The *Shennong bencaojing* 神農本草經 (The Pharmacopoeia of the Heavenly Husbandman) lists 120 superior medical ingredients (*shang yao* 上藥) that arrest the process of ageing and prolong the human lifespan (*bulao yannian* 不老延年). Among these are eighteen different varieties of minerals and stones, namely cinnabar (*dansha* 丹砂), mica (*yunmu* 雲母), jade potion (*yuquan* 玉泉), stalactites (*shiruzhong* 石乳鐘), potash alum (*nieshi* 涅石), potassium nitrate (*xiaoshi* 硝石), crude sodium nitrate (*puxiao* 朴硝), soapstone (*huashi* 滑石), copper sulphate (*shidan* 石膽), malachite (*kongqing* 空青), stratified variety of malachite (*cengqing* 曾青), brown haematite (*Yuyuliang* 禹餘糧), a reddish variety of brown haematite (*Taiyi yuliang* 太乙餘糧), quartz (*baishiying* 白石英), amethyst (*zishiying* 紫石英), the five siliceous clays (*wuse shizhi* 五色石脂) (including the blue and the red variety, Fuller's earth, kaolin and graphite), light-coloured azurite (*baiqing* 白青) and azurite (*bianqing* 扁青). Furthermore, it mentions the alchemical action of certain stones and minerals, for example, it says that sulphur (*shiliuhuang* 石硫黃) is 'an unusual substance that can transform gold, silver, copper and iron' (*neng hua jin yin tong tie qi wu* 能化金銀銅鐵奇物). Such observations can be found quoted in many later pharmacopoeia, some of which have added further information on the alchemical action, properties and method of preparations of other stones and minerals.¹⁷¹ They are regrouped here in the order of the Periodic Table for ease of reference.

Group I

Sodium compounds

Methods of recovering common salt by crystallisation are described in detail both in the pharmacopoeia and in technological books like the *Tiangong kaiwu*.¹⁷² Commonly known as *shiyán* 食鹽¹⁷³, it appears under many synonyms in the pharmacopoeia, namely *shanyan* 山鹽, *muyan* 木鹽, *moyan* 末鹽, *yinyan* 印鹽, *jiayan* 解鹽, *haiyan* 海鹽, *baiyan* 白鹽, *heiyán* 黑鹽, *rouyan* 柔鹽, *chiyan* 赤鹽, *zeyan* 澤鹽, *chouyan* 臭鹽, *shiyán* 石鹽, *machiyan* 馬齒鹽, *boyan* 駁鹽, *qingyan* 青鹽, *jingyan* 井鹽 and *yanzhen* 鹽枕, depending on its origins (the sea, lakes, wells, rocks etc.), its colour (white, green, purple, red, yellow and black etc.) and on its form (crystalline or in lumps). Native salt is called *rongyan* 戎鹽, *huyan* 胡鹽, *qiangyan* 羌鹽, *qingyan* 青鹽, *tudengyan* 秃登鹽 and *yintuyan* 陰土鹽. Rock salt is known as *guangmingyan* 光明鹽, *shengshi* 聖石, *shiyán* 石鹽, and *shuijingyan* 水晶鹽. Native lake salt is known as *luxian* 鹵鹹, *luyan* 鹵鹽, *hanshi* 寒石 and *shiyán* 石鹽.

Known also as *manyán* 蠻鹽, the *Danfang jianyuan* says that native salt has the ability to arrest the process of sublimation in orpiment and realgar and that among native salts the (red) variety *hongyan* 紅鹽 is superior. Dugu Tao also says that native salt (*rongyan* 戎鹽) can cause eggs to heap up (*lei* 累) and can dry up mercury and prevent the process of sublimation in cinnabar.¹⁷⁴

Sodium sulphate in its crude form is known as *puxiao* 樸硝, *xiaoshipu* 硝石樸, *yanxiao* 焰硝 and *pixiao* 皮硝. The *Shennong bencaojing* says that it can transform seventy-two types of minerals and stones. Yuan Hanqing 袁翰青 takes this to mean either dehydration on exposure to air leaving some anhydrous and some hydrates, or that under high temperature it can dissolve a good number of silicates.¹⁷⁵ The *Mingyi bielü* says that the refined product is white as silver and that it will remain unchanged in the ground for a thousand years.

Li Shizhen 李時珍 explains that the word ‘*xiao*’ 消 is included in its name because it dissolves readily in water and will also form solution with various substances. When purified, what is found above in the reaction vessel (i.e. the sublimate) is called *mangxiao* 芒消 or *penxiao* 盆消 or *mayaxiao* 馬牙消. The efflorescent powder is called *fenghuaxiao* 風化消. Caution should be taken that *mangxiao* is not to be confused with nitre (*xiaoshi* 消石). In the more purified form sodium sulphate is known as *xuanmingfen* 玄明粉 and *bailongfen* 白龍粉. A method for purifying sodium sulphate as given in the *Mingyi bielü* says that some clean, crude sodium sulphate should be used during the winter months of frost and snow. This is mixed with three ounces of *Gleditschia sinensis* (*zaojia* 皂莢¹⁷⁶), heated gently over a fire for a while, pounded into pieces and mixed with six cups of hot water. After removing the residue left at the bottom, the liquid is filtered through two layers of thin paper and then poured into an iron pan to be boiled until half of it is left. Once cooled to lukewarm, the liquid is transferred to an earthenware pot and left to cool in the open for one night. The next morning pieces of solids will have formed. These are dissolved in six cups of clean boiling water and boiled together with eight ounces of large radish (*luopu* 蘿蔔) cut into pieces about two-tenth of an inch thick until the radish is cooked. The liquid is again transferred to an earthenware pot, and, with the radish

removed, again left to cool in the open for one night. The next day pieces of solids will have formed. Once removed from the liquid and dried, the solids are put into good paper bags and suspended in a place exposed to the wind. They will naturally turn into powder.¹⁷⁷

Borax, *pengsha* 硼砂, is said to be used for soldering gold and silver (*han jin yin yong* 銲金銀用) in the *Shennong bencaojing*. Li Shizhen says that the white variety from the west has the property of softening substances, removing dirt, changing the Five Metals so that they lose their original forms or properties, having the same effects as saltpetre, and combining well (*xiangde* 相得) with arsenious oxide (*pishi* 砒石), Dugu Tao says that it prevents the process of distillation in mercury (*zhi* 制) and also tarnishes copper, while Tuxiu zhenjun 土宿真君 says that, when heated with arsenious oxide, changes will take place.¹⁷⁸

Potassium compounds

Saltpetre (*xiaoshi* 消石)¹⁷⁹ is regarded as an elixir substance by the *Shennong bencaojing*. It is also known under the synonyms *mangxiao* 芒消, *kuxiao* 苦消, *yanxiao* 鹽消, *huoxiao* 火消, *dishuang* 地霜, *shengxiao* 生消 and *beidi xuanzhu* 北帝玄珠. *Mangxiao* is also a name for sodium sulphate, besides being identified as Epsom salt in 1955.¹⁸⁰ This has given rise to much confusion among both pharmacists and alchemists over the difference between saltpetre and sodium sulphate. Alchemists generally regarded *xiaoshi* as saltpetre, but in medicine Epsom salt and Glauber's salt would sometimes be also used as *xiaoshi*. Crude saltpetre often contains impurities of sodium nitrate and sodium chloride.¹⁸¹ The *Shennong bencaojing* says that it melts when heated. Tao Hongjing states that when burnt it emits purple-bluish smoke. The *Mingyi bielu* says that it is capable of producing changes in seventy-two kinds of stones and minerals, while Zhang Cunhui 張存惠 states that it can be transformed into twelve kinds of stones and minerals.¹⁸² Su Song 蘇頌 says that it bursts into flames completely when burnt, that it can transform metals and stones, and that although it is itself inflammable, it can make various stones and minerals resist fire. The flame test is recommended for distinguishing saltpetre from sodium sulphate. According to Shengxuanzi's 昇玄子 book the *Fugongtu* 伏汞圖 (Chart for Subduing Lead), a piece of quartz (*baishiying* 白石英) that has been heated over a fire will melt when saltpetre is placed on it.

Shipi 石脾 is a mixture of saltpetre and other salts.¹⁸³ Tao Hongjing says that *shipi* can be boiled in water and rendered into *xiaoshi*, and that stones or minerals (*shi* 石) thrown inside will be dissolved (*xiao* 消), and hence the term 'xiaoshi' 消石. It may be pointed out here that both sodium sulphate and saltpetre were called *xiaoshi* by the Chinese, and that *xiaoshi* used by Su Song and Li Shizhen generally means the former.¹⁸⁴

Potash alum is known as *fanshi* 礬石 or any one of its synonyms *nieshi* 涅石, *yunie* 玉涅, *yuze* 羽澤, *bashi* 巴石 and *liuxufan* 柳絮礬.¹⁸⁵ Su Gong 蘇恭 includes ferrous sulphate and ferric sulphate under the general name *fanshi*. Another synonym used to denote potash alum was *shidan* 石膽, which more often refers to copper sulphate. According to Tao Hongjing, potash alum dissolved in vinegar when applied over iron gives it the appearance of copper. Kou Zongshi 寇宗奭 says that solution of potash alum applied on paper renders it waterproof.

Copper and its compounds

The ore from which copper was recovered was malachite ore.¹⁸⁶ Because of its reddish-yellow colour, copper is known as *chitong* 赤銅, *hongtong* 紅銅 and *chijin* 赤金 in Chinese pharmacopoeia, and in fragmentary form as *tongluo* 銅落, *tongmo* 銅末, *tonghua* 銅花, *tongfen* 銅粉 and *tongsha* 銅砂. Although a great deal has been written on various aspects of copper in China, the pharmacopoeia contain surprisingly little on the alchemical and chemical properties of this metal. Li Shizhen mentions that with zinc carbonate (*luganshi* 爐甘石), copper can be made into golden-coloured brass (*huangtong* 黃銅), with arsenious oxide (*pishi* 砒石) it can be made into silver-coloured *baitong* 白銅 and mixed with tin (*xi* 錫) it can be made into bronze (*xiangtong* 響銅).¹⁸⁷ Yuan Hanqing states that *baitong* is an alloy of copper and nickel and that the arsenious oxide mentioned by Li Shizhen has a content of nickel as often found in the arsenious ores in Yunnan province.

The most commonly known salt of copper, copper sulphate, known variously by the names *shidan* 石膽, *bishi* 畢石, *heishi* 黑石, *danfan* 膽礬, *lizhishi* 立制石, *junshi* 君石, *tongle* 銅勒 and *qishi* 碁石 is described by the *Shennong bencaojing* as having the ability of changing iron into copper, and forming gold and silver.¹⁸⁸ This probably referred to the precipitation of copper from copper sulphate on an iron surface. Li Shizhen says that to identify copper sulphate from imitation materials one can put iron or copper wetted with the solution into a flame; the red colour will indicate the genuine substance. Tao Hongjing says that *jishifan* 雞屎礬, probably an impure form of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$, when put in vinegar and then applied on iron, will impart the colour of copper.¹⁸⁹ The basic acetate of copper, *tongqing* 銅青 or *tonglu* 銅綠 according to the description of Li Shizhen, was made by allowing vinegar to act on copper until the latter turned green.¹⁹⁰ From another description quoted by Li Shizhen from Chen Zangqi 陳藏器 that this was the green substance deposited on the surface of copper vessels, *tongqing* can also refer to a basic carbonate, $\text{CuCO}_3 \cdot \text{Cu}(\text{OH})_2$, called *vedigris*, similar in composition to malachite.¹⁹¹

Malachite, known (variously) as *luqing* 綠青, *shilu* 石綠 and *dalü* 大綠, is said by Li Shizhen to occur in copper foundries.¹⁹² He thinks that copper will acquire a green coating with time, and after a long time the metal will change into stone to become malachite. The large hollow variety, known as *kongqing* 空青, is said in the *Shennong bencaojing* to have the power to change copper, iron, lead and tin into gold. Regarding *kongqing* as $\text{Cu}(\text{OH})_2 \cdot \text{CuCO}_3$, Yuan Hanqing interprets this passage as meaning the formation of yellow-coloured alloys when heated with copper, iron, lead and tin, and hence the term 'into gold'.¹⁹³ However, in the mind of the Chinese alchemist, transmutation was a possibility. For example, it is asserted by Tao Hongjing that this transmutation can only be realised after the substance is first made into an elixir. Yuan Hanqing also draws attention to the interesting connection with copper mentioned in the *Tang bencao* 唐本草 (Tang Pharmacopoeia) saying 'when the *qi* 氣 of copper is forced out it gives birth to *kongqing*'.¹⁹⁴ The stratified variety of malachite, *cengqing* 曾青, is also regarded by the *Shennong bencaojing* as having the property of changing into gold and copper.¹⁹⁵ Again, taking *cengqing* as azurite $\text{Cu}(\text{OH})_2 \cdot 2\text{CuCO}_3$, Yuan Hanqing says that it forms a yellow-coloured alloy when heated with copper, and hence the term 'into gold'.¹⁹⁶ Li Shizhen quotes from *Baopuzi neipian* saying that rubbing *cengqing* on iron will give it a red colour like copper. Dugu Tao says that *cengqing* can form an alliance with mercury and that it can prevent cinnabar from subliming (*zhi* 制). The light-

coloured variety of azurite (*baiqing* 白青) has already been mentioned earlier as an elixir substance.

Persian zingar, or cupric chloride, known in Chinese pharmacopoeia as *yanlu* 鹽綠, *luyan* 綠鹽 or *shilu* 石綠 originally came from Sasanian Persia. Su Song says that it was a product of Karasar (Yanqi 焉耆) and the *Mingyi bielu* warns against the use of the imitation substance made locally from copper and vinegar as a medicine.¹⁹⁷ According to the *Tang bencao*, common salt, copper and sal ammoniac mixed together and left for a long period in an atmosphere of carbon dioxide will give rise to cupric chloride, $\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$.¹⁹⁸

Silver

Silver (*yin* 銀)¹⁹⁹, the so-called *white metal* (*baijin* 白金) to the Chinese, is said in the pharmacopoeia to occur often in mines together with copper. Tao Hongjing knows that silver forms an amalgam with mercury.²⁰⁰ Su Song says that silver mixed with large quantity of lead is graded as inferior. Kou Zongshi warns against the use of imitation silver made from cinnabar, or from lead and mercury, or from copper. The *Baozanglun* 寶藏論, discussed earlier, lists seventeen kinds of silver, of which four are regarded as genuine and the rest false. In medicine, silver was often used in the form of silver fragments (*yinxie* 銀屑). It was the practice of the alchemist to mix silver fragments with mercury and to grind the amalgam together with saltpetre and salt into a powder. This was then heated to remove the mercury and washed to remove the excess saltpetre and salt for use as a medicine. Li Shizhen points out that this substance was poisonous and that silver used for medicinal purposes should not be previously treated in this manner. An amalgam of silver, called *yingao* 銀膏 was also used in Chinese medicine. According to Su Song this can be prepared by mixing tin (*baixi* 白錫) and copper foils with mercury.

Gold

Known under the synonyms *huangya* 黃牙 and *taizhen* 太真, gold (*Jin* 金)²⁰¹ has been regarded by the Chinese as the chief of the metals because of the fact that it does not form a coating (of oxide) even when buried over a prolonged period, and it will not lose weight no matter how many times it is subjected to fire. The noble metal was recovered in China both in the form of nuggets, known as *kekuaijin* 顆塊金, as gold dust, called *fujin* 欸金 when obtained from river beds and *shajin* 沙金 when mined. Pharmacopoeia caution against the use of imitation gold as a substitute for the real metal. Li Shizhen also warns against confusing copper foil with gold leaf. In medicine, gold was generally used in the form of gold fragments (*jinxie* 金屑).

Group II

Calcium compounds

Shihui 石灰²⁰² is calcium oxide, often with calcium hydroxide as an impurity. Known variously in the pharmacopoeia as *shie* 石堊, *ehui* 堊灰, *xihui* 希灰, *duanshi* 鍛石, *baihu*

白虎 and *kuanghui* 礦灰 it is said, according to Tao Hongjing, to occur near mountains and is bluish-white in colour. Su Song says that it is of two types—one becomes anhydrous when exposed to wind, and the other becomes hot when water is poured over it and decomposes. Li Shizhen says that it is obtained by making a kiln, then laying a layer of firewood or coal underneath and piling the blue calculable stone over it. When fire is applied from below, the stones break up layer by layer. Dugu Tao says that lime prevents realgar, sulphur and sal ammoniac from subliming and that it removes the tint found on lead.

Mercury and its compounds

Mercury, one of the most extensively used elixir ingredients of the Chinese alchemist, is known in Chinese pharmacopoeia under the names *shuiyin* 水銀, *gong* 汞, *lingye* 靈液 and *chanü* 姦女.²⁰³ According to the *Shennong bencaojing* mercury turns back into *dan* 丹 when melted in the fire. Yuan Hanqing interprets the product as mercury oxide, saying that mercury on being heated oxidises and becomes HgO with a red colour.²⁰⁴ *Dan* can therefore be regarded here as an abbreviation for *sanxiandan* 三仙丹, *hongshengdan* 紅升丹 or *diaojindan* 吊金丹, all of which have been identified as mercury oxide. Tao Hongjing says that when mercury is heated the powder deposited on the cover (of a reaction vessel) is called *gongfen* 汞粉 or *shuiyinhui* 水銀灰 that Yuan Hanqing suggests to be mercury oxide.²⁰⁵ Tao Hongjing also mentions that mercury can be recovered from cinnabar and that when mixed with gold or silver mercury will form a paste. He then points out that the resulting amalgam can be used for plating metals.

In a method described by Su Song for the recovery of mercury from cinnabar by descensory distillation, a jar manufactured in Yangcheng 陽城 is filled with cinnabar mixed with pieces of hard charcoal. The mouth of the jar is covered with a thin iron sheet perforated with small holes. The iron sheet is held in position by tying a length of iron wire round the jar, which is then inverted and placed on top of another jar containing water so that the mouths of the two jars fit together. A lute made up of salt, mud and pig's hair is applied all over the upper jar, particularly at the rim where the two jars meet. When the lute becomes dry the lower jar is buried in the earth so that the rim appears about an inch above ground. A stove is then built surrounding the upper jar so that fire can be applied all round to heat its contents. Four openings are provided, one on each side of the furnace, to permit the supply of air to keep the fire burning. After one double-hour mercury will trickle down into the lower jar.

This quotation by Liu Wentai 劉文泰 is from the *Tujing yanyi bencao* 圖經衍義本草 (Illustrated Dilations upon Pharmaceutical Natural History),²⁰⁶ and it is interesting to note that it differs somewhat in certain details from the quotation made from the same book by Zhang Cunhui and Li Shizhen. In Zhang's *Chongxiu Zhenghe jingshi zhenglei beiyong bencao* a diagram is given to illustrate the process (Figure AI.1).²⁰⁷ There is no mention of Yangcheng and nor is it necessary to put the two vessels in close contact. Another method by descensory distillation from a text called the *Hu Yan danyao mijue* 胡演丹藥秘訣 (Secret Formularies For Hu Yan's Elixir Medicine) somewhat similar to the one just described is also quoted by Li Shizhen.²⁰⁸ It is interesting to compare these with those mentioned in alchemical texts.

A method of extracting mercury from the *machixian* 馬齒莧 plant (*Portulaca oimcea*) from the *Tujing bencao* can be found in Li Shizhen's book. The method says that the plant with small leaves should be used. When dried every 10 pounds of the plant will yield 8 to 10 ounces of mercury. The plant is first pounded with a pestle made from the wood of a *Sophora japonica* (*huai* 槐) tree and then placed on a stand built facing eastwards towards the sun. The plant becomes dry after two or three days, and will look as if it has been left for a long time. After heating it is sealed inside a pottery jar and buried underground. Mercury will be obtained after 49 days.

Li Shizhen also quotes Kou Zongshi on the properties of mercury, saying that together with lead it congeals (*ning* 凝), with sulphur it makes an alliance (*jie* 結) and when ground together with the fleshy part of dates it separates (*san* 散). There are separate methods for making calomel (*nifen* 膩粉) and purified calomel (*fenshuang* 粉霜) by heating mercury. When ground together with saliva, mercury can kill fleas. With mercury copper becomes lustrous. When introduced into a corpse it will delay the process of decomposition. Gold, silver, copper and iron float on mercury. With *ziheche* 紫河車 (*Paris polyphylla*, Sm.) mercury will be subdued (*fu* 伏) (i.e. its distillation is delayed or prevented), and with *Xanthoxylum piperitum* (*chuanjiao* 川椒) it will collect together (*shou* 收). Mercury can hook (*gou* 勾) gold. It can ooze (*yongquan* 湧泉) and has to be tightly enclosed in a container (*kui* 匱) in order to kill (*si* 死) its *qi* 氣 Li further quotes Zhen Quan 甄權, saying that mercury can subdue (*fu*) the Five Metals turning them into the form of a paste, in other words, forming amalgam.²⁰⁹

Another common elixir ingredient used in medicine is cinnabar (*dansha* 丹砂, also known under its synonyms *zhusha* 朱砂, *yundansha* 雲丹砂, *machisha* 馬齒沙, *dousha* 豆砂, *mosha* 末砂, *tusha* 土砂, *shisha* 石砂, *zhenzhu* 真朱, *guangmingsha* 光明砂, *mayasha* 馬牙砂, *wuzhongsha* 無重砂, *Yuesha* 越砂, *lusu* 鹿藺, *miaoliusha* 妙硫砂, *baitingsha* 白庭砂, *jinzuosha* 金座砂, *meibaisha* 梅柏砂, *baijinsha* 白金砂, *chengshuishu* 澄水砂, *yuzuosha* 玉座砂, *chenjinsha* 辰錦砂, *furongsha* 芙蓉砂, *yinchengsha* 銀成砂, *jianzusha* 箭鐵砂, *caomosha* 曹末砂, *jingmiansha* 鏡面砂, *pingmiansha* 平面砂, *shenmosha* 神末砂, *jinxingsha* 金星砂 and *Basha* 巴砂).²¹⁰ It is already noted early in the *Shennong bencaojing* that cinnabar can be converted into mercury (in the presence of heat). The pharmacopoeia gives details regarding the identification of various types of cinnabar ores, noting their lustre, colour, size and general appearance. Warning is given by Tao Hongjing that cinnabar should not be confused with a mixture consisting of realgar and orpiment. Lei Xiao 雷教 says that iron in the presence of cinnabar turns into something looking like mud and powder (*ru ni si fen* 如泥似粉). He must be referring here to iron sulphide. Vermilion (*yinzhu* 銀朱) can be produced, according to the *Hu Yan danyao mijue*, by melting 2 pounds of sulphur in a new pan, which is then mixed with 1 pound of mercury and stirred together. The resulting substance, called *qingsha* 青砂, is to be ground to a fine powder and put in a jar, which is then covered with a stone slab, made airtight with a lute and put over a strong fire. After removal from the fire and cooling, vermillion can be found adhering to the inside of the jar, while cinnabar will gather around the mouth of the jar. Each pound of mercury will yield 14.8 ounces of vermillion.

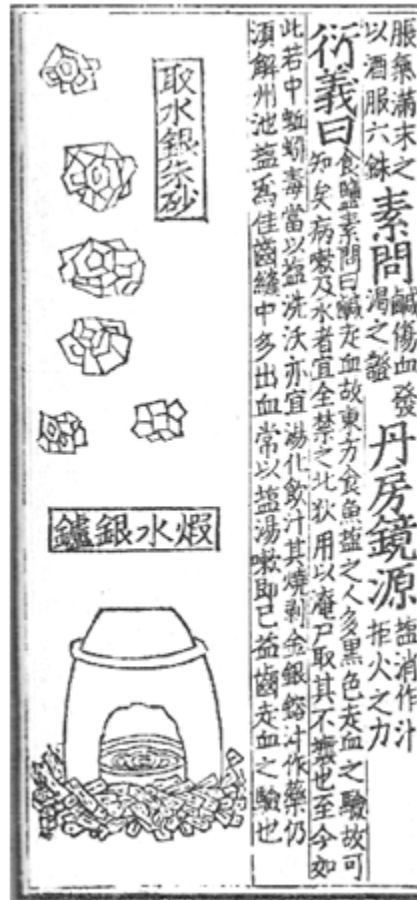
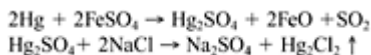


Figure AI.1 Illustration of the recovery of mercury from cinnabar by descensory distillation from the *Chongxiu Zhenghe jingshi zhenglei beiyong bencao* (juan 4).

The sulphide of mercury, *lingsha* 靈砂, or *erqisha* 二氣砂²¹¹ was also popularly used in Chinese medicine. Several methods of preparation can be found in pharmacopoeia. These methods consist essentially of taking four parts of mercury and one part of sulphur by weight, the latter being in a powdered form, heating and stirring the mixture in a pan over a gentle fire, and after cooling sealing the content in a jar, which is then heated at the bottom and water cooled at the top. The sublimate collected from the top of the jar was called *lingsha* and the residue *qingjiindan tou* 青金丹頭. Yuan Hanqing regards the former as the red crystalline form of the sulphide and the latter as black-coloured sulphide. He explains the reactions as follows:²¹²



The other common compound of mercury known to the Chinese is calomel. In the less pure form it is called *shuiyinfen* 水銀粉, *gongfen* 汞粉, *qingfen* 輕粉, *nifen* 膩粉, *qiaofen* 峭粉 etc.²¹³ Li Shizhen gives two different methods of preparation. One method involves the use of one part of mercury to two parts of alum and one part of common salt by weight, another uses ten parts of mercury to seven parts of green vitriol (*zaofan* 皂礬) and five parts of common salt by weight. In the first method it is said that for every ounce of mercury 0.8 ounce of calomel can be produced. The method consists of grinding the three ingredients together until they become even before they are placed on an iron plate and covered with an inverted basin. The basin and the plate are sealed airtight with a lute made of ash from the furnace and salt water. On being heated from underneath calomel will sublime and adhere to the top of the basin. Yuan Hanqing explains the process by the following chemical reactions:²¹⁴



It is interesting that the Chinese attributed the formation of calomel to the use of green vitriol rather than common salt. Li Shizhen quotes from a work called the *Haikelun* 海客論 (Discussion of the Guest from the Sea) saying:

The alums do not combine (*xianghe* 相合) with mercury, but why do green vitriol and common salt together produce a change (*zhi* 制) in mercury making it into calomel? The reason is that mercury is the spirit of the metals and vitriol is the essence of iron. The *qi* of the two come from the same root, and hence they can be made into calomel. Without common salt the substance will not be of a white colour.

He also gives two methods for the preparation of the purified form of calomel, known in pharmacopoeia as *fenshuang* 粉霜, *shuiyinshuang* 水銀霜, *baixue* 白雪 or *bailingsha* 白靈砂.

²¹⁵ One method says that one ounce of ordinary calomel is to be put in an earthenware jar and stirred before the mouth of the jar is covered with a lamp-bowl, which is to face upwards. The rim is to be covered with a lute of salt and mud. A gentle charcoal fire is now applied below the jar, while the inside of the lamp-bowl is continuously wiped with a piece of wet paper. The fire is then made more intense until it reaches the neck of the jar. After the jar is allowed to cool, purified calomel, which looks like white wax, will be formed. The Chinese method of allowing water to evaporate continuously over one surface of the lamp-bowl, though certainly more laborious, is a more efficient cooling system than keeping a fixed quantity of cold water in the same container. It has been suggested that in the development of the East Asian still the cover which gave rise to the still-head could have been convex to the distillation space.²¹⁶ It is interesting here to have the cooling surface in an apparatus used for sublimation convex to the sublimation space. The other method, quoted from the *Waitai miyao* 外臺秘要 (Secret Essentials from the Outer Terrace), came from an old recipe from the Cui 崔 family. It says that 10 ounces

each of mercury and sulphur are to be heated separately in a pan until the mercury becomes hot and the sulphur melts away. At this point the two are to be quickly put into the same pan and stirred vigorously. It cautions that if the mixing is not done quickly enough then the two substances will not come together. After a while the sulphur will turn into ash and no more mercury will be seen. Then, 10 ounces of fine earth taken from the stove (*fulonggan* 伏龍肝) and 1 ounce of powdered common salt are stirred with the product and poured into another pan over a layer of common salt of about a tenth of an inch in thickness.²¹⁷ After covering the contents of the pan with another layer of common salt one-tenth of an inch thick, an earthenware basin is inverted over the pan and the rim is sealed by a lute of salt, earth and mud. It is then heated over a fire, first gently and then with increasing intensity, for a double-hour. Finally, the basin is removed and the sublimate collected using a brush. The operation has to be repeated another six times, each time adding 2 ounces of powdered salt. Liu Youliang has suggested that this method would produce HgCl_2 rather than Hg_2Cl_2 .²¹⁸ A third method mentioned by Liu Wentai involves the use of saltpetre (*yanxiao* 焰硝) common salt, alum, green vitriol and mercury as ingredients and using first an iron pan for heating and later a jar for obtaining calomel by the process of sublimation.²¹⁹

Group IV

Chalcedony

Yugao 玉膏, known also by the names *baiyusui* 白玉髓, *yuzhi* 玉汁 and *yuye* 玉液, in Chinese pharmacopoeia,²²⁰ is said to be the liquid found in the matrix at the jade mines. Chen Zangqi says that it can be made by first softening jade into a muddy form by the use of the grease from a toad (*chanchugao* 蟾蜍膏) and dissolving it in vinegar. Yuan Hanqing thinks that Chen Zangqi must be referring to some false jade that came from some kind of carbonates.²²¹

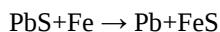
Lead and its compounds

The Chinese distinguished several types of lead ore (*qian* 鉛),²²² one of which, called *caojieqian* 草節鉛 appears to be galena. According to the *Mingyi beilu*, as quoted by Liu Wentai, when this ore is broken up and burnt it gives off the odour of sulphur. It is interesting that the Chinese mention gold, silver and copper together with lead, as compared to our modern knowledge that small amounts of such metals and other impurities often occur together with lead ore. Yuan Hanqing has pointed out that this is an early record showing that the Chinese knew that lead ore contains sulphur.²²³ Li Shizhen quotes from the obscure book *Tuxiu zhenjun bencao* 土宿真君本草 (The Pharmacopoeia of the True Lord Tuxiu) saying,

Lead is the progenitor of all metals (*qian nai wujin zhi zu* 鉛乃五金之祖).²²⁴ Hence it is also called the warden and pursuer (*bihan zhuihun shizhe* 狴狴追魂使者) of the metals because of its ability to bring the metals under submission (*fu* 伏) and to kill (*si* 死) the eight stones (*bashi* 八石).

Orpiment (*cihuang* 雌黃), being the outcrop (*miao* 苗) of gold, contains the *qi* of lead, and hence lead is the progenitor of gold. Lead is found in silver pits and so it is the progenitor of this white metal. Copper occurs together with lead ore in Xinzhou 信州, hence lead is the progenitor of copper. Lead and tin have the same *qi* and so lead is the progenitor of tin. Cinnabar is subdued by lead, but is killed by sulphur. Sulphur has an affinity for lead, but is subdued by sal ammoniac. Iron has an affinity for the lodestone, but is killed by lead. Realgar has an affinity for lead, but is killed by the five siliceous clays (*wushizhi* 五石脂). Therefore lead undergoes the most number of changes. It can change first into white lead (*hufen* 胡粉), secondly into the red oxide of lead (*huangdan* 黃丹), thirdly into litharge (*mituoseng* 密陀僧) and fourthly into lead acetate (*baishuang* 白霜).

Li Shizhen also gives a method for recovering lead from its ore, which probably refers to galena. The ore is roasted in an iron pan (*tiediao* 鐵銚). When melted the contents are poured over a tile and the residue is removed by filtering. The process has to be repeated several times. The reaction can be explained by the equation:



White lead is known in Chinese pharmacopoeia by the names *hufen* 胡粉, *fenxi* 粉錫, *jiefen* 解粉, *dingfen* 定粉, *qianhua* 鉛華, *wafen* 瓦粉, *guangfen* 光粉, *baifen* 白粉, *shuifen* 水粉 and *gongfen* 宮粉.²²⁵ Tao Hongjing says that it is made from lead. Li Shizhen mentions several methods of producing white lead. They generally involved warming lead sheets over a long period of time in the presence of vinegar vapour. He also quotes another method used by the inhabitants of Songyang 嵩陽 for making white lead. The people there would suspend lead sheets for 49 days in a sealed jar containing wine. White lead would be formed when the sheets were taken out. The remains could be heated over a fire to form red oxide of lead and litharge. It is interesting to compare this with the 'Dutch process' of making white lead, where lead acetate is formed at the intermediate stage. The book also points out the occupational disease of these workers, saying that the vapour emitted in the process was quite poisonous.

A process for making red oxide of lead, variously known as *qiandan* 鉛丹, *qianhua* 鉛華, *yandan* 鉛丹, *yanhua* 鉛華, *huangdan* 黃丹, *danfen* 丹粉 and *zhufen* 朱粉 in the pharmacopoeia is contained both in the *Mingyi bielu* and Dugu Tao's *Danfang jianyuan*.²²⁶ The former is quoted by Liu Wentai and the latter by Li Shizhen. According to the *Mingyi bielu* 1 pound of lead, 1 ounce of crude sulphur (Dugu Tao says 10 ounces), and 1 ounce of saltpetre are required. The lead is first melted and vinegar is introduced drop by drop. When heated to boiling a small piece of sulphur is put in followed by a little saltpetre. When it boils again some vinegar is poured in as before and then again followed by sulphur and saltpetre. The process is repeated until all the sulphur and saltpetre are put in. After roasting the product can be made into powder, which is red oxide of lead.

Lead acetate, called *qianshuang* 鉛霜 or *qianbaishuang* 鉛白霜,²²⁷ can be prepared, according to Su Song, by treating 15 ounces of lead and 1 ounce of mercury together and

then making the amalgam into small pieces, which are then put into a jar of vinegar and sealed for a long period. Li Shizhen mentions another method without involving the use of mercury. Here lead is made into the shape of coins so that a string can be passed through the central holes. These pieces are thus suspended over a basin of vinegar about 3 inches away. The whole set-up is covered by a pottery basin and left in a cool place. Lead acetate will deposit on the lead coins and can be removed by scraping with a brush.

The Chinese word for litharge, *mituoseng* 密陀僧 or *meiduoseng* 沒多僧,²²⁸ came from the Persian *mirdasang* or *murdasang* of the same meaning.²²⁹ Known also by the synonym *ludi* 爐底 it first came to China from Persia, but Su Song says that it was also found in the silver and copper foundries of Guangdong and Fujian provinces. The method of extraction according to Su Song is to mix and melt this silver ore containing litharge together with lead. The molten mixture is poured over a pit containing ash and fire is applied over it so that the lead will sink down and the silver will remain on top of the ash. Litharge is then recovered from the bottom of the pit. Litharge was also prepared using a method for making white lead as mentioned earlier.

Group V

Ammonium chloride

Another substance said to be used for soldering is sal ammoniac, known in pharmacopoeia under the names *naosha* 礪砂, *diyan* 狄鹽, *beitingsha* 北庭砂, *qisha* 氣砂, *tougu jiangjun* 透骨將軍 and *nongsha* 農砂.²³⁰ According to the *Mingyi bielu* it can soften gold and silver. Su Song says that it can transform the Five Metals and the Eight Minerals. Kou Zongshi says that it can be used to test imitation gold or silver, because the specimen will dissolve in a pot of sal ammoniac if it is not genuine. Li Shizhen points out that it can be kept dry by putting it in a container suspended over a fire, but if it is kept in a moist place it will turn into a liquid.

Compounds of arsenic

A common arsenic-bearing mineral is arsenopyrite, FeAsS, known to the Chinese pharmacists as *yushi* 礬石.²³¹ It is also known under the synonyms *baiyushi* 白礬石, *Taibaishi* 太白石, *lizhishi* 立制石, *qingjieshi* 青介石, *guyangshi* 固陽石, *shiyen* 石鹽, *zeru* 澤乳 and *shuxiang* 鼠鄉. Of its alchemical properties, Tao Hongjing says that it can soften the metals, and Su Song states that it can resist fire, as after prolonged heating it will merely break up, but without losing its hardness, that is, melting. This second property of arsenopyrite can be employed, continues Su Song, for distinguishing it from white gypsum (*lishi* 理石), which will burn to ash. Tao Hongjing also mentions that arsenopyrite will prevent water from freezing. The coloured variety of the mineral is called *tesheng yushi* 特生礬石, *cang yushi* 蒼礬時, *cangshi* 蒼石 or *shudu* 鼠毒 (rat poison). A fine flaky type with a yellowish white colour is called *woxue yushi* 握雪礬石. Quoting from Dugu Tao, Li Shizhen says that one part of this substance will combine with one hundred parts of mercury by weight.

Arsenious oxide, As_2O_3 , known in Chinese pharmacopoeia as *pishi* 砒石, *renyan* 人言 and *xinshi* 信石 is the substance commonly called arsenic.²³² In the raw form it was known as *pihuang* 砒黃 and after roasting it was called *pishuang* 砒霜. According to Kou Zongshi the former could be covered by an inverted vessel and heated from below, then the latter could be collected from the sublimate, which would adhere to the inside of the cover, suspending downwards like mammalian glands. Li Shizhen also warns about the poisonous vapour given off during the process of roasting.

Orpiment, As_2S_3 , is known in Chinese as *cihuang* 雌黃.²³³ According to Tuxiu zhenjun's book both the trisulphide and the disulphide of arsenic were *Yang* 陽 minerals—that which had not received sufficient *qi* was orpiment, and that with sufficient *qi* was realgar, the time difference between the two was 500 years. According to Dugu Tao, orpiment can soften the Five Metals, dry up mercury, transform sulphur, and prevent calomel from undergoing sublimation. It is also said that realgar will change into iron, and orpiment into lead.

The disulphide, realgar (*xionghuang* 雄黃),²³⁴ according to the Chinese belief of mineral metamorphosis, will transform into gold after a thousand years. Ge Hong mentions that it turns into a liquid when treated with saltpetre and that it can change copper and silver into gold. It is also known under the synonyms *huangjinshi* 黄金石 and *shihuang* 石黃 in Chinese pharmacopoeia. The dark variety of the disulphide is called *xunhuang* 熏黃.

Group VI

Sulphur

Sulphur is variously known under the names *shiliuhuang* 石硫黃, *liuhuang* 硫黃, *huangnaosha* 黃礬砂, *huangya* 黃牙, *Yanghou* 陽侯 and *jiangjun* 將軍 in Chinese pharmacopoeia.²³⁵ The *Shennong bencaojing* mentions its efficacy of changing gold, silver, copper and iron. Yuan Hanqing interprets it as the formation of sulphides with metals.²³⁶ Li Shizhen notes that saltpetre (*xiaoshi* 消石) can turn sulphur into a liquid, and that sulphur contained in a bamboo tube and kept in a horse-dung bed for a month will also do likewise. This probably refers to the formation of carbon disulphide. Dugu Tao says that sulphur can dry up mercury, that it turns black when coming into contact with the Five Metals (gold, silver, copper, iron and lead), but with mercury its colour turns red.

Group VII

Iron and its compounds

The Chinese used iron (*tie* 鐵, with synonyms *heijin* 黑金 and *wujin* 烏金, both meaning 'black metal') in the forms of wrought iron (*shutie* 熟鐵 or *xutie* 鑄鐵), cast iron (*shengtie* 生鐵) and steel (*gangtie* 鋼鐵).²³⁷ Lei Xiao 雷教 says that when iron meets cinnabar (*shensha* 神砂) it will look like earth and powder. We find very little in the

pharmacopoeia concerning the alchemy of iron except a passage on the metamorphosis of the mineral Li Shizhen quotes from the *Tuxiu Zhenjun bencao* that reads,

Iron receives the *qi* of the Greater *Yang*. At the beginning of its formation, rock salt (*lushi* 鹵石) was produced. After one hundred and fifty years it became magnetite (*cishi* 慈石), which after a gestation period of two hundred years became iron. If it is not taken out of the mine and worked on, it will become copper after another two hundred years. Copper will transform into silver, and silver into gold. Hence iron came from the same root as gold and silver. This can be verified by breaking magnetite and finding iron pieces inside it....

Li Shizhen also quotes a sentence from the *Guanzi* 管子 (Book of Master Guan) saying that where there is haematite (*zhe* 赭) above, iron will be found below. This aspect of mineral prospecting by the empirical association of one rock or mineral with another is already discussed in greater length earlier in this chapter and also by Needham.²³⁸

Su Song says that black oxide of iron (*tieluo* 鐵落 also called *tieye* 鐵液) comes from pieces falling out during the forging and beating of iron. Li Shizhen observes that if one writes on a piece of paper with black oxide of iron and vinegar and then smears ink over the back of the paper, one will get the same effect as writings carved on a stone tablet. He also mentions that one can obtain acetate of iron (*tiehuafen* 鐵華粉) by sprinkling salt water over the polished surface of pieces of iron plates and then suspending the plates over vinegar for a period of 100 days.

Tiejing 鐵精 is identified by Read and Pak as either oxide of iron or iron acetate. According to the *Shennong bencaojing* it has the property of being able to change copper (*neng hua tong* 能化銅).²³⁹

The hydrate of ferrous sulphate, $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$, commonly called green vitriol or copperas, is known in Chinese pharmacopoeia as *lufan* 綠礬, *zaofan* 皂礬 and *qingfan* 青礬.²⁴⁰ According to Su Song, when the substance was placed on an iron plate and heated over a charcoal fire, which is assisted by blowing with bellows, a red-coloured liquid would flow out and after giving out all its liquid the substance would look like red oxide of lead (*huangdan* 黃丹). Su Jing said that this test could be used for distinguishing between green vitriol and copper sulphate. This red substance is known as *jiangfan* 絳礬 or *fanhong* 礬紅 in Chinese pharmacopoeia. Yuan Hanqing explains that this method of testing consists essentially of finding out whether the substance will decompose, on application of heat, to Fe_2O_3 .²⁴¹ Li Shizhen mentions the use of green vitriol for making dyes.

A method for the preparation of the sulphide of iron, *zijingdan* 紫精丹, can be found in the fourteenth-century medical treatise *Pujifang* 普濟方 (Prescriptions of Universal Benefit).²⁴² Two ounces of finely powdered sulphur and 4 ounces of fine powdered iron (*zhensha* 針砂) are ground together until even and 2 pints of boiling water poured over it. The water is removed when it has cooled down and the ingredients are then sealed in an airtight pot and warmed over a long period with a gentle fire. The fire is then intensified until the jar becomes red hot. After cooling the content is ground to a fine powder. The powder is collected after washing with hot water, but what remains sticking to the bottom is discarded. The operation is repeated ten times and any iron that remains is removed by

filtration. The product is then placed on layers of paper and dried by putting over some ash.

Conclusions

While the Daoist alchemist's primary objective was the realisation of the drug of immortality, rather similar to the *elixir vitae* of the West with the efficacies of transmutation, healing and prolonging life, the Chinese pharmacist studied the alchemical properties of many natural substances to make it possible to produce certain medicinal products. Liebig (1803–73) asserted that alchemy was never anything different from chemistry. This cannot be truer than in the case of Chinese alchemy of stones and minerals as practised by the pharmacist. Some of the substances used by the Chinese physician, like copper vitriol, corrosive sublimate (mercury chloride), sugar of lead (lead acetate) and arsenic compounds were among the drugs later used for the first time in Europe by Paracelsus.

Alchemy in the West was interwoven with mysticism, mythology, astrology, magic and religion. Alchemical writings in the West were characterised by their vagueness and their frequent use of crypticism and symbolism. The same is often true with Daoist alchemical texts. However, the pharmacopoeia usually give such lucid and precise descriptions of alchemical experiments that they sound quite familiar to the modern chemist. As mentioned earlier, the Chinese method of preparing white lead, for example, almost reads like the *Dutch process* for the industrial production of the carbonate.

One can find many parallels in Chinese and Western alchemy. Mercury and sulphur were common ingredients in Western alchemy, and so were they in China. Egyptian craftsmen used to make imitation gold by the use of copper salts. In the West transmutation was sometimes called 'tingeing'—*Mare tingerem, si mercurius esset*. Chinese pharmacopoeia made many references to imitation gold, from the use of copper sulphate for the precipitation of copper to the application of amalgams to produce such forgeries. As seen in Chapter 4, Chinese sources point out the many types of forgeries to alert the reader rather than to describe the process of making them. The aim of the Chinese alchemist was to make real gold and not forgeries! In Western alchemy terms like 'petrefaction' or 'mortification' were applied to the 'death' of a metal usually through oxidation. The Chinese alchemist spoke in terms of *si* 死 (death) and *sha* 殺 (kill). The central and crucial feature of the preparation of the Philosopher's Stone consisted of heating the ingredients concerned over a prolonged period and under the right condition in the sealed vessel of Hermes. We find similarity in the heating of the sealed reaction vessel over days and months in Chinese alchemy.

The present study has been restricted only to the study of inorganic substances in the Chinese pharmacopoeia. As organic substances are employed in far larger number than stones and minerals in Chinese medicine, Chinese pharmacopoeia are bound to contain information on the alchemy of the former. Even in the Daoist Canon organic substances had a part to play. We found this in our study of aqueous solutions in the *Sanshiliu shuifa* 三十六水法 (Thirty-Six Methods of Bringing Solids into Aqueous Solutions), where acetic acid reacts with various organic substances over long periods to produce various sort of solutions.²⁴³ The alchemical texts discussed in this book clearly show the increasing use

of organic substances with time. Further study on the alchemy of organic substances in China would be of interest.

Appendix II

Extracts from al-Bīrūnī's pharmacopoeia with added commentaries

When discussing Dugu Tao we should not neglect parallel developments in his country of origin so as to obtain a fuller picture of intercultural contact between China and the Arab world. The time when Dugu Tao wrote his *Danfang jianyuan* fell in the historic period of the blossoming of Arabic science that began in the ninth century during the reign of al-Mamūn (813–33). In the next century came the celebrated alchemist and Muslim philosopher al-Rāzī (c.865–923/932), who was better known in Europe under his transliterated Latin name Rhazes. He viewed himself as the Islamic version of Socrates in philosophy and of Hippocrates in medicine. He wrote extensively on medicine, including the *Kitāb al-Hāwī* (Comprehensive Book), where he surveyed Greek, Syrian and early Arabic medicine, as well as some Indian medical knowledge. Throughout his works he added his own considered judgement and his own medical experience as commentary. As we shall soon see, his commentary contained knowledge that came from China. After this great writer of Islamic medicine came Ibn Sīnā (980–1037), popularly known in Europe under his Latinized name Avicenna. He was the most famous and influential of the philosopher-scientists of Islam and the author of the *Canon of Medicine* (the *Qānūn*), which is among the most famous books in the history of medicine both East and West. Indeed, until modern times, for a long time in Europe the rule held that he who would be a good physician must be a good Avicennist.²⁴⁴ Dugu Tao happened to be sandwiched between the shadows of these two eminent personalities.

Ibn Sīnā had a younger contemporary in the person of al-Bīrūnī (973–1048), a Persian scholar and scientist and one of the most learned men of his age. The two had corresponded with each other. Known as the Father of Islamic Pharmacy, al-Bīrūnī also excelled in astronomy, mathematics, chronology, physics, medicine and history and wrote widely on many subjects. We are fortunate to have a full translation with commentary of his original Arabic text *Kitāb al-Šaydanah fī al-Tibb* (Book on Pharmacy and Materia Medica) that throws some light on the transmission of knowledge from China to the Arabic world before the time of Dugu Tao as indicated by its frequent reference to al-Rāzī.²⁴⁵ While many of his quotations came from ninth-century sources; it is interesting to note that some of them traced back to the first century to the time of the great Greek physician and pharmacologist Dioscorides (AD 40–c.90), whose work became the primary text of pharmacology in Europe and continued to be in use until the end of the fifteenth century. His one reference to China quoted by al-Bīrūnī points to intercultural contact between China and East Europe in the first century.

Items touching on China in the *al-Saydanah* are extracted below with references from Chinese sources added as annotations.

Excerpts from the *Kitāb al-Ṣaydanah fī al-Tibb*

(Items in the translated text [indented] are arranged in the order of the Arabic alphabet. My comments follow each entry. The original wordings of the translation from Hakim Mohammad Said (1973) are preserved without change.)

[Abbreviations:

BG=*Bencao gangmu*

RL=Read and Liu (1936)]

Alif**6. *Ābnīs* (Commentary identifies as *Diospuros ebenum* Koen (family, *Ebenaceae*))**

Exegetists have said that this wood...is brought from the country of Nasa' in the interior of China (commentary 5 says in the north of China). It gives off a sweet smell and is heavier than water. I believe this wood to be ebony. The people of Arabia made their bows from a wood from China. It is called *jauz* but preserves from its fruit are not made. The bows are then blackened with fat, and they look like *shizī*. This, however, seems to be quite plausible.

Ebony (*wumu* 烏木) occurs in Hainan, Yunnan and regions occupied by the southern tribal people. Its wood is lacquer black in colour, heavy, hard and fine (BG *juan* 35, p. 2046; RL 190). *Jauz* is walnut (*Juglans regia*, L.), which is indigenous to Kashmir, Iran and China. In China it bears the name huamu 樺木 (BG *juan* 35, p. 2047; RL 619), also called *hutao* 胡桃 in the *Kaibao bencao* 開寶本草 (Pharmacopoeia of the Kaibao Reign), suggesting that the Chinese knew about walnuts produced outside China not later than the tenth century. *Tiangong kaiwu* 天工開物 (The Exploitation of the Works of Nature), *juan* 15 mentions the use of its bark for wrapping round handles of bows and lances to protect the hand, while BG adds that such a use was particularly popular among the foreign *hu* 胡 people.

11. *Abhul* or *Uphul* (Commentary says *Junierus sabina*, L.)

Rāzī holds that as an emmenagogue and as a drug in the treatment of foetal disorders its substitute would be the Chinese cassia.

The Chinese cassia is *jueming* 決明 (BG *juan* 16, p. 1056; RL 379), used in the treatment of eye disorder, head pain, nose bleeding, spreading of ringworm and ulcers, snake poison and eruptions on the back.

98. *Anīsūn* (Commentary says aniseed; *Foeniculum vulgare*, Mill.)

The *Hurmus* is ascribed as an unauthoritative book in which it has been said: '*Anīsūn Rūmī* is moderately hot, while the Persian and Hindi varieties are hot and dry, and the Chinese variety is cold and soft.'

In the *Tang xinxiu bencao* 唐新修本草 (Tang Pharmacopoeia) aniseed is known as *huaixiang* 懷香 (BG juan 34, p. 1951; RL 222).

Ba'

4. *Bādhzahr* (Commentary says a bezoar-type of stone)

According to Hamzah its sources are the remote parts of India and the borders of China.

Chinese pharmacopoeia mention several such types of stones, such as *niuhuang* 牛黃 from an ox, *goubao* 狗黃 from a dog, *shehuang* 蛇黃 from a snake and *tuohuang* 駝黃 from a camel. The general name for gallstone is *pishi* 礬石.

Jīm

1. *Chā'i* (Commentary says tea)

It is said that *chāh* is a Chinese word and is meant for an herb which grows at high altitudes there... The people (of China and Tibet) cook it and preserve it in a cube-shaped vessel after desiccating it. It has the characteristics of water but is especially beneficial in overcoming the influence of bibulation. For this reason it is taken to Tibet where people are habituated to quaffing considerable quantities of wine and there is no better medicine for negating the effect of liquor than this herb. Those who transport it to Tibet accept nothing to barter but musk... The people (of China and Tibet) drink it. It is said that they drink it with hot water and believe it to be a cholagogue and blood purifier. A person who travelled in the place of its occurrence has stated that the king of that country resides in the city of Yanjū. A big river like the Tigris traverses through this city. Both sides of the river are studded with wine sellers' tenements, kilns, and shops. People flock there to drink tea, and do not take Indian cannabis clandestinely. The king of the place receives the capitation tax, and the public cannot transact the sale of tea, since both tea and wine are in the possession of the king. He who transacts business in salt and tea without the king being aware of it is awarded the punishment due to a thief. And the people there slay the thief and eat his flesh. Profits from such places go to the coffers of the king and such profits equal those accruing from gold and silver mines.

Some physicians have mentioned in their pharmacopoeia that tea is a plant produced in China. The people of that country make tablets from it and take them to foreign lands. These pharmacopoeia also describe the origin of tea. A Chinese king became displeased with one of his courtiers whom he exiled from the city in the direction of the mountains. The courtier was seized by a fever, and one day he trudged, in a desperate state, towards the mountain valleys. He was being gnawed by hunger and

he only saw tea plants, whose leaves he ate. After a few days his fever began to abate. He continued eating tea leaves till he recovered from the fever completely.

Another courtier happened to pass this way. He saw the courtier who had staged this remarkable recovery, and informed the king about it. The king was surprised at this and he called the exiled courtier to his court. He was rather pleased to see that the courtier had become as healthy as he was before exile and enquired from him the reason for his recovery. The courtier thereat narrated the remarkable medicinal properties of tea. The king thereupon ordered that tea should be tested, and his physicians enumerated its advantages to him. They also began to incorporate tea in medicines.

(The Commentary points out that this text and the *Akḥbār al-Sīn* contain the two earliest recorded accounts of tea by Muslim writers going back to the ninth century and that the story about people slaying the thief and eat his flesh is obviously based on hearsay accounts. It also mentions another legend ascribing the discovery of tea to the Buddhist patriarch, Bodhidharma, who died in AD 495, from whose eyelids sprang the tea plant and says that al-Bīrūnī's legend seems to bear a greater resemblance to reality. It also says that tea leaf is not a febrifuge, but it is astringent, stimulant, gentle excitant, and diuretic.)

The interesting stories given in the text do not appear in Chinese pharmacopoeia. In the *Tang bencao* tea is also called *ming* 茗 (*BG juan* 32, p. 1870).

9. *Jadwār* (Commentary says *Curcuma zedaria*, L.)

It is brought from Kha ā, which is in China.

This is known as *pengemao* 蓬莪茂 in the *Kaibao bencao* (*BG juan* 14, p. 883; RL 648). Kha ā could perhaps be China itself.

Kha'

1. *Khāwalanjān* (Commentary says greater galangal)

It is brought from China along with gold thread and Chinese rhubarb. Arranjānī regards Chinese cassia tree as its substitute Ibn Māsawāib holds one and a half times its weight of Chinese cassia tree to be its succedaneum, and, in the case of its being not available, one half by weight of cloves.

(The Commentary says that it is *kann-leang-keang* and *liang keang* in Chinese and that it was introduced to Iran during the Sassanid period in the sixth century AD.)

This is *gaoliang Jiang* 高良薑 (*Alpinia officinarum*, Hance), named after its place of origin Gaoliang 高良 according to Tao Hongjing and which Li Shizhen identified as Gaoliang 高梁, a former township in Linfen xian, Shanxi province (*BG juan* 14, p. 862).

24. *Khutū* (Commentary says rhinoceros horn)

Ibrahim Sandānī once travelled in the desert of China with a nomadic tribe. He has narrated that when the sun was about to set, the people accompanying them dismounted from their horses and prostrated themselves. He also prostrated himself. The orison continued till the sun disappeared completely from view. On Ibrahim's enquiry why this was being done, the people explained that they considered the sun to be a god in the form of a very big bird whose habitat is a barren and uninhabited desert, between Zanj and China, feeding on huge elephants which cannot be tamed, and which they called *khutū*... When I inquired from the emissaries of Qutai Khan about *khutū*, they were unable to tell me anything substantial except that it is like the people said and that, when it is taken close to a poison, it becomes wet. They say that it is the bone from the forehead of a bullock.

This is another interesting traveller's tale about China, but it records one of the medicinal attributes accorded to the rhinoceros horn (*xijiao* 犀角) in Chinese medicine, namely detection of poison. The use of bullock horns as forgeries is also well known even today (*BG juan* 51, p. 2829; Read (1931), item 355).

37. *Khusraw dārū* (Commentary says *galangal*, see under *khawalanjan*)

The substitute for *khusraw dārū* is Chinese cinnamon and half its weight of nettle seeds.

Cinnamon (*gui* 桂) is mentioned in the *Shennong bencaojing* 神農本草經 (The Pharmacopoeia of the Heavenly Husbandman) (*BG juan* 34, p. 1925; RL 494).

47. *Khilāf* (Commentary says Egyptian willow; *Salix aegyptica*)

The red variety is shown upside down in the temples of China when its branches incline downwards towards the ground and a sort of cupola is formed.

This is not an accurate explanation of the drooping branches of the Chinese willow. It refers probably to the red variety of willow called *chiyang* 赤楊 (*BG juan* 35, p. 2035).

Dāl

4. *Dār Šīnī* (Commentary says Ceylon cinnamon)

There is one variety which is thickset, smaller, ruby-colored, and whose peel is like that of Chinese cinnamon. Although hard, it is not too hard: its root is thick. This variety has a fragrance more or less like that of mastic, or like that of myrtle or Chinese cinnamon, is nearly useless as regards quality.

Abū Muā'dh writes: 'The African *dār chīnī* and spurious *dār chīnī* are both *qīrfah* (Commentary says an inferior type of cinnamon); this has been so stated by Paulos. Its substitute is an equivalent weight of Chinese cinnamon.' Galen writes: 'If required in bitter cathartics, its substitute could be the highquality Chinese cinnamon.'

See *Kha'* item 37 earlier.

21. *Dulfin* (Commentary says dolphin)

Cleopatra says that it is a fish, which is called *dulfin* in Egypt, and in Basrāh and the Indian and Chinese seas *dukhas*.

Dukhas is not the Chinese name for dolphin. The Sanskrit name is *garbha*.

26. *Dand* (Commentary says croton seeds; *Croton tiglium*, L.)

Arrajānī and Rasāyilī write that the best variety grows in China.

This is *badou* 巴豆 mentioned in the *Shennong bencaojing* (BG juan 35, p. 2052; RL 322).

Zā'

7. *Zarāwand* (Commentary says *Aristolochia spp.*)

According to Ibn Māsawaih the substitute for *zarāwand* is an equivalent or half weight of Chinese rhubarb.

Chinese rhubarb is *dahuang* 大黃, mentioned in the *Shennong bencaojing* (BG juan 17, pp. 1115 ff.; RL 582).

12. *Zarnab* and *Zarfaqt* (Commentary suggests yew, *Taxus baccata*, L.)

Rāzī asservates [sic] that its potency is almost equal to that of Chinese cinnamon, and, with the incorporation of cubeb, equals Chinese rhubarb's.

For cinnamon and rhubarb, see earlier entries.

22. *Zanjabīl* (Commentary says ginger)

Abdul Hanīfah says: 'It is endemic to the villages of Oman. The bundles found underground are the rhizomes and not the plants. It is a plant like *elecampane*. The Chinese or the *Zangī* is appreciated more than the other varieties.'

For Chinese ginger, see BG juan 26, pp. 1620 ff.; RL 650.

25. *Zūfā Yābis* (Commentary gives hyssop; *Hysoppus officinalis*, L.)

Rāzī writes on the authority of Ibn Māsawaih to say that the substitute for moist *zif~* is the mixture of the brain of the cow, one-fourth weight of spikenard, and one-sixth weight of Chinese cinnamon.

For cinnamon, see earlier entries.

Sīm

20. *Su'd* (Commentary says *Cyperus rotundus*, L.)

Grammarians say that *kilān* grows on the riversides of China, where the rivers advance and recede. Its root is called *Khawalanjan*; it is brought from China.

Galingale (also galangal) is the aromatic rhizome of East Asian plants of the genera *Alpinia* and *Kaempferia*, used in medicine and cookery. Some sedge of the genera *Cyperus* also have roots with similar properties. There is a separate entry in the text for *Khawalanjnn*, which is *Alpinia officinarum*, Hance. The Commentary, however, gives *Su'd* as *Cyperus rotundus*, L., which is *xiangfu* 香附, another well-known plant root used in Chinese medicine. It appears both had found their way to the Arab world not later than the tenth century.

27. *Sukk* (Commentary says a compound perfume)

Ibn Māndawaih says: '*Sukk*, in fact, is brought from China and is made from dried or fresh *emblic mycrobalan*. When *emblic mycrobalan* became difficult to procure, the apothecaries began to make it in the manner of black perfume mixed with musk by mixing raw dates and oak galls. It then became a substitute for the Chinese drug.' ... The real *sukk* is Chinese and is prepared from *emblic mycrobalan*.

The Chinese name for *emblic mycrobalan* is *yuganzi* 俞甘子, also known as *anmole* 菴摩勒 in the *Tang bencao* (BG *juan* 31, p. 1824; RL 330).

58. *Sumbādhaj* (Commentary says coarse corundrum employed for polishing purposes)

Dioscorides has this to say: 'It is very smooth. Gems of rings are cleaned by it. It is produced in the mines in China.'

This is *jingangshi* 金剛石, used for polishing jade and mending porcelain (BG *juan* 10, p. 615).

Fā'

34. *Filfil* (Commentary says long pepper; *Piper longum*, L.)

Ummanī writes: ‘If you leave for China from Sarbazah (Sadbazah) you will sail northward through the islands of Zabaj in the sea of Harkand. It is from here that pepper is brought.’

(The Commentary says that probably the text refers to Malaysia and Indonesia.)

This looks like a ninth-century reference to the spice trade between the Arab world and South-East Asia.

Qāf

15. *Qaranful* (Commentary says clove; *Syzygium aromaticum*, L.)

Atārad says: ‘It is the fruit of the Chinese orange. Its peel is the *qirfah-iqaranful*...’

Atārad is referring here to the Chinese orange (*Citrus mobilis*, Lour.), the peel of which has medicinal value in Chinese pharmacopoeia (*BG juan* 30, p. 1792; RL 348).

35. *Qāsa* (Chinese cassia tree)

Rāzī says that it is the Chinese cassia tree. And they are the particles which come off while iron is being round.

The Commentary says: ‘This is a rather incongruous statement, for the author calls the Chinese cassia tree and iron filings *qāsa* at the same time. It may be that *qāsa* is also the name given to iron filings, but this fact has not been mentioned in the text.’

The Chinese cassia tree (*Cassia tora*, L.) is known in Chinese as *juemingzi* 決明子 or simply *jueming* (*BG juan* 16, p. 1056; RL 379).

Kāf

30. *Kamāfī us* (Commentary says a species of *Celsia* (family *Sorophulariaceae*))

Rāzī says: ‘Its substitute is (a mixture of) half its weight of *assafoetida* and a quarter weight of Chinese cassia.’

For the Chinese cassia tree, see the item earlier.

Mīm

5. *Māmīrān* (Commentary says this is probably *Coptis teeta* Wall.)

There are two varieties of the herb. One variety is Chinese and is the best.

This is *huanglian* 黃連 (*BG juan* 13, p. 771; RL 534).

33. *Misk* (Commentary says musk)

In one book it has been stated: 'The best is the Chinese, then the Tibetan, followed by the Tūmastī, Nepalese, Khutaī, Tartarean, Kirghīzī, and Oceanic in that order. It is called *moron* in Roman and *maska* in Syriac.'

Musk she 麝 is mentioned in the *Shennong bencaojing* (*BG juan* 51, p. 2867; Read (1931) item 369).

56. *Milb* (Commentary says common salt)

Al-Kindī says: 'The Chinese salt is crystalline, which women incorporate into fattening gruels.'

Crystal salt, *rongyan* 戎鹽, is mentioned in the *Shennong bencaojing*. Various types of common salt are described in the pharmacopoeia, for example in *BG juan* 11. See RP 115, 116, 117 and 118.

Wāw

6. *Al-ward al-* 'Irāqī (translator gives dog-rose)

Dog-rose is called *ward-i-Chīnī* in China.

This is not the Chinese name for the dog-rose, but rather the name to indicate the country of origin. It is called *qiangwei* 薔薇 in the *Shennong bencaojing* and is also known as *wushi* 蕪實 in some pharmacopoeia. See Wong Shiu Hon (1989), nos. 1935, 1936 and 1937.

Yā'

6. *Yashm* (Commentary says a sort of jasper or agate; one particularly which, according to Castellus, comes from China or India, and has the quality of diverting lightning from any place where it is laid, or from any person who wears it.)

Ibn Māsah writes about *yashab* in the following words: 'Yashab is the name of a white Chinese stone as well.'

From the item it is under, this white Chinese stone should be a sort of jasper or agate, which is *manao* 瑪瑙. However, Chinese sources regard the better quality variety of this stone as coming from west of China. The most popular Chinese precious stone has always been jade. Perhaps the text is referring to its white variety.

Table I
A glossary of common Chinese alchemical terms

<i>Chinese term</i>	<i>Literal meaning</i>	<i>Alchemical meaning</i>
<i>an</i> 安	To place	To set up, to place
<i>chou</i> 抽	To draw out	To distil
<i>dian</i> 點	To act upon; to project	Small quantity of a substance producing changes in a large quantity of another substance
<i>dianhua</i> 點化	- Ditto	- Ditto
<i>duan</i> 煅	To forge	To heat to a high temperature
<i>fei</i> 飛	To fly	Sublimation; distillation; vaporisation
<i>fu</i> 伏	To subdue; to prostrate	To extract; to prevent or delay the process of sublimation or distillation; the product
<i>gou</i> 勾	To hook	To combine; to extract
<i>guan</i> 關	To shut	To enclose
<i>guji</i> 固濟	To stop the flow	To seal with a lute
<i>hua</i> 化	To change	To change; to melt
<i>huakai</i> 化開	To decompose	To melt
<i>jiao</i> 澆	To water	To pour out a hot liquid and allow it to cool slowly
<i>jie</i> 結	To tie up, to form an alliance	To combine
<i>jiu</i> 灸	To cauterise	To apply heat locally
<i>lian</i> 煉	To refine	To heat a substance without water
<i>lin</i> 淋	To soak	To dissolve a substance partially in water and then separate the solution from the residue
<i>muyu</i> 沐浴	To bathe	To grind
<i>ning</i> 凝	To congeal	To solidify; to harden
<i>san</i> 散	To disperse	To separate
<i>sha</i> 殺	To kill	To change the original form or properties of a substance

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<i>Chinese term</i>	<i>Literal meaning</i>	<i>Alchemical meaning</i>
<i>sheng</i> 昇	To rise	Sublimation; distillation; vaporisation
<i>si</i> 死	To die	To change the original form or properties of a substance
<i>yan</i> 研	To grind	To grind
<i>yang</i> 養	To nourish	To apply heat gently over a period
<i>zhi</i> 制	To control	To prevent or delay the process of distillation or sublimation; to produce a change
<i>zhu</i> 煮	To boil	To heat a substance put in water
<i>zhuan</i> 轉	To turn round	Cycle of changes

Source: Reproduced, with slight modifications, from Ho Peng Yoke (1968), p. 157.

Table II
 Plant names and properties in *Chunyang Lü*
Zhenren yaoshizhi and *Xuanyuan Huangdi*
shuijing yaofa

		Chunyang lü zhenren yaoshizhi	Xuanyuan Huangdi shuijing yaofa
1	Term used	<i>tianbao</i> 天寶 heavenly precious	Same
	Plant name	<i>chiqin</i> 赤芹 <i>Corydalis incise</i> , Pers.	<i>chijie</i> 赤芥 ²⁴⁶
	Properties	Fixes the five metals ²⁴⁷ , and the eight minerals, and translates copper	Fixes (<i>fu</i> 伏 cinnabar)
2	Term used	<i>baosha</i> 寶砂 precious sand	<i>jinsha</i> 錦砂 embroidered sand
	Plant name	<i>sangye</i> 桑葉 mulberry leaves	Same
	Properties	Translates copper	Fixes cinnabar
3	Term used	<i>dujie</i> 對節 opposing joints	Same
	Plant name	<i>yimu</i> 益母 <i>Leonurus sibiricus</i> L.	Same
	Properties	Fixes the five metals and the eight minerals	Missing
4	Term used	<i>weitang</i> 味棠 delicious pear	Same
	Plant name	<i>dulier</i> 杜梨兒 small coarse pear	Same
	Properties	Fixes mercury	Same
5	Term used	<i>erqi</i> 二氣 two cosmic <i>pneumata</i>	Same
	Plant name	<i>shanheye</i> 山荷葉 umbrella leaf	Same
	Properties	Fixes sulphur and mercury	Same
6	Term used	<i>guanzhong</i> 五鳳 wood fern	Same
	Plant name	<i>wufeng</i> 管仲 five -phoenixes	Same
	Properties	Missing	Fixes the five metals and the eight minerals
7	Term used	<i>tianren</i> 天刃 celestial blade	Same
	Plant name	<i>changpu</i> 菖蒲 <i>Acorus gramineus</i> , Ait.	Same
	Properties	Translates realgar	Fixes realgar

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8	Term used	<i>dijin</i> 地錦 embroidered carpet	Same
	Plant name	<i>yiban</i> 衣班 thyme-leaf spurge	Same
	Properties	Fixes realgar	Same
9	Term used	<i>jinsuo</i> 錦綹 inlaid lock	Same
	Plant name	<i>xudian</i> 續斷 white nettle	Missing
	Properties	Fixes saltpetre, translates copper	Fixes saltpetre and cinnabar and translates copper
10	Term used	<i>ganlu</i> 甘露 sweet dew	Same
	Plant name	<i>gancao</i> 甘草 licorice	Same
	Properties	Fixes arsenic	Fixes cinnabar
11	Term used	<i>jinmei</i> 金美 golden beauty	<i>jinmai</i> 金麥 golden wheat
	Plant name	<i>yangti</i> 羊蹄 yellow dock	Same
	Properties	Fixes calomel, translates copper and silver	Fixes copper and translates red metal (copper)
12	Term used	<i>miwu</i> 覓烏 searching crow	Missing
	Plant name	<i>yingtao</i> 櫻桃 cherry	Missing
	Properties	Translates sal ammoniac	Missing
13	Term used	<i>jinsi</i> 金絲 golden thread	Same
	Plant name	<i>tusi</i> 兔絲 choisy or dodder	<i>zhangliu</i> 章柳 poke root
	Properties	Fixes sulphur	Same
14	Term used	<i>wuyou</i> 無憂 without anxiety	<i>huzhao</i> 虎爪 tiger claw
	Plant name	<i>xuancao</i> 萱草 yellow day lily	Same
	Properties	Missing	Fixes sal ammoniac; translates the five metals and the eight minerals
15	Term used	<i>suiyan</i> 碎焰 flame-crusher	Same
	Plant name	<i>huzhai</i> 護宅 <i>Sedum alboroseum</i> , Bak.	Same
	Properties	Fixes sal ammoniac, copper and iron	Fixes sal ammoniac and translates (metals) into gold
16	Term used	<i>baixue</i> 白雪 white snow	Same
	Plant name	<i>tuchuanghua</i> 禿瘡花 <i>mazus rugosus</i> , L.	<i>tuchuangcao</i> 禿瘡草
	Properties	Fixes sulphur	Same

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17	Term used	<i>wuxin</i> 無心 heartless (plant)	Same
	Plant name	<i>banxia</i> 半夏 <i>Pinellia tuberifera</i> , Ten.	Same
	Properties	Fixes copper and translates mercury and cinnabar	Fixes copper and translates the red metal
18	Term used	<i>jinsi</i> 金絲 golden thread	<i>jinse</i> 金色 golden colour
	Plant name	<i>tusi</i> 兔絲 dodder	<i>tusizi</i> 兔絲子 dodder
	Properties	Fixes mercury	Same
19	Term used	<i>lurong</i> 鹿茸 deer antler	Same
	Plant name	<i>lancao</i> 藍草 indigo plant	<i>lanye</i> 藍葉 indigo plant
	Properties	Fixes cinnabar and arsenic	Fixes cinnabar and translates arsenic
20	Term used	<i>yuping</i> 玉瓶 jade vase	Same
	Plant name	<i>luobo</i> 蘿蔔 <i>Raphanus satinus</i> , L.	Same
	Properties	Fixes cinnabar	Same
21	Term used	<i>yuying</i> 玉英 jade-like elegance	Same
	Plant name	<i>liuxu</i> 柳絮 common willow catkins	Same
	Properties	Missing	Fixes mercury
22	Term used	<i>xuandou</i> 懸豆 hanging beans	Same
	Plant name	<i>zaojia</i> 皂莢 soap bean	<i>huaijiao</i> 截角 <i>Sophora japonica</i>
	Properties	Fixes sal ammoniac and translates copper	Fixes cinnabar
23	Term used	<i>jinjing</i> 金精 gold essence	Same
	Plant name	<i>daji</i> 大戟 Peking spurge	Same
	Properties	Fixes mercury	Same
24	Term used	<i>wuye</i> 五葉 five-leaves	Same
	Plant name	<i>machi</i> 馬齒 purslane	Same
	Properties	Fixes cinnabar	Same
25	Term used	<i>shuifu</i> 水浮 water-floating	Same
	Plant name	<i>fuping</i> 浮萍 duckweed	Same
	Properties	Fixes sal ammoniac	Fixes sal ammoniac and translates the five metals and the eight minerals
26	Term used	<i>tongding</i> 通頂 balding (plant)	Same
	Plant name	<i>gujingcao</i> 谷精草 pipewort	Same

Table II 161

	Properties	Fixes cinnabar	Same
27	Term used	<i>digu</i> 地骨 earth bone	Same
	Plant name	<i>gouqi</i> 枸杞 <i>Lycium chinense</i> Mill.	Same
	Properties	Fixes cinnabar	Same
28	Term used	<i>diding</i> 地丁 land attendant	Same
	Plant name	<i>cheqianzi</i> 車前子 <i>Plantago major</i> , L.	Same
	Properties	Fixes mercury	Same
29	Term used	<i>muer</i> 木耳 woody ear	Same
	Plant name	<i>foercao</i> 佛耳草 <i>Auricularia auricula-judae</i> , Schr.	Same
	Properties	Translates realgar	Fixes realgar
30	Term used	<i>dipan</i> 地盤 earth bowl	Same
	Plant name	<i>heye</i> 荷葉 lotus leaves	Same
	Properties	Fixes arsenic	Fixes the five metals and the eight minerals
31	Term used	<i>wanzhang</i> 萬丈 extreme length	Same
	Plant name	<i>songluo</i> 松蘿 pine creepers	<i>tengge</i> 籐葛 creepers
	Properties	Fixes cinnabar	Same
32	Term used	<i>zihua</i> 紫花 purple flower	Missing
	Plant name	<i>ciji</i> 刺薊 tiger thistle	Missing
	Properties	Fixes arsenic and mercury	Missing
33	Term used	<i>xiangmu</i> 香木 fragrant wood	Missing
	Plant name	<i>chunmu</i> 椿木 <i>Cedrela sinensis</i> , Juss.	Missing
	Properties	Fixes arsenic, translates copper and iron	Missing
34	Term used	<i>jinrui</i> 金蕊 golden stamens	Same
	Plant name	<i>juhua</i> 菊華 chrysanthemum flower	Same
	Properties	Fixes sulphur	Same
35	Term used	<i>wudou</i> 烏豆 black bean	<i>wushi</i> 烏石 black stone
	Plant name	<i>heidou</i> 黑豆 black soybean	Same
	Properties	Fixes cinnabar	Same
36	Term used	<i>yuanye</i> 圓葉 round leaf	Same
	Plant name	<i>xianlingpi</i> 仙靈脾 <i>Epimedium macranthum</i> , Morr. et Dene.	Same
	Properties	Fixes realgar	Fixes cinnabar

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37	Term used	<i>xiangfu</i> 香附 fragrant acronite	Same
	Plant name	<i>shacao</i> 莎草 nutgrass	<i>shacaogen</i> 莎草根 nutgrass roots
	Properties	Fixes arsenic	Fixes realgar
38	Term used	<i>cisha</i> 慈砂 magnetic grains	Same
	Plant name	<i>tiannanxing</i> 天南星 Jack-inthe-pulpit	(<i>Tian</i>) <i>nanxing</i>
	Properties	Kills iron and transmutes copper	Fixes realgar
39	Term used	<i>yihua</i> 異花 uncommon flower	Same
	Plant name	<i>shaoyao</i> 芍藥 Chinese peony	Same
	Properties	Transmutes calomel	Fixes copper and transmutes the red metal
40	Term used	<i>longbao</i> 龍寶 dragon treasure	<i>huabao</i> 花寶 flower treasure
	Plant name	<i>mudan</i> 牡丹 tree peony	Same
	Properties	Fixes calomel	Fixes copper and translates the red metal
41	Term used	<i>yongqing</i> 永青 evergreen	Same
	Plant name	<i>song</i> 松 pine	Same
	Properties	Fixes mercury	Same
42	Term used	<i>cebai</i> 側柏 inclined arbor vitae	Same
	Plant name	<i>bai</i> 柏 <i>arbor vitae</i>	<i>baizi</i> 柏子 <i>Arbor vitae</i> cones
	Properties	Fixes calomel and changes white silver	Fixes the five metals and the eight minerals
43	Term used	<i>jinhua</i> 金華 golden flower	Missing
	Plant name	<i>kui</i> 葵 Chinese mallow	Missing
	Properties	Missing	Missing
44	Term used	<i>zijin</i> 紫金 purple gold	Same
	Plant name	<i>zhangliu</i> 章柳 poke root	Same
	Properties	Fixes metals and minerals and stops sulphur	Fixes realgar
45	Term used	<i>didan</i> 地膽 earth gall	Same
	Plant name	<i>tusizi</i> 兔絲子 <i>Cuscuta japonica</i>	Same
	Properties	Fixes arsenic and enters sulphur	Same

Table II 163

46	Term used	<i>tiesuo</i> 帖索 dangling rope	Same
	Plant name	<i>yangjiaomiao</i> 羊角苗 Chinese yam	<i>banjia</i> 半甲 [?]
	Properties	[Stanza missing]	Fixes mercury
47	Term used	<i>jingtu</i> 淨土 earth cleaner	Same
	Plant name	<i>duzhoucao</i> 獨帚草 broom plant	<i>dusuicao</i> 獨穗草 broom plant
	Properties	Fixes cinnabar	Same
48	Term used	<i>daosheng</i> 道生 wayside growth	Same
	Plant name	<i>dibianzhu</i> 地編竹 knotweed, gooseweed	<i>bianzhu</i> 編竹
	Properties	Fixes arsenic and translates copper	Fixes the five metals and the eight minerals
49	Term used	<i>xianyi</i> 仙衣 immortal's dress	Same
	Plant name	<i>songluo</i> 松蘿 pine creeper	Same
	Properties	Fixes and vaporises metals and minerals; fixes mercury and kills sulphur	Fixes sulphur, translates cinnabar and fixes the five metals and eight minerals
50	Term used	<i>chizhao</i> 赤爪 red claw	Same
	Plant name	<i>bocai</i> 菠菜 spinach	Same
	Properties	Fixes arsenic	Fixes mercury
51	Term used	<i>xianzhang</i> 仙掌 immortal's palm	<i>jingou</i> 金鉤 golden hook
	Plant name	<i>cangpeng</i> 蒼蓬; <i>suanzao</i> 金鉤; wild jujubes	<i>suanzao</i> 酸棗 wild jujubes
	Properties	Fixes sulphur	Fixes the five metals and the eight minerals and fixes arsenic
52	Term used	<i>yinfa</i> 銀髮 silvery hair	Same
	Plant name	<i>cong</i> 蔥 <i>Allium fistulosum</i> , L.	Same
	Properties	Fixes arsenic, kills calomel	Missing
53	Term used	<i>xianli</i> 仙力 immortal power	Same
	Plant name	<i>jiu</i> 韭 <i>Allium odorum</i> , L.	Same
	Properties	Fixes copper	Fixes copper, translates the red metal
54	Term used	<i>changsheng</i> 長生 longevity	Same
	Plant name	<i>naidong</i> 柰凍 <i>Tracelospermum divaricatum</i> , K. Sch.	Same

Table II 164

	Properties	Fixes sulphur, translates copper and transmutes iron	Fixes sulphur
55	Term used	<i>sanhuang</i> 三黄 three yellow	Same
	Plant name	<i>dihuang</i> 地黄 <i>Rehmannia glutinosa</i> , Lib.	Same
	Properties	Fixes sulphur	Same
56	Term used	<i>chanshu</i> 纏樹 tree-entwiner	Same
	Plant name	<i>lingxiao</i> 凌霄 <i>Tecoma grandiflora</i> , Loisel	<i>lingxiaohua</i> 凌霄花 sky-reaching flower
	Properties	Translates mercury	Fixes mercury
57	Term used	<i>shesheng</i> 舍生 house-grown	Missing
	Plant name	<i>wasong</i> 瓦松 <i>Cotyledon fimbriata</i> , Turcz.	Missing
	Properties	Translates mercury	Missing
58	Term used	<i>naidong</i> 耐凍 cold-endurer	Same
	Plant name	<i>xiakucao</i> 夏枯草 <i>Prunella vulgaris</i> , L.	Same
	Properties	Translates mercury	Fixes mercury
59	Term used	<i>sangshen</i> 桑筍 mulberry cone	Same
	Plant name	<i>sangye</i> 桑葉 mulberry leaves	Same
	Properties	Commutes with sulphur and translates mercury	Fixes sulphur
60	Term used	<i>zhongyang</i> 中央 central (plant)	Same
	Plant name	<i>huangcao</i> 黃草 common mugwort	Same
	Properties	Fixes mercury	Same
61	Term used	<i>xuanqiu</i> 玄球 mysterious ball	<i>xuanqiu</i> 懸球 hanging ball
	Plant name	<i>qiezi</i> 茄子 eggplant	Same
	Properties	Translates copper	Same
62	Term used	<i>xianglu</i> 香爐 incense burner	Same
	Plant name	<i>zisu</i> 紫蘇 <i>Perilla nankinensis</i> , Decne.	Same
	Properties	Fixes sulphur	Fixes sal ammoniac, translates the five metals and the eight minerals
63	Term used	<i>qinglong</i> 青龍 empyrean dragon	Same
	Plant name	<i>gegenman</i> 葛根蔓 vine of <i>Oueraria lirsuta</i> , Schneid	Same
	Properties	Fixes mercury	Same

Table II 165

64	Term used	<i>dishen</i> 地參 earth ginseng	Same
	Plant name	<i>zhimu</i> 知母 <i>Anemarrhena asphodeloides</i> , Bge.	Same
	Properties	Translates cinnabar	Same
65	Term used	<i>zibei</i> 紫背 purple back	Same
	Plant name	<i>youdianye</i> 油點葉 <i>Potentilla kleiniana</i> , Wight	Same
	Properties	Kills cinnabar, fixes mercury	Same
66	Term used	<i>tianyan</i> 天焰 celestial flame	Same
	Plant name	<i>lianhua</i> 蓮華 lotus flower	Same
	Properties	Fixes mercury	Same

The following six items are not listed in *Chunyang Lü Zhenren yaoshizhi*:

1	Term used	<i>qingshu</i> 青樹 green tree	
	Plant name	<i>chunshu</i> 椿樹 <i>Cynanchum atratum</i> Bge. (?)	
	Properties	Missing	
2	Term used	<i>youmiao</i> 酉苗 evening shoot	
	Plant name	<i>jichangcao</i> 雞腸草 <i>Eritrichium pedunculare</i> , DC.	
	Properties	Fixes the five metals and the eight minerals	
3	Term used	<i>yuzhi</i> 玉汁 jade juice	
	Plant name	<i>woju</i> 萵苣 lettuce	
	Properties	Fixes copper, transmutes the red metal	
4	Term used	<i>weigan</i> 味甘 sweet tasting	
	Plant name	<i>ganzhe</i> 甘蔗 sugar cane	
	Properties	Translates copper, fixes realgar	
5	Term used	<i>qinzhū</i> 禽住 birds' abode	
	Plant name	<i>shesong</i> 舍松 household pine	
	Properties	Fixes mercury	
6	Term used	<i>jinyuan</i> 金苑 golden garden	
	Plant name	<i>jiao</i> 椒 pepper	
	Properties	Fixes cinnabar	

Table III
Chinese dynasties

Xia 夏	Second millennium BC
Shang 商	c. C16th–1045 BC
Zhou 周	
Western Zhou 西周	1045–771 BC
Chunqiu 春秋 (Spring and Autumn)	771–475 BC
Zhanguo 戰國 (Warring States)	475–221 BC
Qin 秦	221–207 BC
Han 漢	202 BC–AD 220
Sanguo 三國 (Three Kingdoms)	211–265
Jin 晉	265–420
Nanbei chao 南北朝 (Northern and Southern Dynasties)	479–581
Sui 隋	581–618
Tang 唐	618–906
Wudai 五代 (Five Dynasties)	907–960
Song 宋	960–1279
Liao 遼	907–1124
Jin 金	1115–1234
Yuan 元	1260–1368
Ming 明	1368–1644
Qing 清	1644–1911

Notes

Foreword, by T.H.Barrett

- 1 The point in question is made in He Bingyu 何丙郁 (1987), a good example of Professor Ho's writing directed at a non-specialist Chinese readership. I should perhaps note here that, due to variety of romanisation systems used for transliterating Chinese characters, Professor Ho's name can appear as Ho Peng Yoke, He Bingyu or Ho Ping-yü. Rest assured that they are all the same person.
- 2 Most recently Wilkinson, Endymion (2000), though this is but one of a number of helpful aids; note also, for example, Zurndorfer, Harriet T. (1995).
- 3 Note the admiring comment on the first essay republished here of Nathan Sivin on p. 14 of the 'Selected, Annotated Bibliography of the History of Chinese Science: Sources in Western Languages', published as item IX in Sivin, Nathan (1995).
- 4 For one recent and particularly well-documented contribution to this debate, see Volkov, Alexei (1996–7), pp. 1–58.
- 5 This bibliographical argument for an association between Taoism and science is advanced briefly on p. 29 of Barrett, T.H. (1998), pp. 425–30; one might further note that in the view of at least some Confucians, the construction of canonical compendia by both the Buddhists and the Daoists gave them a bibliographical advantage in preserving materials when compared with their secular rivals: see Nivison, David S. (1966), p. 78.
- 6 For some speculation on the origin of Dugu's family name, see Cohen, Alvin P. ed. (1979), p. 157. For the Japanese physician, see Barrett, T.H. (1994), pp. 71–7.
- 7 For the early exploitation of the Daoist Canon, see the introduction to Maspero, Henri (1981).
- 8 See the works of Chen listed in Bibliography B, especially Chen Guofu (2004). This work does contain on pp. 217–47 in revised form a couple of previously published indexes of alchemical materials keyed directly to the Daoist Canon editions of the source texts that certainly need to be consulted along with the index to the present volume.
- 9 On this topic, see my recent article Barrett, T.H. (2005).
- 10 This work, *Taoist books in the libraries of the Sung period* (London: Ithaca Press, 1984), forms one of the most valuable legacies of the remarkable scholarship of Piet van der Loon (1920–2002).
- 11 For quite an extensive coverage of these one may consult the introductory section of one of the most recent contributions to the field, Komjathy, Louis (2002).
- 12 For a good example of the exploitation of information of this sort, note Dudbridge, G. (1970), p. 122—this study, with its frequent explanations of the dating of literary materials, is in many ways complementary to Professor Ho's articles collected here as a source of good examples of scholarly practice. The work of Hucker, Charles O. (1985), provides a very convenient introduction to the nomenclature of the Chinese bureaucracy, but one that sometimes needs to be supplemented by more specialised studies in order to give precise dates for the period usage of specific official titles.
- 13 But for studies of the conventions used in describing similar figures, note Kieschnik, John (1997) and Berkowitz, Alan J. (2000), though it is also worth noting that Benjamin Penny has demonstrated in his essay 'Jiao Xian's Three Lives', in Penny, Benjamin ed. (2002), pp. 13–29, that one and the same figure may be described according to different conventions in different sources—including in this case a prototypical work of Daoist hagiography.

- 14 Dudbridge, G. (1970), pp. 91–2, shows how the titles awarded to other figures (in this case Confucius) may also be brought into play, as does Chen Guofu (2004), pp. 353–4.
- 15 See on this phenomenon my remarks in review of Trombert, Erik (1995) in Barrett, T.H. (1997), pp. 327–9.
- 16 For such a typical example, note in Huang Yunmei, ed. (1980), pp. 220–1, that the *Dongming ji*, a supposedly Han work, is assigned to the Six Dynasties on grounds of style, without any specific discussion of its language at all. For the original 1932 edition of Huang's work, the digest of traditional scholarship underlying it, and other similar research aids, see Tsien, T.H. (1978), pp. 182–4.
- 17 A good example of this type of scholarship would be the linguistic evidence brought forward by A.C. Graham on pp. 248–64 of his study 'The Date and Composition of *Lieh-tzu*', as reprinted in Graham, A.C. (1990), pp. 216–82.
- 18 Prominent among these would be the twenty volumes of the Hanazono University Concordance Series, published in the 1990s, though other texts outside this series have also been equipped with concordances in Japan.
- 19 See for example the dictionaries of Song and Yuan colloquial listed on p. 876 of Wilkinson, Endymion (2000).
- 20 These excellent studies, accessible through either English or Chinese or Japanese (with the author given as Seishi Karashima for the benefit of the first group of users) appeared as Volumes I and IV in the series *Bibliotheca Philologica et Philosophica Buddhica* (in 1998 and 2001 respectively) from the International Research Institute for Advanced Buddhism, Soka University, Tokyo. All the publications of this institute constitute significant additions to philological scholarship.
- 21 These publications were, respectively, Pulleyblank, Edwin G. (1991) and (1983).
- 22 Thus, for example, to state as he does on Chen Guofu (2004), p. 126, that the rhymes in the *Han wudi neizhuan* appear to date to the Han period may be true enough in itself, but still needs to be confronted with the evidence for a later date for this text assembled in Schipper, K.M. (1965). One possible resolution, however, as he points out on p. 355 with regard to the fourth-century Shangqing corpus to which Schipper relates the text, is that we should distinguish the main text from prefatory material. The Shangqing revelations may perhaps have functioned to validate existing materials in more cases than we realise. They certainly had this function with regard to one famous example concerning China's supposed earliest Buddhist text: see Robinet, Isabella (1984), p. 87.
- 23 Good examples of this alternative approach are Ho, Go and Lim (1972) and Ho, Go and Parker (1974), pp. 163–86. The online bibliography on Chinese alchemy prepared by Fabrizio Pregadio—currently located at <http://www.stanford.edu/~pregadio/index.html>—lists a number of other joint studies of this type carried out by Professor Ho on other occasions.
- 24 Note that Barrett, T.H. (2004), pp. 171–86, draws on the standard materials used entirely appositely in Ho and Needham (1959c), and yet finds other materials of contemporary date ultimately impossible to evaluate safely.
- 25 For republication in English, the original edition in Chinese has been replaced by a translation that appears here for the first time. On the earlier *Danfang jingyuan*, upon which it appears to have been based, see now also Chen Guofu (2004), pp. 119–20.
- 26 I have commented elsewhere on some aspects of this problem, with regard to materials somewhat earlier than those treated by Professor Ho, in Barrett, T.H. (2003), pp. 229–35.
- 27 Note, for example, that the standard handbook by Reynolds and Wilson (1991), pp. 234–7, pays due attention to this problem.
- 28 An extreme example of this tendency would seem to be offered by Wallis, Faith (1995), pp. 101–26.
- 29 For one mention in English of this *fluidity*—a term also used by other Japanese scholars—see p. 193 of Yanagida Seizan (1983), translated by John R. McRae.

- 30 For this phenomenon, see Gómez, Luis O. (1983), pp. 69–167. Note, however, that Sørensen, Hendrick H. (1989), pp. 132–4, goes so far as to talk of ‘text modules’ and a ‘source pool’, in Chan verse manuscripts—I am grateful to Antonello Palumbo for drawing this to my attention.
- 31 Chen Guofu (2004), pp. 50–74.
- 32 Currently the quickest way to do this is undoubtedly to consult Fabrizio Pregadio’s website (see note 23 above).

Preface

- 1 I am glad that they did serve some useful purpose in Cambridge. See for example, Needham and Lu (1983), pp. xxxiii, 455.
- 2 Culminating in Ho Peng Yoke (2003), *Chinese Mathematical Astrology: Reaching out to the Stars*, London and New York: Routledge/Curzon.
- 3 For a list of his publications to date, see his website, currently at <http://www.stanford.edu/~pregadio/cv.html>
- 4 See Barrett, T.H. (1994).
- 5 Furthermore, many of them were written in Chinese and several in Japanese.
- 6 This is not to be interpreted as a complaint. SCC has, in fact, devoted much more space to the Chinese alchemy section than to any other.
- 7 See Needham and Lu (1983).

1

Introduction

- 1 Boas, Marie (1962), pp. 166–7.
- 2 Yoshida, Mitsukuni (1970).
- 3 Ho Peng Yoke (2003), pp. 8, 23–4.
- 4 For a fuller description of the historical trends of Chinese alchemy, see Needham, Lu and Ho (1976).
- 5 For a recent study, see Pregadio, Fabrizio (2002).
- 6 Zhao Kuanghua (1984b).
- 7 Needham and Lu (1983), p. 23.
- 8 See ‘*Daozang* keben zhi sige riqi’ 道藏刻本之四個日期 in Liu Ts’un-yan (1991), Vol. 2:942–73.
- 9 See Chapter 3.
- 10 This was later reprinted in 1995 in the same city by Bashu shushe 巴蜀書店.
- 11 Note that a different collection was published under the same title in 1993.
- 12 The catalogue of Long Bojian (1957) contains 278 titles of Chinese pharmacopoeia still extant, while the much larger catalogue produced by the Zhongguo Zhongyi Yanjiuyuan Tushuguan (1991), pp. 155–207, lists nearly 400.
- 13 The most recent edition is Ma Jixing 馬繼興 *et al.* eds (1995). For introductions to traditional Chinese pharmacopoeia, see, for instance, Cheung, Kwan and Kong (1983); Shang Zhijun *et al.* (1989); Unschuld, Paul U. (1986).
- 14 The most recent of these is Wong Shiu-hon (1989). Identifications of modern specimens of substances mentioned in the *Bencao gangmu* pharmacopoeia are collected in Read and Pak (1936) and Read and Liu (1936). More recent reference to modern identifications of Chinese pharmaceutical substances include Jiangsu Xinyi Xueyuan (1977), and, largest of all, Guojia Zhongyiyao Guanliju (1999).

- 15 Read and Liu (1936), item 685.
- 16 *Bencao gangmu*, *juan* 2, pp. 95 ff.
- 17 As pointed out in Cheung, Kwan and Kong (1983), pp. 61 ff.
- 18 Masutomi Junosuke (1957) only proves that the specimen now preserved in Kyoto is not saltpetre but Glauber's salt. That is, not all specimens of *xiaoshi* are saltpetre, but one solitary sample does not prove that all specimens of *xiaoshi* in Tang China were not saltpetre.
- 19 Meng Naichang (1983), esp. pp.103 ff.
- 20 The reader is referred to Needham, Lu, Ho and Sivin (1980), pp. 1–210.
- 21 See Ho Peng Yoke (1979), pp. 69–70 on the use of some of these alchemical and pharmaceutical terms.
- 22 For descriptions of apparatus, see Ho and Needham (1959b) and Needham, Lu, Ho and Sivin (1980); for procedural terms, see Yuan Hanqing (1956), pp. 192 ff. and Ho Peng Yoke (1968), p. 157.
- 23 See Ho Peng Yoke (1968), p. 157; Ho Peng Yoke (1974), pp. 295–8 and Yuan Hanqing (1956), pp. 207–9.
- 24 Chen Guofu (1983b) elaborates further on both alchemical terms and alchemical equipment.

2

On the dating of Daoist alchemical texts

- 25 See pp. 3–4 earlier for the background to this collection for which the name Daoist Canon will be used throughout this book.
- 26 See Wylie, A. (1867), pp. 215–25.
- 27 See Wieger, L. (1911 and 1913).
- 28 See Liu Ts'un-yan (1974).
- 29 See Chen Guofu (1949), (1963) and (1983a) and Weng Dujian (1935).
- 30 An interesting exercise in the investigation of a spurious Daoist text can be seen in Wong Shiu Hon (1976).
- 31 Works in Western languages can be found in the ongoing bibliographies of Chinese religion compiled by Laurence Thompson and his colleagues, see Thompson and Song (2002); Thompson, Laurence G. (1985) and Thompson and Seaman (1993), (1998).
- 32 See for example the three volumes of Liu Ts'un-yan (1991). At the time of the preparation of this volume, the major studies of the Daoist Canon by Kristopher Schipper *et al.* were due for publication, see Schipper and Verellen eds (2005).
- 33 There was also Wong Shiu Hon doing research on the Daoist Zhang Sanfeng at the Australian National University in Canberra under the supervision of Liu Ts'un-yan. I was an external examiner for his doctoral dissertation. Later he became a colleague of mine for 6 years when I was head of the Chinese Department at the University of Hong Kong between 1981 and 1987.
- 34 At the time when Ho Peng Yoke (1979) was prepared for printing, facilities to insert Chinese characters with a word processor were not available. I was then on sabbatical leave in Hong Kong preparing Ho Peng Yoke (1980). The editor of the *Griffith Asian Papers* enlisted the help of Ling Wing Tim.
- 35 Some of the bibliographies in the official dynastic histories and in the compendia have been incorporated into the works of Wieger and Chen Guofu.
- 36 Naturally extra caution should be taken when dealing with Daoist hagiographies. See Liu Ts'un-yan (1974).
- 37 See Sivin, Nathan (1968) for a detailed account of the dating of this text.

- 38 Chen Guofu (1963) Vol. 2, p. 419 considers most of the prose in the *Taiqing jinye shendan jing* probably to belong to the fifth century. It appears that this Daoist text was a collection of works written separately by different people at different periods of time.
- 39 However, the *Yunji qiqian* itself is included in the *Zhengtong daozang*.
- 40 See *Yunji qiqian*, *juan* 63 to 87.
- 41 See Ho and Lim (1972).
- 42 See Chapter 3 of this book, and also Ho and Su (1970).
- 43 I made a full translation of the text of this book in the Daoist Canon in draft form during my first sojourn in Cambridge between 1958 and 1959. The draft of this tentative translation is preserved in the East Asian History of Science Library, Cambridge (Needham Research Institute archives, ref. SCC2/193/3). I was unaware of the quotations in the pharmacopoeia at that time. Users of the draft translation should note this omission.
- 44 See the Introduction provided earlier.
- 45 See Sivin, Nathan (1968).
- 46 Ibid. p.71.
- 47 See the studies by Pregadio, Fabrizio, for example (1995) and (2002) for the background to this important work.
- 48 The Daoist Canon includes another text submitted by Lu, namely the *Zhizhenzi longhu dadan shi* 至真子龍虎大丹詩 (Master Zhizhen's Poems on the Great Elixir of the Dragon and Tiger), written by Zhou Fang 周方 in 1026.
- 49 There were nine grades, each subdivided into two, namely *zheng* 正 (principal) and *cong* 從 (subordinate). The highest ranking officer was *zheng yipin* 正一品 (principal first grade) and the lowest *cong jiupin* 從九品 (subordinate ninth grade). For the civil service in China, see Kracke, E.A. (1953) and (1957) and Lo, Winston W. (1987).
- 50 *Zhongguo renming dacidian*, p. 1597.
- 51 *Shuofu* (Hanfen lou 誦芬樓 edition), *juan* 24, p. 23b.
- 52 *Qinding Siku quanshu zongmu tiyao*, *juan* 64, p. 1a.
- 53 *Zhejiang tongzhi*, *juan* 115, p. 4.
- 54 See *Shiyao erya*, *juan* 2, p. 3b. The character Tong 童 is missing in the *Shiyao erya*, but the name must be Huang Tongjun. *Lingsha* 靈砂 and *dansha* 丹砂 are synonyms for cinnabar.
- 55 For instance, Wang Li (1957) and (1963).
- 56 Wang Li (1963), p. 70. Of course, it is impossible for us to know exactly how people in the past pronounced their words, but linguists have succeeded in making educated guesses about how Chinese was spoken then. See for example, Kalgren, B. (1963).
- 57 The text gives only the word *xiong* 雄, which is normally an abbreviation for *xionghuang* 雄黃 (realgar) in Daoist alchemical texts. This identification is confirmed when we compare the *Chunyang Lü Zhenren yaoshizhi* with the glossary in the *Xuanyuan Huangdi shuijing yaofa*.
- 58 Rare exceptions can be found, for example, in the *Zhujia shenpin danfa* 諸家神品丹法 (Methods of the Various Schools for Magical Elixir Preparations) *juan* 4, which mentions the *zijin longya* 紫金龍芽 (purple gold dragon sprout), the *fengwei longya* 鳳尾龍芽 (phoenix-tail dragon sprout), the *wufang longya* 五方龍芽 (five directions dragon sprout), the *duijie longya* 對節龍芽 (opposing joint dragon sprout) and the *wushou longya* 烏壽龍芽 (black longevity dragon sprout).
- 59 *Bencao gangmu*, *juan* 16, p. 1072, under the entry for mabiancao 馬鞭草.
- 60 Some of the pharmacopoeia are no longer extant, and survive in quotation only, usually found under the appropriate heading in the *Bencao gangmu*.
- 61 This work survives in quotation only. For a reconstruction of the text, see Shang Zhijun ed. (1987).
- 62 This work survives in quotation only. For a reconstruction of the text, see Shang Zhijun ed. (1994).
- 63 For a reconstruction of the text, see Shang Zhijun ed. (1998).

- 64 This work survives in quotation only. Shang Zhijun *et al.* (1989), pp. 200–3, date this text to the period AD 908–23.
- 65 Again, this work survives in quotation only.
- 66 See Goodrich and Fang (1976), pp. 350–4.
- 67 See Chapter 4.
- 68 For a full translation and analysis of this book, see Ts'ao, Ho and Needham (1959).
- 69 Ho Peng Yoke (1979). The *Griffith Asian Papers* series is no longer active at the time of the writing of this book.

3

***Danfang jianyuan* (Mirror of Alchemical Processes—a Source Book) and *Danfang jingyuan* (Mirror of the Alchemical Laboratory)**

- 70 As shown by Ho and Su (1970), pp. 1–2.
- 71 This is the original introduction from Ho Peng Yoke (1980) with slight modifications. Chapter 3 is an adaptation from the same work with full translation of the two alchemical texts concerned.
- 72 See Needham, Lu and Ho (1976), p. 180. For further research on this text, see Feng and Collier (1937); Ho and Su (1970) and Sivin, Nathan (1968).
- 73 See Ho and Su (1970).
- 74 Needham Research Institute archives, ref. SCC2/195/2.
- 75 See Lo, Hsiang-lin (1966).
- 76 The text is based on the 1804 MS copy preserved in the Japanese National Diet Library, Tokyo. A partial translation of the text based on the Daoist Canon is given in Feng and Collier (1937).
- 77 The term *qiushi* was later adopted for preparations of steroid sex hormones, see Needham and Lu (1974), pp. 166–7.
- 78 *Huangdan* is also a synonym for litharge (RP 14).
- 79 For an introduction to the complicated background to the compilation of this text, see the *neirong jianjie* 內容簡介 in the 1957 Renmin weisheng chubanshe edition, and Shang Zhijun *et al.* (1989), pp. 216 ff., esp. pp. 228–32.
- 80 Legend has it that after his defeat in battle Gonggong 共工 knocked his head against the Buzhou 不周 mountain causing damage to one of the pillars that supported the heavens. As a result the heavens tilted and cracks appeared. The goddess Nüwa 女媧 refined stones of the five colours to mend the cracks. This story was the origin of the term '*butian* 補天 (mending the heavens)'.
- 81 The Chinese weight *liang* 兩 is rendered here as ounce for easy reading. The modern *liang* is about one and one-third ounce. However, weights and measure varied with time and the actual measure meant by the original writer cannot be accurately known.
- 82 Here, and in entries JY30 and JY31 below, 'grass' (*cao*) may also refer to a certain unspecified material from the vegetable kingdom.
- 83 For *tianbei* [tiankui], see JY4.
- 84 I prefer to use the old pronunciation of *yan* for the character 鉛 throughout.

4

Partial restoration, collation and translation of lost alchemical texts

- 85 This chapter is an adapted translation of Ho and Chiu (1983).

- 86 In *Bencao gangmu*, *juan* 1A p. 336. See also Needham, Lu and Ho (1976), pp. 210–12.
- 87 See Needham, Lu and Ho (1976), p. 208.
- 88 Ibid. p. 167.
- 89 I had an opportunity to talk on this subject to the Daoist patriarch Zhang Enpu 張恩溥, a descendant of Zhang Daoling 張道陵, when he visited me in Kuala Lumpur at my office in 1964. He said that when he was in Longhushan 龍虎山 mountain someone gave him an elixir, but he did not eat it.
- 90 See Ho and Chiu (1983). For a biography of Zhu Quan see, for example, *Mingshi* 明史 (History of the Ming) *juan* 117, and the entry ‘Chu Ch’uan’ by D.R. Jonker in Goodrich and Fang (1976), Vol. 1, pp. 305–7.
- 91 See Needham, Wang and Robinson (1962), pp. 220 ff.
- 92 Wong, Shiu Hon (1989) makes a comprehensive study of synonyms. For example *qinglanggan* was also known as *shiwei* 石味 and *qingzhu* 青珠.
- 93 The Japanese word *maki* has exactly the same meaning as the Chinese word *juan*.
- 94 The number thirty comes from the sum of all the even numbers from 2 to 10, the Earth numbers.
- 95 This is also a synonym for *lishi* 理石 (Fibrous gypsum; ZY 4066 and RP 52).
- 96 It is also a synonym for *pusashi* 菩薩石 (quartz; RP 42).
- 97 In common usage the Five Metals refer to gold, silver, copper, iron and lead (sometimes tin), but in Chinese alchemy it referred to cinnabar, mercury, realgar, orpiment and sulphur. The Three Yellow [Minerals] were sulphur (*liuhuang*), realgar (*xionghuang*) and orpiment (*cihuang*).
- 98 It is also a synonym for *shehe* 蛇合 (*Potentilla kleiniana*; ZY 4336).
- 99 It is also a synonym for *gansui* 甘遂 (*Euphorbia kansui*; ZY 1188).
- 100 See GY25 later.
- 101 As will be discussed later, this was a fictitious plant.
- 102 Unidentified, perhaps a kind of weeping willow if not a misprint for *shibeiliu* 石背柳 (*Pyrrosia lingua* (Thumb) Farw.; ZY 1202) or for *shiyangmei* 石楊梅, a synonym of *maiheu* 麥斛 (*Bulbophyllum inconspicuum*, Maxim.; ZY 2081).
- 103 *Suanya* is perhaps a synonym or a misprint for *suancao* 酸草 (*Oxalis corniculata*, L.; ZY 4777).
- 104 This is a modified version of Ho Peng Yoke (1982).
- 105 Needham and Wang (1959), p. 676.
- 106 *Suishu*, *juan* 34, p. 1038.
- 107 Wu Shu first wrote the *Shileifu* and later added a commentary (*zhu*) to his own work.
- 108 *Han-Tang dili shuchao*, pp. 53–4.
- 109 *Jingdian jilin*, *juan* 32.
- 110 This translation is based on Ma Guohan’s version (Vol. 7, pp. 172–4), but comparison is made with the versions of Wang Mo and Hong Yixuan. Numbers are added to the different items for ease of reference. These numbers follow the order given by Ma Guohan.
- 111 *Bencao gangmu*, *juan* 1, p. 10. See also He Bingyu (1982), pp. 358–66.
- 112 It is to be noted, however, that tin and lead were commonly referred to as *xi* 錫 in ancient Chinese writings.
- 113 The Daoist Trinity in the Nine Heavens must refer to alchemists in the past who had succeeded in preparing the elixir and attained holy immortality.
- 114 That is, attaining the ultimate state of perfection in accordance to the Way of Nature.
- 115 Epsom salt was often taken for *xiaoshi*, but the text here refers to saltpetre. The term *yanxiao* specifically refers to saltpetre.
- 116 *Bencao gangmu*, *juan* 1, p. 10.
- 117 In translating the verse in Cui’s book one *liang* will be rendered as 1 ounce, although one *liang* is one-sixteenth of a *jin*, approximately one-twelfth of a pound.
- 118 *Gengdaoji*, *juan* 1, pp. 8–9.

- 119 *Gengdaoji*, *juan* 1, pp. 9–10.
- 120 See the discussion of Qingxiazi later.
- 121 Needham, Lu and Ho (1976), p. 300.
- 122 Zhao Kuanghua (1984a), p. 19.
- 123 *Lishi zhenxian tidao tongjian*, *juan* 42.
- 124 Strictly speaking, 1 *hang* or 1 catty is about one and one-third of a pound. However, due to variations of weights and measures with time, exact equivalence is hardly attainable. The word *pound* reads easier in English than ‘catty’.
- 125 Zhao Kuanghua (1984a), pp. 19–20, identifies *woqian* as zinc.
- 126 Probably a misprint for *jinciao* 葦草 (Chinese elder, *Sambucus thunbergiana*, Bi.; RL 78).
- 127 Further information on Qingxiazi will come under Qingxiazi’s *Dantailu* that follows.
- 128 Coldness could refer to illness due to external causes.
- 129 Chen Guofu (1963), p. 435, n.16.
- 130 Chen Guofu (1983a), pp. 314–15.
- 131 *Xin Tangshu*, *juan* 59, p. 1521.
- 132 *Tongzhi*, *juan* 67, pp. 792, 793.
- 133 Chen Guofu (1963), p. 435, n.16. An almost identical passage can be found in the *Guangdong tongzhi* 廣東通志 (Comprehensive Gazetteer of Guangdong), *juan* 56, p. 7.
- 134 *Shiyao erya*, *juan* 2.
- 135 *Taiqing shibiji*, *juan* 3, p. 30.
- 136 Chen Guofu (1963), p. 435, n.16.
- 137 *Songshi*, *juan* 205, p. 5194.
- 138 *Leng* and *feng* refer to diseases due to external causes.

5

General discussions

- 139 *Baopuzi neipian*, *juan* 17.
- 140 For an introduction to these concepts, see Ho Peng Yoke (1985), pp. 1–34.
- 141 Needham and Wang (1959), p. 640.
- 142 *Baopuzi neipien*, *juan* 16.
- 143 *Ibid.*, *juan* 11.
- 144 *Chunzhu jiwen*, *juan* 10, p. 8a-b.
- 145 See Needham and Wang (1959), pp. 676 ff.
- 146 *Ibid.*
- 147 See Ho Peng Yoke (1974) for parallel roles of alchemical substances in some elixir formula.
- 148 *Yin Zhenjun jinshi wuxianglei*, p. 25b.
- 149 The development of Chinese alchemy is, of course, covered in great detail by Joseph Needham in Volume 5, Parts 2–5 of *Science and Civilisation in China*. For a more recent and succinct treatment, see Skar (2003).
- 150 *juan* 1A.
- 151 For elixir poisoning, see Ho and Needham (1959c).
- 152 Examples of Tang and Song poets with interest in alchemy are given in Ho, Goh and Parker (1974) and Ho, Goh and Lim (1972).
- 153 Needham, Lu, Ho and Sivin (1980), pp. 323 ff.
- 154 *Ibid.* pp. 339–55.
- 155 *Ibid.* pp. 55 ff.; Huang H.T. (2000), pp. 203–31.
- 156 For a survey of contacts between India and China during this period, see Liu, Xinru (1994).
- 157 Needham, Lu, Ho and Sivin (1980), p. 186.

- 158 For an account of the Nestorian presence in China, see Saeki (1951).
 159 The development and spread of the marine compass is described in Needham, Wang and Robinson (1962), pp. 229 ff.
 160 Needham, Lu, Ho and Sivin (1980), pp. 366 ff.
 161 The early history of this complex work is described by Pregadio, Fabrizio (2002).
 162 Both of these texts only survived in quotations. For a modern reconstruction of *Bencao shiyi*, see Shang Zhijun ed. (2002), and for *Haiyao bencao*, see Shang Zhijun ed. (1997).
 163 Laufer, Berthold (1919), pp. 246 ff.
 164 Laufer, Berthold (1919), pp. 460–2.
 165 *Bencao gangmu*, *juan* 10.

Appendix I:

beyond the Daoist Canon: proto-chemistry in the pharmacopoeia

- 166 Needham, Lu, Ho and Sivin (1980), pp. 311 ff., 324 ff.
 167 For example, the central and crucial feature of the preparation of the Philosopher's Stone consisted of heating the ingredients concerned over a prolonged period and under the right conditions in the sealed vessel of Hermes. We find similarity in the heating of the sealed reaction vessel over days and months in Chinese alchemy.
 168 This is true in the case of the information contained in the Daoist Canon, but other texts do tell us about proto-chemistry in traditional China, as we shall see.
 169 For a full English translation of the *Tiangong kaiwu*, see Sun and Sun (1966), for a study of the original text with annotations, see Pan Jixing (1989).
 170 See Ho and Needham (1959c), esp. p. 246.
 171 The discussion later on is largely based on the entries in the *Bencao gangmu*, *juan* 8 to 11, where Li Shizhen collects relevant entries from many lost works, such as the *Shennong bencaojing*, *Mingyi bielu* etc., and the pharmacopoeia extant at his time.
 172 See, for example, Sun and Sun (1966), pp. 108–23.
 173 *Bencao gangmu*, *juan* 11, pp. 629 ff.
 174 See *DT* 109 earlier.
 175 Yuan Hanqing (1956), p. 242.
 176 Read and Liu (1936), item 387. The plant *zaojia* contains saponin $C_{59}H_{100}O_{20}$ and Arabinose.
 177 *Bencao gangmu*, *juan* 11, pp. 651.
 178 *Bencao gangmu*, *juan* 11, pp. 659 ff.
 179 *Bencao gangmu*, *juan* 11, pp. 649 ff.
 180 The author owes this point to Miyashita Saburo. See also Masutomi Junosuke (1957).
 181 Read and Pak (1936), item 125.
 182 Here the number seventy-two refers to a large number, that is, many, rather than an exact number of seventy-two.
 183 *Bencao gangmu*, *juan* 11, pp. 651 and 652; Read and Pak (1936), item 135a.
 184 The author owes this point to Miyashita Saburo.
 185 *Bencao gangmu*, *juan* 11, pp. 669 ff.
 186 Yuan Hanqing (1956), p. 56.
 187 *Bencao gangmu*, *juan* 8, pp. 465 ff.
 188 *Bencao gangmu*, *juan* 11, pp. 600 ff.; Read and Pak (1936), item 87.
 189 Yuan Hanqing (1956), p. 243.
 190 *Bencao gangmu*, *juan* 9, pp. 468–9; Read and Pak (1936), item 9.
 191 Liu Youliang (1964), p. 45.
 192 *Bencao gangmu*, *juan* 10, pp. 597 ff.; Read and Pak (1936), item 82.

- 193 Yuan Hanqing (1956), p. 241.
- 194 Ibid. p. 244.
- 195 *Bencao gangmu*, *juan* 10, pp. 595; Read and Pak (1936), item 83.
- 196 Yuan Hanqing (1956), p. 241.
- 197 Laufer, Berthold (1919), p. 510; *Bencao gangmu*, *juan* 11, pp. 643 ff.
- 198 Yuan Hanqing (1956), p. 244.
- 199 *Bencao gangmu*, *juan* 8, pp. 461 ff.
- 200 Yuan Hanqing (1956), p. 243.
- 201 *Bencao gangmu*, *juan* 8, pp. 459 ff.
- 202 *Bencao gangmu*, *juan* 9, pp. 572 ff.
- 203 *Bencao gangmu*, *juan* 9, pp. 523 ff.; Read and Pak (1936), item 44. The number of synonyms used in Chinese pharmacopoeia for mercury is far fewer than that used by alchemists. The *Shiyao eryl* 石藥爾雅 (Synonymic Dictionary of Minerals and Drugs), for example, gives twenty-one synonyms for mercury, and the list given is by no means exhaustive.
- 204 Yuan Hanqing (1956), p. 242.
- 205 Yuan Hanqing (1956), p. 243.
- 206 In the *Bencao pinhui jingyao* 本草品彙精要, *juan* 3, p. 155.
- 207 *Chongxiu Zhenghe jingshi zhenglei beiyong bencao*, p. 107.
- 208 *Bencao gangmu*, *juan* 9, p. 524.
- 209 Ibid. p. 525.
- 210 *Bencao gangmu*, *juan* 9, pp. 517 ff.; *Bencao pinhui jingyao*, *juan* 1, p. 107; Read and Pak (1936), item 43.
- 211 *Bencao gangmu*, *juan* 9, pp. 533 ff.; *Bencao pinhui jingyao*, *juan* 3, p. 156; Read and Pak (1936), item 48.
- 212 Yuan Hanqing (1956), p. 250.
- 213 *Bencao gangmu*, *juan* 9, pp. 527 ff.; Read and Pak (1936), item 45.
- 214 Yuan Hanqing (1956), p. 250.
- 215 *Bencao gangmu*, *juan* 9, p. 530; Read and Pak (1936), item 46.
- 216 The development of the East Asian still is described in Ho and Needham (1959b), pp. 94–108.
- 217 Contains H_2SiO_3 , Al_2O_3 , Fe_2O_3 and CaCO_3 according to Liu Youliang (1964), p. 74.
- 218 Ibid. p. 14.
- 219 *Bencao pinhui jingyao*, *juan* 6, pp. 214–15.
- 220 *Bencao gangmu*, *juan* 8, p. 501; *Bencao pinhui jingyao* *juan* 2, p. 136; Read and Pak (1936), item 30.
- 221 Yuan Hanqing (1956), p. 245.
- 222 *Bencao gangmu*, *juan* 8, pp. 469 ff.; *Bencao pinhui jingyao* *juan* 5, pp. 183–4; Read and Pak (1936), item 10.
- 223 Yuan Hanqing (1956), p. 248.
- 224 See also Needham and Wang (1959), p. 639.
- 225 *Bencao gangmu*, *juan* 8, pp. 474 ff.; Read and Pak (1936), item 12.
- 226 *Bencao gangmu*, *juan* 8, pp. 477 ff.; *Bencao pinhui jingyao* *juan* 5, p. 183; Read and Pak (1936), item 13.
- 227 *Bencao gangmu*, *juan* 8, pp. 473 ff.; Read and Pak (1936), item 11.
- 228 *Bencao gangmu*, *juan* 8, pp. 479 ff.; Read and Pak (1936), item 14.
- 229 See Laufer, Berthold (1919), p. 508.
- 230 *Bencao gangmu*, *juan* 11, pp. 655 ff.; Read and Pak (1936), item 126.
- 231 *Bencao gangmu*, *juan* 10, pp. 602 ff.; Read and Pak (1936), item 88.
- 232 *Bencao gangmu*, *juan* 10, pp. 606 ff.; Read and Pak (1936), item 91.
- 233 *Bencao gangmu*, *juan* 9, pp. 540 ff.; Read and Pak (1936), item 50.
- 234 *Bencao gangmu*, *juan* 9, pp. 534 ff.; Read and Pak (1936), items 49, 49a.

- 235 *Bencao gangmu*, *juan* 11, pp. 660 ff.; Read and Pak (1936), item 128.
 236 Yuan Hanqing (1956), p. 242.
 237 *Bencao gangmu*, *juan* 8, pp. 486 ff.; Read and Pak (1936), item 20.
 238 See Needham and Wang (1959), p. 674.
 239 *Bencao gangmu*, *juan* 8, pp. 491–2; Read and Pak (1936), item 23.
 240 *Bencao gangmu*, *juan* 11, pp. 677 ff.; Read and Pak (1936), item 132.
 241 Yuan Hanqing (1956), p. 248.
 242 *Pujifang*, *juan* 265, p. 4549.
 243 See Ts'ao, Ho and Needham (1959).

Appendix II:

extracts from al-Bīrūnī's pharmacopoeia with added commentaries

- 244 See Ho and Lisowski (1998).
 245 See Said, Hakim Mohammad (1973). I met Hakim Mohammad Said on several occasions during international conferences on the history of science. I take this opportunity to acknowledge that the copy of his book used here was a personal present from him.

Table II:

plant names and properties in *Chunyang Lü Zhenren yaoshizhi* and *Xuanyuan Huangdi shuijing yaofa*

- 246 *Chijie* is probably copyist's error for *chijin* 赤金.
 247 The five metals, according to the *Sun Zhenren danjing* 孫真人丹經 are cinnabar, mercury, realgar, orpiment and sulphur, while the eight minerals are a stratified variety of malachite (*cengqing* 曾青 a large hollow variety of malachite (*kongqing* 空青), potash alum (*shidan* 石膽), arsenic (*pishuang* 砒霜), sal ammoniac (*naosha* 礞砂), white common salt (*baiyan* 白鹽), alum (*baifan* 白礬 and saltpeter (*xiaoshi* 硝石).

Bibliography

Primary sources

- Baopuzi neipian* 抱朴子內篇 (Inner Chapters of the Book of the Preservation-of-Solidarity Master), by Ge Hong 葛洪 (283–343) c. 320 AD. In *Zhengtong Daozang*, Volume 45.
- Beishan jiujiing* 北山酒經 (Wine Classic of the North Mountain), by Zhu Hong 朱耽, 1117. In *Yingyin Wenyuange Siku Quanshu*, Volume 844.
- Beitang shuchao* 北堂書鈔 (Written Notes in the North Hall), by Yu Shinan 虞世南, 17th century. Taipei: Xinxing shuju, 1971.
- Bencao gangmu* 本草綱目 (The Great Pharmacopoeia), by Li Shizhen 李時珍, 1596. Beijing: Renmin weisheng chubanshe, 1975. [Though this edition is in simplified characters, it has the advantage of being complemented by a comprehensive index, Zheng Jinsheng *et al.* (1999).]
- Bencao gangmu shiyi* 本草綱目拾遺 (Additions to the Great Pharmacopoeia), by Zhao Xuemin 趙學敏, 1765. Shanghai: Shangwu yinshuguan, 1955.
- Bencao pinhui jingyao* 本草品彙精要 (Essentials of the Pharmacopoeia Ranked according to Nature and Efficacy), by Liu Wentai 劉文泰 *et al.*, 1505. Beijing: Renmin weisheng chubanshe, 1982.
- Bencao shiyi* 本草拾遺 (Additions to the Materia Medica), by Chen Zangqi 陳藏器, written between 713–41. See Shang Zhijun ed. (2002).
- Bencao tujing* 本草圖經 (Illustrated Pharmacopoeia), by Su Song 蘇頌, c. 1061. See Shang Zhijun ed. (1994).
- Cantongqi wuxianglei miyao* 參同契五相類秘要 (Arcane Essentials of the Similarities and Categories of the Five Substances in the *Kinship of the Three*), no later than the 8th century. In *Zhengtong Daozang*, Volume 31.
- Chongxiu Zhenghe jingshi zhenglei beiyong bencao* 重修正和經史證類備用本草 (New Revision of the Pharmacopoeia of the Zhenghe Reign-Period: The Classified and Consolidated Armamentarium), compiled by Zhang Cunhui 張存惠, 1249. Beijing: Renmin weisheng chubanshe, 1957.
- Chunyang Lü Zhenren yaoshizhi* 純陽呂真人藥石製 (The Immortal Lü Dongbin's Book on Preparation of Drugs and Minerals), around end of 14th and beginning of 15th century. In *Zhengtong Daozang*, Volume 31.
- Chunzhu jiwen* 春渚紀聞 (Records of Things Heard at Spring Island), by He Wei 何薳, c. 1005. In *Yingyin Wenyuange Siku Quanshu*, Volume 863.
- Chuxueji* 初學記 (Encyclopaedia for Entry into Learning), by Xu Jian 初學記 700. Beijing: Zhonghua shuju, 1962.
- Dadanji* 大丹記 (Records of the Great Elixir), late Tang or Five Dynasties. In *Zhengtong Daozang*, Volume 31.
- Danfang jianyuan* 丹方鑒源 (Mirror of Alchemical Processes), by Dugu Tao 獨孤酒, compiled some time between the years 938 and 965. In *Zhengtong Daozang*, Volume 32.
- Daoshu* 道樞 (The Pivot of the Way), compiled by Zeng Zao 曾慥, Song period. In *Zhengtong Daozang*, Volume 35.
- Daozang jinghua* 道藏精華 (Essence of the Daoist Patrology), edited by Xiao Tianshi 蕭天石. Taipei: Ziyou chubanshe, 1965–.
- Daozang jinghua* 道藏精華 (Essence of the Daoist Patrology), edited by Hu Daojing 胡道靜. Changsha: Yuelu shushe, 1993.

- Daozang jiyao* 道藏輯要 (Essentials from the Daoist Patrology), compiled by Peng Dingqiu 彭定求, 1906. Chengdu: Bashu shushe, 1995.
- Daozang xubian chujì* 道藏續編初集 (First Collection of the Supplement to the Daoist Patrology), compiled by Min Yide 閔一得, 1834. Shanghai: Yixue shuju, (n.d.).
- Dongpo jiujiang* 東坡酒經 (Dongpo's Wine Classic), by Su Dongpo 蘇東坡, (late 11th century). In *Shuofu*, ch. 94.
- Fayuan zhulin* 法苑珠林 (Forest of Pearls from the Garden of the Buddhist Law), by Daoshi, 668. In *Yingyin Wenyuange Siku Quanshu*, Volumes 1049–50.
- Gengdaoji* 庚道集 (Collections of Procedures for Gold-Making), compiled after 1144 by someone using the style Mengxuan jushi 蒙軒居士. In *Zhengtong Daozang*, Volume 32.
- Gewu cutan* 格物畧談 (Simple Discourses on the Investigations of Things), possibly by the 11th-century monk Zanning 贊寧. Shanghai: Shangwu yinshuguan, 1937.
- Gezhi jingyuan* 格致鏡源 (Mirror Source Book for the Investigations of Things), by Chen Yuanlong 陳元龍, 1717. 1735 woodblock edition.
- Guangdong tongzhi* 廣東通志 (Comprehensive Gazetteer of Guangdong). In *Yingyin Wenyuange Siku Quanshu*, Volumes 562–4.
- Guangyun* 廣韻 (Enlarged Dictionary of Sounds), by Chen Pengnian 陳彭年 *et al.*, 1008. Beijing: Zhongguo shudian, 1982.
- Haiyao bencao* 海藥本草 (Materia Medica of Countries beyond the Seas), by Li Xun 李珣, c.885. See Shang Zhijun ed. (1997).
- Han-Tang dili shuchao* 漢唐地理書鈔 (Written Notes on Han and Tang Geography), compiled by Wang Mo 王謨, late 18th century. Beijing: Zhonghua shuju, 1961.
- Huainan wanbishi* 淮南萬畢術 (The Ten Thousand Infallible Arts of the Prince of Huainan), accredited to Liu An 劉安, d. 160 BC. Shanghai: Shangwu yinshuguan, 1939.
- Jingdian jilin* 經典集林 (Forest of Collected Classics and Canons), compiled by Hong Yixuan 洪頤煊, early 19th century. In *Xuxiu siku quanshu* 續修四庫全書, Volume 1200 (Shanghai: Shanghai guji chubanshe, 1995–2002).
- Jinshibu wujiushujue* 金石簿五九數訣 (Explanation of the Inventory of Metals and Minerals According to the Numbers of Five and Nine), Five Dynasties period. In *Zhengtong Daozang*, Volume 31.
- Jiuhuang bencao* 救荒本草 (Famine Relief Pharmacopoeia) by Zhu Su 朱肱, 1406. Beijing: Zhonghua shuju, 1959.
- Jiu Tangshu* 舊唐書 (Old History of the Tang Dynasty), by Liu Xu, 945. Beijing: Zhonghua shuju, 1975.
- Jiyun* 集韻 (Collected Rhyming Words), compiled by Ding Du 丁度 *et al.*, 1039. Beijing: Zhonghua shuju, 1989.
- Kaibao bencao* 開寶本草 (Pharmacopoeia of the Kaibao Reign), compiled by Liu Han 劉翰 *et al.*, 973. See Shang Zhijun ed. (1998).
- Kaiyuan zhanjing* 開元占經 (Prognostication Classic of the Kaiyuan Era), by Qutan Xida 瞿曇悉達, 729. In *Zhongguo kexue jishu dianji tonghui: tianwen juan* 中國 科學技術典籍通匯: 天文卷, Volume 5 (Zhengzhou: Henan jiaoyu chubanshe, n.d.).
- Kō Yamato honzō betsurōku* 廣大和本草別錄 (Records of the Expanded Japanese Pharmacopoeia), manuscript copy held in Tokyo Kokkai Toshokan 東京國會圖書館.
- Lishi zhenxian taidao tongjian* 歷世真仙體道通鑑 (A History of True Immortals who Embodied the Way through the Ages), by Zhao Daoyi 趙道一 c.1294. In *Zhengtong daoang*, Volume 8.
- Longhu huandanjue* 龍虎還丹訣 (Explanation of the Dragon-and-Tiger Cyclically Transformed Elixir), Tang Dynasty In *Zhengtong daoang*, Volume 32.
- Lüxue xinshuo* 律學新說 (A New Account of the Science of the Pitch-Pipes), by Zhu Zaiyu 朱載堉, 1584. Beijing: Renmin yinyue chubanshe, 1986.
- Mingshi* 明史 (History of the Ming), compiled by Zhang Tingyu 張廷玉 *et al.*, 1739. Beijing: Zhonghua shuju, 1974.

- Pujifang* 普濟方 (Prescriptions of Universal Benefit), compiled by Zhu Xiao 朱肱, 1390. Beijing: Renmin weisheng chubanshe, 1958.
- Qiangong jiageng zhibao jicheng* 鉛汞甲庚至寶集成 (Compendium on the Perfected Treasure of Lead, Mercury, Wood and Metal), possibly Five Dynasties or Song. In *Zhengtong daoang*, Volume 32.
- Qimin yaoshu* 齊民要術 (Important Arts for the People's Welfare), by Jia Sixie 賈思勰, written between 533 and 544. Beijing: Kexue chubanshe, 1957.
- Qinding Siku quanshu zongmu tiyao* 欽定四庫全書總目提要 (Abstracts for the Complete Table of Contents of the Complete Books of the Four Repositories). In *Yingyin Wenyuange Siku Quanshu*, Volumes 1–5.
- Rucuo pian* 茹草篇 (Book of Edible Herbs) by Zhou Lüjing 周履靖, 1597. In *Yimen guangdu* 夷門廣綫 (Taipei: Taiwan shangwu yinshuguan, 1969).
- Sanshiliu shuifa* 三十六水法 (Thirty-Six Methods of Bringing Solids into Aqueous Solutions), probably compiled early 6th century. In *Zhengtong daoang*, Volume 32.
- Shennong bencaojing* 神農本草經 (The Pharmacopoeia of the Heavenly Husbandman), compiled c.1st century AD. See Ma Jixing *et al.* eds (1995).
- Shilei fuzhu* 事類賦注 (Commentary to Fu Poems on Categorised Affairs), compiled by Wu Shu 吳淑 during the 10th century. Beijing: Zhonghua shuju, 1989.
- Shiliao bencao* 食療本草 (Pharmacopoeia of Foodstuffs), by Meng Shen 孟詵, early 8th century AD. Beijing: Renmin weisheng chubanshe, 1984.
- Shiyao eryl* 石藥爾雅 (Synonymic Dictionary of Minerals and Drugs), by Mei Biao 梅彪, 806. In *Zhengtong daoang*, Volume 31.
- Shobutsu ruisan* 庶物類纂 (Things Categorised and Compiled), compiled by Inō Jakusui 稻生若水, 1747, manuscript copy held in Tokyo Kokkai Toshokan 東京國會圖書館.
- Shuofu* 說郛, by Tao Zongyi, c.1316–1402. Wanweishan tang 宛委山堂 edition (1652); Hanfen lou 涵芬樓 edition (1927).
- Songshi* 宋史 (History of the Song Dynasty), compiled by Tuotuo 脫脫 *et al.*, 1345. Beijing: Zhonghua shuju, 1985.
- Suishu* 隋書 (History of the Sui Dynasty), compiled by Wei Zheng 魏徵 *et al.*, 636. Beijing: Zhonghua shuju, 1973.
- Taiping yulan* 太平御覽 (Imperial Survey of the Taiping Era), edited by Li Fang 李昉, c.983. Beijing: Zhonghua shuju, 1960.
- Taiqing danjing yaojue* 太清丹經要訣 (Essential Formulae for the Alchemical Classics: A *Taiqing* Scripture), attributed to Sun Simiao's 孫思邈, 7th century. In *Yunji qiqian* 雲笈七籤.
- Taiqing jinye shendan jing* 太清金液神丹經 (Manual of the Potable Gold and the Magical Elixir: A *Taiqing* Scripture), 5th to 10th centuries. In *Zhengtong daoang*, Volume 31.
- Taiqing shibiji* 太清石壁記 (Records in the Rock Chamber; a *Taiqing* Scripture), probably compiled early 6th century. In *Zhengtong daoang*, Volume 31.
- Tang xinxiu bencao* 唐新修本草 (Tang Pharmacopoeia), otherwise known as *Tang bencao* 唐本草 or *Xinxu bencao* 新修本草, compiled by Su Jing 蘇敬 (also known as Su Gong 蘇恭 *et al.*, 659. Shanghai: Qunlian chubanshe, 1955.
- Tiangong kaiwu* 天工開物 (The Exploitation of the Works of Nature), by Song Yingxing 宋應星, 1637. Beijing: Zhonghua shuju, 1959.
- Tianyuan yuli xiangyifu* 天元玉曆祥異賦 (Essays on Astrological and Meteorological Presages), MS copy, Cambridge University Library.
- Tongzhi* 通志 (Comprehensive History of Institutions) by Zheng Qiao 鄭樵, c.1150. Shanghai: Shangwu yinshuguan, 1935.
- Tujing yanyi bencao* 圖經衍義本草 (Illustrated Dilations upon Pharmaceutical Natural History), also known as *Bencao yanyi* 本草衍義, compiled by Kou Zongshu 寇宗奭, 1116. Beijing: Renmin weisheng chubanshe, 1990.

- Wei Boyang qifan dansha jue* 魏伯陽七返丹砂訣 (Explanations of the Seven-Fold Cyclically Transformed Cinnabar Elixir of Wei Boyang), attributed to the second century alchemist Wei Boyang and contains a commentary by Huang Tongjun 黃童君 of around 800. In *Zhengtong daoang*, Volume 31.
- Wenxian tongkao* 文獻通考 (Comprehensive Study of Civilisation) by Ma Duanlin 馬端臨, between 1254 and 1280. Shanghai: Shangwu yinshuguan, 1935.
- Wufang yuanyin* 五方謠音 (Original Sounds of the Five Directions) by Fan Tengfeng 樊騰鳳 (1624–72). In *Xuxiu siku quanshu* 續修四庫全書 (Shanghai: Shanghai guji chubanshe, 1995–2002).
- Wulei xianggan zhi* 物類相感志 (On the Natural Responses of Things according to their Categories), by the monk Zanning 贊寧, 11th century. Shanghai: Shangwu yinshuguan, 1937.
- Wuli xiaoshi* 物理小識 (Small Encyclopaedia of the Principles of Things), by Fang Yizhi 方以智, 1643. Shanghai: Shangwu yinshuguan, 1937.
- Wushi bencao* 吳氏本草 (Pharmacopoeia of Mr Wu), by Wu Pu 吳普, 3rd century AD. See Shang Zhijun ed. (1987).
- Xin Tangshu* 新唐書 (New History of the Tang Dynasty), compiled by Ouyang Xiu 歐陽修 *et al.*, 1060. Beijing: Zhonghua shuju, 1975.
- Xixi congyu* 西溪叢語 (Collected Remarks from the Western Pool), by Yao Kuan 姚寬, c.1150. Beijing: Zhonghua shuju, 1993.
- Xuanyuan Huangdi shuijing yaofa* 軒輅黃帝水經藥法 (Medicinal Methods from the Aqueous Manual of Xuanyuan, the Yellow Emperor), late 15th or early 16th century. In *Zhengtong daoang*, Volume 32.
- Yecai bolu* 野菜博錄 (Encyclopaedia of Wild Vegetables), by Bao Shan 鮑山, 1622. Taipei: Taiwan shangwu yinshuguan, 1976.
- Yecai pu* 野菜譜 (Treatise of Wild Vegetables), by Wang Pan 王磐, fl. 1522–66. In *Shuofu xu juan* 說郛續, 46. Taipei: Xinxing shuju, 1964.
- Yingyin Wenyuange Siku Quanshu* 影印文淵閣四庫全書 (Reprint of the Wenyuan Pavillion Complete Books of the Four Repositories). Taipei: Taiwan shangwu yin shuguan, 1986.
- Yin Zhenjun jinshi wuxianglei* 陰真君金石五相類 (The Similarities and Categories of the Five Substances among Metals and Minerals by the Deified Adept Yin), author and date unknown. In *Zhengtong daoang*, Volume 31.
- Yiwen leiju* 藝文類聚 (Categorised Collection on Arts and Literature), by Ouyang Xun 歐陽詢, 7th century. Beijing: Zhonghua shuju, 1965.
- Youyang zazu* 酉陽雜俎 (Miscellaneous Offerings from Youyang), by Duan Chengshi 段成式, 863. Beijing: Zhonghua shuju, 1981.
- Yuanjian leihan* 淵鑑類函 (Classified Dictionary), by Zhang Ying 張英 *et al.*, 1710. Shanghai: Shanghai guji chubanshe, 1992.
- Yuhan shanfang jiyishu* 玉函山房輯佚書 (Collected Lost Books from the House at Yuhan Mountain), compiled by Ma Guohan 馬國翰, mid-19th century. Yangzhou: Jiangsu guangling guji keyinshe, 1990.
- Yunji qiqian* 雲笈七籤 (The Seven Bamboo Tablets of the Cloudy Satchel), compiled by Zhang Junfang 張君房, c.1022. In *Zhengtong daoang*, Volumes 37–8.
- Zangwai daoshu* 藏外道書 (Daoist texts beyond the Daoist Patrology), edited by Chen Dali 陳大利, He Zhihua 何志華 *et al.* Chengdu: Bashu shushe, 1992–.
- Zhejiang tongzhi* 浙江通志 (Gazetteer of Zhejiang Province). In *Yingyin Wenyuange Siku Quanshu*, Volumes 519–26.
- Zhengtong daoang* 正統道藏 (Daoist Patrology of the Zhengtong reign-period). Taipei: Xinwenfeng chubanshe, 1977.
- Zhiwu mingshi tukao* 植物名實圖考 (Illustrated Account of the Names and Features of Plants), by Wu Qijun, 1848. Shanghai: Shangwu yinshuguan, 1919.
- Zhizhenzi longhu dadan shi* 至真子龍虎大丹詩 (Master Zhizhen's Poems on the Great Elixir of the Dragon and Tiger), by Zhou Fang 周方, 1026. In *Zhengtong daoang*, Volume 7.

- Zhongyuan yinyun* 中原音韻 (Dictionary of Sounds of Henan Province), by Zhou Deqing 周德清, 1324. Beijing: Zhonghua shuju, 1978.
- (*Zhouyi*) *Cantongqi* 周易參同契 (Kinship of the Three Basing on the Book of Changes), written in the second century AD by Wei Boyang 魏伯陽. In *Zhengtong daoang*, Volume 34.
- Zhuang Lin xu Daoang* 莊林續道藏 (Zhuang Lin Supplementary Daoist Patrology), compiled by Michael Saso. Taipei: Chengwen chubanshe, 1975.
- Zhufanzhi* 諸蕃志 (Records of Foreign Peoples), by Zhao Rukuo 趙汝适, c.1225. Changsha: Shangwu yinshuguan, 1940.
- Zhujia shenpin danfa* 諸家神品丹法 (Methods of the Various Schools for Magical Elixir Preparations), a Song work by Meng Yaofu 孟要甫 *et al.* In *Zhengtong daoang*, Volume 32.

Secondary sources

[Only representative references are given here. For more detailed references before 1980 see those in Needham (and collaborators) (1974 to 1983); for Chinese and Japanese references see Liu Ts'un-yan (1991) volume 2; and for modern references see Pregadio, Fabrizio (1995).]

- Barrett, T.H. (1994), 'The Daoist canon in Japan: some implications of the research of Ho Peng Yoke', *Daoist Resources*, 5.2:71–7.
- (1997), Review of Trombert, Erik (1995), *Le credit a Dunhuang*, *Journal of the Economic and Social History of the Orient*, 40.3.
- (1998), 'Science and religion in medieval China', *Journal of the Royal Asiatic Society*, Third series, 8.3.
- (2003), 'On the reconstruction of the *Shenxian zhuan*', *Bulletin of the School of Oriental and African Studies*, 66.2.
- (2004), 'The Madness of Emperor Wuzong', *Cahiers d'Extrême-Asie*, 14.
- (2005), 'Religion and the first recorded print run: Luoyang, July 855', *Bulletin of the School of Oriental and African Studies*, 68.3.
- Berkowitz, Alan J. (2000), *Patterns of Disengagement: The Practice and Portrayal of Reclusion in Early Medieval China*, Stanford, CA: Stanford University Press.
- Boas, Marie (1962), *The Scientific Renaissance 1450–1630*, London: Collins.
- Chen Guofu 陳國符 (1949), *Daoang yuanliu kao* 道藏源流考 (A study on the evolution of the Daoist Canon), Shanghai: Zhonghua shuju.
- (1963), *Daoang yuanliu kao* 道藏源流考 (A study on the evolution of the Daoist Canon), rev. ed., 2 vols, Beijing: Zhonghua shuju.
- (1979), 'Daoangjing zhong waidan huangbaishu cailian de zhengli 道藏經中外丹黃白術採煉的整理' (Bringing into order the material on gold and silver making in *waidan* alchemy as contained in the Daoist Canon), *Huaxue tongbao* 化學通報, 6:78–87.
- (1983a), *Daoang yuanliu xukao* 道藏源流續考 (Supplement to a study on the evolution of the Daoist Canon), Taipei: Mingwen shuju.
- (1983b), 'Daoangjing zhong ruogan kegong yanjiu Zhongguo gudai ziran kexue yu keji shiliao 道藏經中若干可供研究中國古代自然科學與科技史料' (Some historical data in the Daoist Canon useful for the study of ancient Chinese natural sciences and technology), *Ziran kexueshi yanjiu* 自然科學研究, 2.3:216–24.
- (2004), *Chen Guofu Daoang yanjiu lunwen ji* 陳國符道藏研究論文集 (Chen Guofu's collected essays on the Daoist Canon), Shanghai: Shanghai Guji chubanshe.
- Chen Yuan 陳垣 (1958), *Shihui juli* 史諱舉例 (Examples of taboo words in history), Beijing: Kexue chubanshe.

- Cheung, S.C. 蔴兆祥, P.S.Kwan, 關培生 and Y.C.Kong 江潤祥 (1983), *Bencao yanjiu rumen* 本草研究入門 (An introduction to research on Chinese pharmacopoeia), Hong Kong: Zhongwen daxue chubanshe.
- Cohen, Alvin P. ed. (1979), *Selected Works of Peter A. Boodberg*, Berkeley and Los Angeles, CA: University of California Press.
- Davis, Tenney L. and Chao Yun-ts'ung (1939a), 'An Alchemical Poem by Kao Hsiang hsien (14th century A.D.)', *ISIS*, 30:236–40.
- (1939b), 'Chang Po-tuan of T'ien-t'ai; his Wu Chên P'ien [Essay on the Understanding of the Truth]; A Contribution to the Study of Chinese Alchemy', *Proceedings of the American Academy of Arts and Sciences*, 73:97–117.
- (1940a), '15th Century Chinese Encyclopaedia of Alchemy', *Proceedings of the American Academy of Arts and Sciences*, 73:391–9.
- (1940b), 'The Four-hundred Word Chin Tan of Chang Po-tuan', *Proceedings of the American Academy of Arts and Sciences*, 73:371–6.
- (1940c), 'Three Alchemical Poems by Chang Po-tuan', *Proceedings of the American Academy of Arts and Sciences*, 73:377–9.
- Davis, Tenney L. and Ch'en Kuo-fu (1941), 'The Inner Chapters of the Pao P'u Tzu', *Proceedings of the American Academy of Arts and Sciences*, 74:297–325.
- (1942), 'Shang Yang Tzu, Taoist Writer and Commentator on Alchemy', *Harvard Journal of Asiatic Studies*, 7:126–9.
- Davis, Tenney L. and Wu Lu-ch'iang (1935), 'Ko Hung on the Gold Medicine and on the Yellow and the White', *Proceedings of the American Academy of Arts and Sciences*, 70:221–84.
- Dudbridge, G. (1970), *The Hsi-yü Chi: A Study of the Antecedents to the Sixteenth-Century Chinese Novel*, Cambridge: Cambridge University Press.
- Feifel, E. (1944), 'Pao P'u Tzu (Nei P'ien), Chapter 4', *Monumenta Serica*, 9:1–33.
- Feng Chia-lo and H.B.Collier (1937), 'A Sung Dynasty Treatise; the Outline of Alchemical Preparations—Tan-fang chien yuan—by Tuku T'ao 10th century A.D.', *Journal of the West China Border Research Society*, 9:199–209.
- Franke, W. (1968), *An Introduction to the Sources of Ming History*, Kuala Lumpur: University of Malaya Press.
- Giles, L. (1948), *A Gallery of Chinese Immortals, Selected Bibliographies Translated From Chinese Sources*, London: J.Murray.
- Gómez, Luis O. (1983), 'The Direct and the Gradual Approaches of Zen Master Mahayana', in Robert M.Gimello and Peter N.Gregory, eds, *Studies in Ch'an and Hua-yen*, Honolulu, HI: University of Hawaii Press.
- Goodrich, C. and C.Fang (1976), *Dictionary of Ming Biography 1368–1644*, 2 vols, New York: Columbia University Press.
- Graham, A.C. (1990), *Studies in Chinese Philosophy and Philosophical Literature*, Albany, NY: State University of New York Press.
- Guojia Zhongyiyao Guanliju 國家中醫藥管理局 (1999), *Zhonghua bencao* 中華本草 (China's Pharmacopoeia), 10 vols, Shanghai: Shanghai kexue jishu chubanshe.
- Guo Zhengyi 郭正誼 'Cong Longhu huandan jue kan woguo liandanjia dui huaxue de gongxian 從龍虎還丹訣看我國煉丹家化學的貢獻' (Contributions to chemistry by Chinese alchemists as seen from the *Longhu huandan jue*), *Ziran kexueshi yanjiu* 自然科學史研究, 2.2:112–17.
- He Bingyu [Ho Peng Yoke] 何丙郁 (1982), 'Zaohua zhinan' de yanjiu 造化指南的研究' (Research on the *Zaohua zhinan*), in *Explorations in the History of Science and Technology*, Li Guohao et al., eds, Shanghai: Shanghai Chinese Classics Publishing House.
- (1987), 'Kexue wenxue yixianqian 科學文學—線牽' (A string pulling between science and literature), *Mingbao yuekan* 明報月刊, 22.3:84–91.
- Ho Peng Yoke (1966), *The Astronomical Chapters of the Chin Shu*, Paris: Mouton.
- (1968), 'Alchemy on Stones and Minerals in Chinese Pharmacopoeias', *Chung Chi Journal*, 7:155–70.

- (1974), 'Chinese Alchemical and Medical Preparations—A Preliminary Study', *14th International Congress of the History of Science Proceedings*, 3:295–8.
- (1979), *On the Dating of Taoist Alchemical Texts* (Griffith Occasional Paper Monograph No.1), Brisbane: Griffith University Press.
- (1980), *Daozang Danfang jianyuan* 道藏丹方鑑源 (Tuku T'ao's *Tan-fang chienyuan*: a 10th-Century Chinese Alchemical Source-Book), Hong Kong: Centre for Asian Studies, University of Hong Kong.
- (1982), 'The Ti-Ching-T'u: A lost manual on mining and geobotanical prospecting', (in Austrina: Commemorative volume to celebrate the first twenty-five years of the Oriental Society of Australia), Sidney: Oriental Society of Australia; 77–92.
- (1985), *Li, Qi and Shu: An Introduction to Science and Civilization in China*, Hong Kong: Hong Kong University Press.
- (2001), *He Bingyu Zhongguo keji shi lunji* 何丙郁中國科技史論集 (Collected essays on history of Chinese science and technology by Ho Peng Yoke), Shenyang: Liaoning jiaoyu chubanshe.
- (2003), *Chinese Mathematical Astrology: Reaching out to the Stars*, London: Routledge/Curzon.
- Ho Peng Yoke and Chen Tieh-fan 陳鐵凡 (1971), 'Lun Chunyang Lüzhenren yaoshizhi de zhucheng shidai 論純陽呂真人藥石製的注成時代' (A discussion of the date of composition of the *Chunyang Lü Zhenren yaoshizhi*), *Journal of Oriental Studies*, 9.2:181–229.
- Ho Peng Yoke and Chiu Ling Yeong 趙令揚 (1983), 'Ning Wang Zhu Quan ji qi Gengxin yuce 寧王朱權及其庚辛玉冊' (Prince Zhu Quan and his *Gengxin Yuce*), Department of Chinese, University of Hong Kong Monograph No. 1, Griffith University, Asian Papers Publication No.8, Hong Kong, Brisbane.
- Ho Peng Yoke and Lim Beda (1972), 'Ts'ui Fang, a Forgotten 11th Century Alchemist', *Japanese Studies in the History of Science*, 11:103–12.
- Ho Peng Yoke and Peter Lisowski (1998), *A Brief History of Chinese Medicine and Its Influence*, Singapore: World Scientific.
- Ho Peng Yoke and Su Ying-hui 蘇英輝 (1970), 'Danfang jingyuan kao 丹房鏡原考' (Investigations on *Danfang jingyuan*), *Journal of Oriental Studies*, 8:1–23.
- Ho Peng Yoke, Goh Thean Chye and Beda Lim (1972), *Lu Yu, The Poet-Alchemist* (*Asian Studies Occasional Paper* 13), Canberra: Faculty of Asian Studies, Australian National University.
- Ho Peng Yoke, Lim Beda and Francis Morsingh (1973), 'Elixir Plants: The *Ch'unyang Lü Chenjen yao shih chih*', in Nakayama and Sivin, *Chinese Science: Explorations of an Ancient Tradition*, Cambridge, MA: Harvard University Press.
- Ho Peng Yoke, Goh Thean Chye and David Parker (1974), 'Po Chü-i's poems on immortality', *Harvard Journal of Asiatic Studies*, 34:163–86.
- Ho Ping-yü and Joseph Needham (1959a), 'Theory of Categories in Early Mediaeval Chinese Alchemy', *Journal of the Warburg and Courtauld Institute*, 22:173–210.
- (1959b), 'The Laboratory Equipment of the Early Mediaeval Chinese Alchemists', *Ambix*, 7:57–115.
- (1959c), 'Elixir Poisoning in Mediaeval China', *Janus*, 48.4:222–51.
- Huang H.T. (2000), *Science and Civilisation in China*, Vol. 6, Part 5: *Fermentations and Food Science*, Cambridge: Cambridge University Press.
- Huang Yunmei ed. (1980), *Gujin weishu kao buzheng* 古今偽書考補正 (Supplementary corrections on ancient and modern forged books), Jinan: Qilu shushe.
- Hucker, Charles O. (1985), *A Dictionary of Official Titles in Imperial China*, Stanford, CA: Stanford University Press.
- Jao Tsung-i 饒宗頤 (1970), 'Taiqing jinyi shendan jing (juan xia) yu Nanhai dili 太清金液神丹經卷下與南海地理' (Chapter 2 of *Taiqing jinye shendan jing* and the geography of the south seas), *Journal of the Institute of Chinese Studies, Chinese University of Hong Kong*, 3:31–76.

- Jiang Sheng 姜生 and Tang Weixia 湯偉俠 eds (2002), *Zhongguo daojiao kexue jishu shi: Han Wei Liang Jin juan* 中國道教科學技術史：漢魏兩晉卷 (The history of science and technology in Daoism: Chapters on the Han, Wei and the two Jin dynasties), Beijing: Kexue chubanshe.
- Jiangsu Xinyi Xueyuan 江蘇新醫學院 (1977), *Zhongyao da cidian* 中藥大辭典 (Great dictionary of Chinese materia medica), Shanghai: Shanghai kexue jishu chubanshe.
- Karlgren, B. (1941), *Grammata Serica; Script and Phonetics in Chinese and SinoJapanese*, Beijing [reprinted from *Bulletin of the Museum of Far Eastern Antiquities*, No. 12, Stockholm, 1940].
- (1963), *Compendium of Phonetics in Ancient and Archaic Chinese*, Stockholm [reprinted from the *Bulletin of the Museum of Far Eastern Antiquities*, No. 22, Stockholm, 1954].
- Kieschnik, John (1997), *The Eminent Monk: Buddhist Ideals in Medieval Chinese Historiography*, Honolulu, HI: University of Hawaii Press.
- Komjathy, Louis (2002), *Title Index to Taoist Collections*, Cambridge, MA: Three Pines Press.
- Kracke, E.A. (1953), *Civil Service in Early Sung China 960–1067*, Cambridge, MA: Harvard University Press.
- (1957), *Translation of Sung Civil Service Titles*, Paris: École pratique des hautes études, Centre de recherches historiques.
- Laufer, Berthold (1919), *Sino-Iranica*, Chicago, IL: Field Museum of Natural History.
- Lin Tianwei 林天蔚 (1986), *Songdai xiangyao maoyishi* 宋代香藥貿易史 (History of the spice trade in Song China), Taipei: Zhongguo wenhua daxue chubanshe.
- Liu, Xinru (1994), *Ancient India and Ancient China: Trade and Religious Exchanges, AD 1–600*, Delhi: Oxford University Press.
- Liu Guang-ding 劉廣定 (1986), ‘Zhongguo gudai lianzhi jindan qiju de yixie wenti 中國古代煉製金丹器具的一些問題’ (Some problems concerning the apparatus used in ancient China for elixir preparations), *Kexueshi tongxun* 科學史通訊 (The History of Science Newsletter), 5:16–19.
- (2002), *Zhongguo kexueshi lunji* 中國科學史論集 (Collected essays on history of Chinese science), Taipei: Guoli Taiwan Daxue chuban zhongxin.
- Liu Ts’un-yan 柳存仁 (1968), ‘Lu Hsi-hsing and his Commentaries on the Ts’an-t’ungch’i’, *Ts’ing-Hua Journal of Chinese Studies*, 7.1:71–98.
- (1974), ‘The Compilation and Historical Value of the Tao-tsang’, in Donald Leslie, Collin Mackerras, Wang Gungwu, eds. *Essays on the Sources of Chinese History*, Canberra: Australia National University Press, 104–19.
- (1977), *Hefengtang dushu ji* 和風堂讀書集 (Essays from the Hall of Harmonious Wind), 2 vols, Hong Kong: Lung Men.
- (1991), *Hefengtang wenji* 和風堂文集 (Collected writings from the Hall of Harmonious Wind), 3 vols, Shanghai: Shanghai guji chubanshe.
- Liu Youliang 劉友樸 (1964), *Kuangwuyao yu danyao* 礦物藥與丹藥 (Mineral drugs and elixirs), Shanghai: Shanghai kexue jishu chubanshe.
- Lo, Hsiang-lin (1966), ‘Li Hsün of the Persians and his Exotic Pharmacopoeia’, *Symposium on Chinese Studies Commemorating the Golden Jubilee of the University of Hong Kong*, 2:217–39.
- Lo, Winston W. (1987), *An Introduction to the Civil Service of Sung China*, Honolulu, HI: University of Hawaii Press.
- Long Bojian 龍伯堅 (1957), *Xiancun bencao shulu* 現存本草書錄 (Catalogue of existing pharmacopoeia), Beijing: Renmin weisheng chubanshe.
- Lung, T.N. 龍村倪 (1986), ‘Danshui lian tong 膽水煉銅’ (The history of copper cementation on iron—the world’s first hydrometallurgical process from medieval China) (in Chinese), *Thought and Word*, 24.2:139–56.
- Luo Guihuan 羅桂環 (1985), ‘Zhu Su he tade Jiuhuang bencao 朱橚和他的救荒本草’ (Zhu Su and his Jiuhuang bencao pharmacopoeia), *Ziran kexueshi yanjiu* 自然科學史研究, 4.2:189–94.
- Ma Jixing 馬繼興 et al., eds (1995), *Shennong bencaojing jizhu* 神農本草經輯注 (Compilation and commentary on the Pharmacopoeia of the Heavenly Husbandman), Beijing: Renmin chubanshe.

- Maspero, Henri (1981), Kierman Jr, Frank A. trans., *Taoism and Chinese Religion*, Amherst, MA: University of Massachusetts Press.
- Masutomi Junosuke 益富壽之助 (1957), Shōsōin Yakubutsu o chūshin to sum kodai sekiyaku no kenkyū 正倉院藥物を中心とする古代石薬の研究 (Research on ancient mineral *materia medica* from among the Shōsōi Museum medical artefacts), Kyoto: Nihon kobutsu shumi no kai.
- Meng Naichang 孟乃昌 (1982), 'Qiushi shiyi 秋石試議' (A tentative discussion on the Autumn Stone), *Ziran kexueshi yanjiu* 自然科學史研究 1.4:289–99.
- (1983), 'Han Tang xiaoshi mingshi kaobian 漢唐硝石名實考辨' (Studies on the 自然科學史研究, term *xiaoshi* used from the Han to the Tang periods), *Ziran kexueshi yanjiu* 2.2:97–111.
- (1984), 'Zhongguo gudai yangqi faxian zhi mi 中國古代氧氣發現之謎' (On the puzzle about the discovery of oxygen in ancient China), *Ziran kexueshi yanjiu* 自然科學史研究, 3.1:31–3.
- (1985), 'Zhongguo liandanshu yanjiu de guoqu he xianzai 中國煉丹術研究的過去和現在' (Research in Chinese alchemy past and present), *Zhongguo keji shiliao* 中國科技史料, 6.4:32–40.
- Meng Naichang 孟乃昌, Lü Yuecheng 呂躍成 and Li Xiaohong 李小红 (1984), 'Zhongguo liandanshu fu liuhuang xiaoshi naosha zhufa de shiyan yanjiu 中國煉丹術 伏硫黃硝石礱砂諸法的試驗研究' (Experimental studies on the various methods of subduing sulphur, saltpetre and sal ammoniac in Chinese alchemy), *Ziran kexueshi yanjiu* 自然科學史研究, 113–27.
- Na Qi 那琦 (1984), 'Mingdai weiyi chizhuan bencao Bencao pinhui jingyao yuanben zhi liuluo haiwai yuqi yaotu zhi baiyunian hou moxieben Jinshi kunchong caomu zhuang zhi kanxing jiazhi 明代唯一敍撰本草本草品彙精要原本之流落海外及其藥圖之百餘年後模寫本金石昆蟲草木莊之刊行價值' (The discovery of over a hundred years of missing original copies of the *Bencao pinhui jingyao*, the only authorised official Ming pharmacopoeia, and the evaluation of the publication of the *Jinshi kunchong caomu zhuang*, a manuscript copied from the colour illustrations of the former), *Kexueshi tongxun* 科學史通訊 (The History of Science Newsletter), 3:35–43.
- Needham, Joseph, with the research assistance of Wang Ling (1959), *Science and Civilisation in China, Vol. 3: Mathematics and the Sciences of the Heavens and Earth*, Cambridge: Cambridge University Press.
- Needham, Joseph, with the research assistance of Wang Ling and the special cooperation of Kenneth Robinson (1962), *Science and Civilisation in China, Vol. 4, Part 1: Physics*, Cambridge: Cambridge University Press.
- Needham, Joseph, with the collaboration of Lu Gwei-Djen (1974), *Science and Civilisation in China, Vol. 5, Part 2: Spagyric Discovery and Invention: Magisteries of Gold and Immortality*, Cambridge: Cambridge University Press.
- Needham, Joseph, with the collaboration of Lu Gwei-Djen and Ho Ping-Yu (1976), *Science and Civilisation in China, Vol. 5, Part 3: Spagyric Discovery and Invention: Historical Survey, from Cinnabar Elixirs to Synthetic Insulin*, Cambridge: Cambridge University Press.
- Needham, Joseph, with the collaboration of Lu Gwei-Djen, Ho Ping-Yu and N.Sivin, (1980), *Science and Civilisation in China, Vol. 5, Part 4: Spagyric Discovery and Invention: Apparatus and Theory*, Cambridge: Cambridge University Press.
- Needham, Joseph, with the collaboration of Lu Gwei-Djen (1983), *Science and Civilisation in China, Vol. 5, Part 5: Spagyric Discovery and Invention: Physiological Alchemy*, Cambridge: Cambridge University Press.
- Needham, J., A.R.Butler and C.Glidewell, (1980), 'Solubilisation of Cinnabar—Explanation of a Sixth-century Chinese Alchemical Recipe', *Journal of Chemical Research (S)* 47, (M) 0817–32.
- Nivison, David S. (1966), *The Life and Thought of Chang Hsüeh-ch'eng (1738–1801)*, Stanford, CA: Stanford University Press.
- Okanishi Tameto 岡西爲人 (1958), *Song yiqian yiji kao* 宋以前醫籍考 (Comprehensive annotated bibliography of Chinese medical literature in and before the Song period), Beijing: Renmin weisheng chubanshe.
- (1967), 'Chūgoku honsō no dentō to Kin Gen no honsō 中國本草の伝統と金元の本草' (Successions of Chinese pharmacopoeia and the pharmacopoeia of the Jurchen and Yuan

- Periods), in Yabuuti Kiyosi 巖内清, ed., *Sō-Gen jidai no kagaku gijitsu shi* 宋元時代の科学技術史 (History of Science and Technology in the Sung and Yuan Periods), Kyoto: Kyoto daigaku jinbun kagaku kenkyujo, pp. 171–210.
- Pan Jixing 潘吉星 (1982), 'Tiangong kaiwu banben kao 天工開物版本考' (On the editions of the *Tiangong kaiwu*), *Ziran kexueshi yanjiu* 自然科學史研究, 1.1:40–54.
- (1989), *Tiangong kaiwu jiaozhu yu yanjiu* 天工開物校注與研究 (Commentary and research on *Tiangong kaiwu*), Chengdu: Bashu shushe.
- Penny, Benjamin ed. (2002), *Religion and Biography in China and Tibet*, Richmond, Surrey: RoutledgeCurzon.
- (2006), *Daoism in History: Essays in Honour of Liu Ts 'un-yan*, Richmond, Surrey: RoutledgeCurzon.
- Pregadio, Fabrizio (1995), 'The representation of time in the *Cantongqi*', *Cahier d'Extrême-Asie*, 8:155–73.
- (1996), 'Chinese Alchemy: An Annotated Bibliography of Works in Western Languages', *Monumenta Serica*, 44:439–76.
- (2000), 'The Elixirs of Immortality', in Livia Kohn, ed., *Handbook of Taoism*, Leiden: E.J.Brill, 169–95.
- (2002), 'The Early History of the *Zhouyi cantong qi*', *Journal of Chinese Religions*, 30:149–76.
- (2006), *Great Clarity: Alchemy and Taoism in Early Medieval China*, Stanford, CA: Stanford University Press.
- Pulleyblank, Edwin G. (1983), *Middle Chinese: A Study in Historical Phonology*, Vancouver, WA: University of British Columbia Press.
- (1991), *Lexicon of Reconstructed Pronunciation in Early Middle Chinese, Late Middle Chinese, and Early Mandarin*, Vancouver, WA: University of British Columbia Press.
- Read, Bernard E. (1931), *Chinese Materia Medica: Animal Drugs*, Peking Natural History Bulletin.
- Read, Bernard E. and Liu Yu-ch'iang (1936), *Chinese Medical Plants from the Pen-ts'ao kang-mu*, 3rd ed., Peking: Peking Natural History Bulletin.
- Read, Bernard E. and C.Pak (1936), *A compendium of Minerals and Stones from the Pents'ao kang-mu*, Peking: Peking Natural History Bulletin.
- Reynolds, L.D. and N.G.Wilson (1991), *Scribes and Scholars: A Guide to the Transmission of Greek and Latin Literature*, 3rd ed., Oxford: Oxford University Press.
- Robinet, Isabelle (1984), *La Révélation du Shangqing dans l'histoire du Taoisme I*, Paris: École Française d'Extrême-Orient.
- Saeki, P.Y. (1951), *The Nestorian Documents and Relics in China*, Tokyo: The Toho Bunkwa Gakuin.
- Said, Hakim Mohammed (1965; revised and enlarged 1981), *Medicine in China*, Karachi: Hamdard Academy.
- (1973), *Al-Buruni's Book on Pharmacy and Materia Medica*, 2 vols, Karachi: Hamdard National Foundation, Pakistan.
- (1976), 'Medieval Chinese, Japanese and Arab Medicine—reciprocal Impact' (paper originally presented at the XXV International Congress for the History of Medicine, Quebec, Canada, 21–8 August, 1976), *Hamdard Medicus*, 19.7–12:99–109.
- Schipper, Kristofer M. (1965), *L'Empereur Wou des Han dans la Légende Taoiste*, Paris: EFEO.
- Schipper, Kristofer M. and Franciscus Verellen eds (2005), *The Taoist Canon: A Historical Companion to the Daozang*, Chicago, IL: Chicago University Press.
- Seaman, Gary, Laurence G.Thompson and Zhifang Song (2002), *Chinese Religions: Publications in Western Languages. Volume 4:1996 through 2000* (The Association of Asian Studies Resources for Scholarship on Asia, No. 1), Ann Arbor, MI: The Association of Asian Studies.
- Shang Zhijun 尚志钧 ed. (1987), *Wu Pu bencao* 吳普本草 (Pharmacopoeia of Wu Pu), Beijing: Renmin weisheng chubanshe.

- Shang Zhijun 尚志鈞 ed. (1994), *Bencao tujing* 本草圖經 (Illustrated Pharmacopoeia), Hefei: Anhui kexue jishu chubanshe.
- Shang Zhijun 尚志鈞 ed. (1997), *Haiyao bencao jijiaoben* 海藥本草輯校本 (Compilation of Materia Medica of Countries beyond the Seas with commentary), Beijing: Renmin weisheng chubanshe.
- Shang Zhijun 尚志鈞 ed. (1998), *Kaibao bencao jifuben* 開寶本草輯復本 (Pharmacopoeia of the Kaibao reign), Hefei: Anhui kexue jishu chubanshe.
- Shang Zhijun 尚志鈞 ed. (2002), *Bencao shiyi jishi* 本草拾遺輯釋 (Compilation and explanation of Additions to the Materia Medica), Hefei: Anhui kexue jishu chubanshe.
- Shang Zhijun 尚志鈞, Lin Qianliang 林乾良, Zheng Jinsheng 鄭金生 (1989), *Lidai Zhongyao wenxian jinghua* 歷代中藥文獻精華 (The essence of Chinese materia medica texts through the ages), Beijing: Kexue jishu wenxian chubanshe.
- Sivin, Nathan (1968), *Chinese Alchemy: Preliminary Studies*, Cambridge, MA: Harvard University Press.
- (1995), *Science in Ancient China*, Aldershot, Hampshire: Variorum.
- Skar, Lowell (2003), *Golden Elixir Alchemy: The formation of the Southern Lineage of Taoism and the Transformation of Medieval China*, PhD. dissertation, University of Pennsylvania.
- Sørensen, Hendrick H. (1989), 'Chinese Chan Manuscripts from Dunhuang', *Studies in Central & East Asian Religions* 2 (Autumn 1989), pp. 115–39.
- Sun, E-tu Zen and Shiou-Chuan Sun (1966), *Chinese Technology in the Seventeenth Century by Sung Ying-Hsing*, Pennsylvania, PA: The Pennsylvania State University Press.
- Thompson, Laurence G. (1985), *Chinese Religion in Western Languages: A Comprehensive and Classified Bibliography of Publications in English, French, and German through 1980* (The Association of Asian Studies Monograph No. XLI), Tucson, AZ: The University of Arizona Press.
- Thompson, Laurence G. and Gary Seaman (1993), *Chinese Religions: Publications in Western Languages, 1981 through 1990* (The Association of Asian Studies Monograph No. 47), Ann Arbor, MA: The Association of Asian Studies.
- (1998), *Chinese Religions: Publications in Western Languages. Volume 3:1991–1995* (The Association of Asian Studies Monograph No. 58), Ann Arbor, MA: The Association of Asian Studies.
- Tōdō Akiyasu 藤堂明保 (1957), *Chūgokugo on'inron* 中國語音韻論 (On Chinese Phonology), Tokyo: Kōnan shoin.
- Trombert, Erik (1995), *Le credit a Dunhuang*, Paris: Collège de France, Institut des hautes études chinoises.
- Ts'ao T'ien-ch'ien, Ho Ping-Yu and J. Needham (1959), 'An Early Mediaeval Chinese Alchemical Text on Aqueous Solutions', *Ambix*, 7:122–58. Translated into Chinese by Wang Kuikue 王奎克 (1963), *Kexueshi jikan* 科學史集刊, 5.
- Tsien, T.H. (1978), *China: an annotated bibliography of bibliographies*, Boston, MA: G.K.Hall.
- Unschuld, Paul U. (1986), *Medicine in China: A History of Pharmaceutics*, Berkeley, CA: University of California Press.
- van der Loon, Piet (1984), *Taoist books in the libraries of the Sung period*, London: Ithaca Press.
- Volkov, Alexei (1996–7), 'Science and Daoism: An Introduction', *Taiwanese Journal for the Philosophy and History of Science*, 8:1–58.
- Wallis, Faith (1995), 'The experience of the book; manuscripts, texts, and the role of epistemology in early medieval medicine', in Don Bates, ed., *Knowledge and the scholarly medical traditions*, Cambridge: Cambridge University Press, 101–26.
- Wan, C.P. 萬家保 (1986), 'Guanyu Zhongguo zaoqi tonghejin hanxin de wenti 關於中國早期銅合金含鋅的問題' (On the zinc content of early Chinese copper alloy), *Thought and Word*, 24.2:157–65.
- Wang Kuikue 王奎克, Zhu Sheng 朱晟, Zheng long 鄭同 and Yuan Shuyu 袁書玉 (1982), 'Shen de lishu zai Zhongguo 砷的歷史在中國' (The history of arsenic lies in China), *Ziran kexueshi yanjiu* 自然科學史研究, 1.2:115–26.

- Wang Li 王力 (1957), *Hanyu yinyunxue* 漢語音韻學 (Chinese Phonology), Beijing: Zhonghua shuju.
 — (1963), *Hanyu yinyun* 漢語音韻 (Chinese Sounds), Beijing: Zhonghua shuju.
- Ware, J.R. (1966), *Alchemy, Medicine and Religion in the China of A.D. 320: the 'Nei P'ien' of Ko Hung*, Cambridge, MA: The Massachusetts Institute of Technology Press.
- Weng Dujian 翁獨健 (1935), *Daozang zimu yinde* 道藏字母引得 (Index to the Daoist Canon), Beijing: Harvard-Yenching Institute.
- Wieger, L. (1911), *Taoisme*, Vol. 1, Hien-hien.
 — (1913), *Taoisme*, Vol. 2, Hien-hien.
- Wilkinson, Endymion (2000), *Chinese History: A Manual*, Cambridge, MA: Harvard University Press.
- Wong Shiu Hon (1976), *On the Cult of Zhang Sanfeng (Chang Sanfeng) and the Authenticity of His Works*, PhD thesis, Australian National University.
 — (1989), *Daozang danyao yiming suoyin* 道藏丹藥異名索引 (Chinese alchemical terms: Guide-book to pseudonyms in the Daoist Canon), Taipei: Taiwan Xuesheng shuju.
- Wu Lu-ch'iang (1932), 'An Ancient Chinese Treatise on Alchemy entitled Ts'an T'ung Ch'i', written by Wei Po-yang about 142 AD', *ISIS*, 18:210–89.
- Wylie, A. (1867), *Notes on Chinese Literature*, Shanghai: American Presbyterian Mission Press.
- Yabuuti, Kiyosi 藪内清 ed. (1967), *Sō-Gen jidai no kagaku gijutsu shi* 宋元時代の科学技術史, Kyoto: Kyoto daigaku jinbun kagaku kenkyujo.
- Yanagida Seizan (1983), 'The "Recorded Sayings" Texts of Chinese Ch'an Buddhism', in Whalen Lai and Lewis R. Lancaster, eds, *Early Ch'an in China and Tibet*, Berkeley, CA: Asian Humanities Press.
- Yan Yunhe 嚴雲鶴 (1973), *Shiwu yiming dianlin* 事物異名典林 (Forest of different names of things), Taipei: Yan Yunhe.
- Yao Pinwen 姚品文 (1993), *Zhu Quan yanjiu* 朱權研究 (Research on Zhu Quan), Nanchang: Jiangxi gaoxiao chubanshe.
- Yoshida, Mitsukuni 吉田光邦 (1970), *Renkinjitsu: Senjitsu to kagaku no aida* 鍊金術：仙術と科学の間 (Alchemy: Between the Arts of the Holy Immortals and Science), Tokyo: Chūō kōronsha.
- Yoshioska Yoshitoyo 吉岡義豊 (1955), *Dōkyō kyōden shiron* 道教經典史論 (On the history of the Daoist canon), Tokyo: Dōkyō kankōkai.
- Yuan Hanqing 袁翰青 (1956), *Zhongguo huaxueshi lunwenji* 中國化學史論文集 (Collection of essays on the history of Chinese chemistry), Beijing: Sanlian shudian.
- Zhang Jueren 張覺人 (1980), *Zhongguo liandanshu yu danyao* 中國煉丹術與丹藥 (Chinese alchemy and alchemical medicine), Chengdu: Sichuan renmin chubanshe.
- Zhang Zigao 張子高 et al. (1964), *Zhongguo huaxueshi gao* 中國化學史稿 (Draft history of Chinese chemistry), Beijing: Kexue chubanshe.
- Zhao Kuanghua 趙匡華 (1984a), 'Zaitan woguo yong xin qiyuan 再談我國用鋅起源' (Reinvestigating the early use of zinc in China), *Zhongguo keji shiliao* 中國科技史料, 5.4:15–23.
 — (1984b), 'Hu Gangzi jiqi dui Zhongguo gudai huaxue de zhuoyue gongxian 氣剛子及其對中國古代化學的卓越貢獻' (Hu Gangzi and his remarkable contribution to ancient Chinese chemistry), *Ziran kexueshi yanjiu* 自然科學史研究, 3.3:224–35.
 — ed. (1985), *Zhongguo gudai huaxueshi yanjiu* 中國古代化學史研究 (Studies on his tory of Chinese chemistry), Beijing: Beijing daxue chubanshe.
- Zhao Kuanghua and Wu Langyu 吳琅宇 (1983), 'Guanyu Zhongguo liandanshu he yiyao huaxue zhong zhi qingfen, fenshuang zhufang de shiyan yanjiu 關於中國煉丹術和化學中製輕粉霜諸方的實驗研究' (Experimental studies on the recipes for preparing mercurous chloride and purified mercurous chloride in Chinese alchemy and pharmacology), *Ziran kexueshi yanjiu* 自然科學史研究, 2.3:204–12.
- Zhao Kuanghua and Zhang Huizhen 張惠珍 (1985), 'Handai yangke wudufang de yuan liu yu shiyan yanjiu 漢代瘍科五毒方的源流與實驗研究' (The origin and evolution of the *wudufang* medical prescription in the Han dynasty and its experimental study), *Ziran kexueshi yanjiu* 自然科學史研究, 4.3:199–211.

- Zhao Kuanghua, Ruan Shengkang 阮慎康 and Luo Meng 駱萌 (1983), 'Woguo jindanshu zhong shenbaitong de yuanliu yu yanzheng 我國金丹術中神白銅的源流與驗證' (The origin of arsenic copper-nickel alloy in Chinese alchemy and its testing and verification), *Ziran kexueshi yanjiu* 自然科學史研究, 2.1:24–31.
- Zheng Jinsheng 鄭金生 *et al.* (1999), *Bencao gangmu suoyin* 本草綱目索引 (Index to the *Bencao gangmu*), Beijing: Renmin weisheng chubanshe.
- Zhongguo renming dacidian* 中國人名大辭典 (Dictionary of Chinese Personal Names), 12th ed., Shanghai: Shangwu yinshuguan, 1933.
- Zhongguo Zhongyi Yanjiuyuan Tushuguan 中國中醫研究院圖書館 eds (1991), *Quanguo zhongyi tushuguan lianhe mulu* 全國中醫圖書館聯合目錄 (Union catalogue of Chinese medicine books in libraries in China), Beijing: Zhongyi guji chubanshe.
- Zhu Sheng 朱晟 (1980), 'Woguo gudai huaxue zai wujisuan youjisuan shengwujian fangmian de yixie chengjiu 我國古代化學在無機酸有機酸生物鹼方面的一些成就' (Findings concerning inorganic and organic acids, inorganic alkalis and alkaloids in ancient Chinese chemistry), *Kejishi wenji* 科技史文集 3:119–23.
- Zurndorfer, Harriet T. (1995), *China Bibliography: A Research Guide to Reference Works about China Past and Present*, Leiden: E.J.Brill.

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