Ninth stage in the long march of Joseph Needham

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Science & Civilisation in China, Vol. V:4. By Joseph Needham. Pp.772. ISBN 0-521-08573-X. (Cambridge University Press: 1980.) £48, \$105.

DR Needham's great compilation at this stage occupies a substantial length of bookshelf — already more, for example, than Thorndike's monumental *A History of Magical and Experimental Science*. Though this volume is the ninth to appear, a recently issued "State of the Project" pamphlet states that the completed series will comprise 20 books. There will be three further volumes on chemistry and chemical technology after the currently reviewed volume, the third to appear.

Three major areas are covered by this book: chemical techniques, alchemical theory and comparative macrobiotics. The first is largely involved with a description of distillation processes. Here, as with many other topics treated by Needham in the series, the reader is not simply provided with an elucidation of the Chinese tradition, but with the best comparative account available for a number of cultures. However one main argument has now been shown to be inaccurate: the suggested greater efficiency of the Eastern stills to the simple Western types (retort or alembic). Needham proposes that the relatively late date for the distillation of alcoholic spirits in the West (13th century AD) can be explained by the ineffectiveness of the condensation surface of the retort and alembic. In China, he maintains, the more efficient stills account for evidence of spiritous liquors in the 7th century AD. This argument has been demolished in a recent paper in *Ambix* (27, 69; 1980) (of which Needham, it must be admitted, is co-author) in which stylized Western retorts, Mongolian stills and Chinese stills were tested experimentally and were shown to be equally efficient at alcohol distillation. How odd, then, that there is no positive evidence of earlier distillation of spirits in the West as there is of perfume oils and petroleum fractions.

Much less is said about other processes and the associated apparatus, though there is an interesting discussion of reaction-chambers (which do not have an exact Western counterpart). Cunningly designed water-cooled examples are illustrated, redrawn from the *Chin Hua Chung Pi Tan Ching Pi Chih* ("Confidential Instructions on the Manual of the Heaven-piercing Golden Flower Elixir") of 1225 AD. So bizarre are some of these that one wonders if they were really constructed.

The second section, "Alchemical Theory", discusses the application of Taoist philosophy to an understanding of chemical materials and their reactions. To the Western mind of today, the explanations of the Chinese alchemists bear little

Chart illustrating the multifocal origins of proto-chemistry, to be seen as superimposed roughly upon a map of the Old World. See p.504 of the book for further details.

or no relationship to current scientific understanding; Needham himself says that "the dominant goal of proto-scientific alchemy was contemplative" (p.244) — though this must be reconciled with a later statement that theoretical alchemy was "a deductive proto-science on quite the same level as medicine, acoustics or magnetic geomancy" (p.298).

In the final part of the book, macrobiotics is defined as longevity or material immortality attained with the aid of chemical knowledge. Here a comparison is made of Chinese alchemy, Hellenistic proto-chemistry (macrobiotics played little part in Graeco-Egyptian culture) and Arabic and Latin alchemy. Most importantly, the interactions and hence influences are probed. Thus it is shown that the early chemistry of the Arabs was not exclusively Graeco-Egyptian in origin, but included contributions from China, India and Persia. A summing-up is provided in the form of a chart (reproduced above), illustrating the complex multifocal origins of proto-chemistry.

The reader of this authoritative and rewarding book is left with the impression of two themes pursued relentlessly by Needham. First, routes of influence are constantly sought, the chances of independent discovery of the same solution of the same problem in geographically distant places only being considered when all else fails. This can produce some rather absurd, tongue-in-cheek suggestions such as the relationship between the Mongolian still and the Irish poteen still. Second, is the effort made to claim primacy for the Chinese on every occasion. Thus in a passage attempting to pre-date Western spirit distillation by the Chinese, Needham follows some rather ambiguous early

evidence with the revealing remark "We still have plenty of time before us ere we reach the +12th century, time of the first distillation in the West".

Yet it is the highly personal approach which helps to make this prodigious work so enjoyable. How delightful and revealing, for example, is the seemingly careless comment: "Resting one day in 1968 at a wayside auberge in the South of France, I read again the text of the *Tabula Smaragdina* and felt so much the Chinese flavour of it that I started translating it to see how it would look in that language".

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Bright future of NSE

B. E. F. Fender

Neutron Spin Echo. Lecture Notes in Physics, 128. Edited by F. Mezei. Pp.253. ISBN 3-540-10004-0. (Springer-Verlag: 1980.) \$19.50, DM 33.

NEUTRON spin echo (NSE) techniques represent the single most important innovation in neutron scattering methods in recent years. The idea originated with F. Mezei and has been skilfully realized at the Institut Laue-Langevin in a full working instrument by J. Hayter and Mezei.

Conventional neutron inelastic scattering instruments for studying the dynamics of materials are conceptually simple; neutrons of a particular energy are selected by a monochromating crystal or a