

matters arising

Chinese cosmology

GRIBBIN'S essay¹ is based on a few pages of Joseph Needham's *Science and Civilisation in China*², but makes an exaggerated claim for Chinese openmindedness as contrasted with Western narrowness by disregarding Needham's sensitivity to context and implications, and by painting an extremely one-sided picture of the European tradition. The statement that Western science was a branch of religion three hundred years ago is either misinformed or extremely ill-stated. Gribbin confuses cosmology and astronomy when he talks about the centre of development of the science shifting to the West by the end of the seventeenth century. "The science" must mean astronomy, mentioned in the preceding sentence. It is impossible to sustain an argument that the centre of astronomy lay in China until that time. Needham proves that early Chinese astronomy was as estimable as that of the West, but his argument ignores the consistent superiority of Europe in computational astronomy. Gribbin is apparently unaware of the work of Nakayama³, myself⁴, and others who have provided independent quantitative comparisons in the nearly twenty years since volume 3 of *Science and Civilisation in China* was completed.

Gribbin's article reads like a caricature of Needham, because he ignores everything that does not fit his thesis. One could make an equally one-sided argument in the other direction by noting that Aristarchus of Samos, in the third century BC, asserted that the Earth revolves about its own axis and about the Sun, an idea that never appeared independently in China. Aristarchus also suggested that the stars were immeasurably far from the Sun, but Gribbin does not mention this.

Although it is true, as Gribbin says, that any study of Chinese astrology and cosmology must draw on Needham's work, it cannot end there. Needham's sections on astronomy and mathematics depend much more heavily on the secondary literature than his later volumes. His accounts of early cosmology require correction from other sources. The earliest concept did not, as Needham and Gribbin claim, represent the heavens as a hemispherical dome. As Nakayama has

shown in English, there were two stages; in the first sky and Earth were flat, and in the second they were indefinitely vault-shaped. The second concept was not that of "a celestial sphere surrounding the spherical Earth". Recent Chinese research has proved what Western writers have suggested, namely that the Earth in this model was either flat or hemispherical⁵. Neither concept, in fact, was a cosmology either in the modern sense or in the sense that gave philosophical cosmology authority over computational astronomy in the early West. The two Chinese concepts did not displace each other because it was a matter of no practical consequence which was correct. The independence of astronomy from cosmology in China has been noted by many recent writers. Of the several ancient authorities that Needham cites regarding the "empty space" theory, only one was an astronomer.

Gribbin's reading on supernovae also inadequately represents the very considerable literature that has accumulated⁶. He does not mention the best-documented supernova of all, that of 1006, and does not seem to be aware that Ho *et al.* have produced evidence to cast considerable doubt on his identification of the supernova of 1054 with the Crab Nebula⁷.

Now let me take up what I consider ill advised about Gribbin's topic itself. Historians of science have by now given up treating ancient speculations as foreshadowings, forerunners, or anticipations of the precise concepts of the modern exact sciences, since no one who has hunted for such anticipations with sufficient determination (and willingness to abide bad metaphors) has failed to track them back to the dawn of history. Instead historians think of early ideas as constituents in an endlessly complex and never predictable development from one phase of understanding and practice to the next. I am unable, in any case, to understand why Gribbin believes the Mohist idea that motion requires duration is equivalent to any innovation of Einstein. He also finds deep significance in the fact that the Chinese language includes a compound in which one character stands for space (in the everyday sense) and one stands for time, but this is a purely lexical matter, and has nothing at all to do

with the modern physical concept which we express inadequately in quotidian language as "a continuum in four dimensions".

To sum up, Dr Gribbin has not taken the trouble that he assuredly would have done had he prepared a scientific paper for *Nature*. He has not studied enough, and has not taken sufficient pains to understand what he has studied.

N. SIVIN

*Technology Studies,
Massachusetts Institute of
Technology,
Cambridge, Massachusetts 02139*

¹ Gribbin, J., *Nature*, 256, 619-620 (1975).

² Needham, J., *Science and Civilization in China*, 3 (Cambridge University Press, London, 1959).

³ Nakayama, S., *A History of Japanese Astronomy* (MIT Press, Cambridge, Massachusetts, 1969).

⁴ Sivin, N., *Cosmos and Computation in Early Chinese Mathematical Astronomy* (Leiden, 1969).

⁵ Tang, J. C., *K'o-hsueh-shih chi-k'an (History of Science)*, 4, 47-58 (1962).

⁶ Stephenson, F. R., in *Supernovae and Supernova Remnants* (edit. by Cosmovici, C. B.), 75-85 (Dordrecht, 1974).

⁷ Ho, P. Y., Paar, F. W., and Parsons, P. W., in *Vistas in Astronomy* (edit. by Beer, A.), 13, 1-13 (Oxford, 1971).

Moinian and Lewisian of Sutherland and the Morarian Orogeny

IN view of speculation concerning the Moinian geology of Sutherland^{1,2}, a short resume of our research in central Sutherland (S.J.M.) and the Bettyhill-Strathy area of north-eastern Sutherland (V.E.H.) is of interest.

In central Sutherland there are three large, sub-parallel Lewisian sheets within the Moinian west of the migmatite complex³. In the Bettyhill-Strathy area there are sheets and broad areas of Lewisian. Our extensive geochemical data indicate that the majority of the Lewisian in these areas has strong Scourian affinities⁴⁻⁶. The Borgie Lewisian⁶ and that at Ribigill near Tongue (unpublished), contains both Scourian and Laxfordian types. Geochemical distinctions between the western and the eastern Moinian in northern Sutherland⁷, cited by Garson and Plant³, represent a distinction between Moinian with extensive basic Lewisian in the west, the Tongue-Borgie area, and acid Lewisian with