Meticulous archaeological surveys

J. E. Wood

Megalithic Remains in Britain and Brittany. By A. Thom and A. S. Thom. Pp. 192. (Clarendon/Oxford University Press: Oxford, 1978.) £8.95.

THE senior author of this book, Alexander Thom, is a mechanical engineer and was Professor of Engineering Science at Oxford University for 16 years until his retirement in 1961. For 35 years or more he has devoted much of his life to the study of the many stone settings which are found in the wilder parts of Britain and in Brittany and date from the late Neolithic and Early Bronze Ages. Thom is not an archaeologist and his research is done, not with the spade, but with the steel tape and the theodolite. He has applied his scientific training to the precise measurement and surveying of these remains. His work was originally published in scientific papers, but at intervals he has collected his results together for publication in book form. *Megalithic Remains in Britain and Brittany* is the third book; the earlier ones, *Megalithic Sites in Britain* and *Megalithic Lunar Observatories*, were published in 1967 and 1971.

The new book was written jointly by Alexander Thom and his son Archibald S. Thom, who has been actively working with his father for many years. About 80% of it is based on a series of papers which were published in *Journal for the History of Astronomy* between 1971 and 1977. Some of the paragraphs and most of the diagrams are indeed identical to those previously published in the *Journal*, but apart from the convenience of having Thoms' results in one volume, their work gains in significance when it can be studied as a whole. The book is particularly valuable for giving a comprehensive view of their work on the Carnac megaliths; this is the main topic and acounts for about one third of the text. They describe their surveys of the stone rows, give geometrical interpretations and postulate the existence of two prehistoric lunar observatories. Avebury, Stonehenge and the Ring of Brodgar are also analysed in detail, and there are short notes on several lesser sites. There is also a chapter on the geometry of cup and ring marks.

One's first reaction on reading the book is a feeling of admiration and awe. The whole of its contents is the original work of one dedicated man and his team of assistants. Only someone who has walked along the stone rows of Carnac and Kermario, and seen the vast numbers of stones, the almost impenetrable thickets of gorse which cover the smaller ones and the clouds of voracious midges in midsummer, can appreciate the enormous amount of hard work and discomfort that underlies the Thoms' detailed plans of the alignments. They have raised the standards of archaeological survey work to a far higher level of accuracy than earlier surveyors of stone rows, and the archaeological community should be ever grateful.

In the course of his studies, Professor Thom arrived at three conclusions: (a) that the non-circular stone rings were not merely accidental departures from circles but were intentionally laid out in other geometrical figures, such as ellipses, flattened circles and egg-shapes; (b) that a precise unit of length, the Megalithic yard of 2.722 feet, was used in setting out the stone rows and circles, over the whole area from Shetland to Carnac and for the whole period of Megalithic buildings; and (c) that the function of many of the stone settings was astronomical, either indicating sightlines for observations of the azimuths of the rising and setting points of the Sun and Moon, or as calculators for predicting lunar eclipses.

Thom's conclusions have been hotly debated by archaeologists for more than a decade, and are not fully accepted at the present time. (Many archaeologists, for example, would accept the idea of a local unit of length, but not the universality of Thom's proposal.) In their book there is barely a hint of the controversy. The starting point is the assumed correctness of the elder Thom's ideas, and sites are individually interpreted in that light. There are no alternative explanations and in the minds of the authors there are no doubts.

Thus, the authors' approach is largely to disregard conventional archaeology, and they do not discuss whether their conclusions are reasonable in the light of current archaeological knowledge. The stone circle at Avebury, for example, is analysed by the Thoms as a compound ring consisting of six circular arcs drawn from six centres which are geometrically related to a 3, 4, 5 Pythagorean triangle. It is the most complicated ring in Great Britain. However, archaeologically there are grounds for believing Avebury is earlier than most rings in the British Isles, that early rings were geometricaley simple, and that the more complicated rings are the later ones. The Thoms' interpretation does not fit

comfortably into the archaeological framework, and archaeologists are bound to ask if simpler constructions are possible. The robustness of their interpretation, such as the possible range of values for the radii of the arcs, is not discussed.

Another example of their conclusions being in conflict with the archaeology is the supposed distant foresight at Stonehenge, called 'Peter's Mound', which was suggested as an indicator for midsummer sunrise. This looked unlikely archaeologically for several reasons, and indeed was shown by excavation in 1977 to be modern, though this fact does not appear in the book.

These criticisms are not meant to detract from the authors' work, for which I personally have considerable admiration, but are intended to indicate the nature of the book. It is not a balanced account of megalithic astronomy and geometry, but a compilation of original work, the field reports of a team of meticulous surveyors, to which the serious student of the period will turn and which no specialist in the late Neolithic and Early Bronze Ages can ignore. Some of their interpretations may be proved incorrect in the course of time, but this is not particularly important; *Megalithic Remains in Britain and Brittany*, together with Alexander Thom's two earlier works, will be an invaluable source book for researchers for very many years. □

J. E. Wood is a Deputy-Director of the Admiralty Surface Weapons Establishment, Portsdown, UK.

Star formation

Bart J. Bok

Stellar Formation. By V. C. Reddish. Pp. 287. (Pergamon: Oxford, 1978.) Hardback £15; paperback £7.50.

THIS is an interesting volume and I learned much from reading it with care. At the same time, I express deep regret that it came out in print effectively four years after the writing was finished. It covers adequately and thoughtfully the literature available to the end of 1974 and should therefore have been published by the end of 1975. It does not include the new results reported at IAU Symposium No. 75, which was held at Geneva in September, 1976 (International Astronomical Union Symposium No. 75, *Star Formation*, D. Reidel: Dordrecht, Netherlands, 1977), nor does it include researches that were discussed and analysed at the Tucson Colloquium of January, 1978, papers that are now in print (T. Gehrels, *Protostars and Planets*, University of Arizona Press: Tucson, 1979; *The Moon And The Planets*, **19**, No. 2, 1978).

There are several very good chapters in the present volume. Chapter 3 deals in a masterly fashion with the determination of the initial luminosity function and the initial mass function. The three chapters that follow it are a bit on the meagre side, but the concluding chapter of the observational half of the book gives a well-rounded review of the necessary environment for fostering star building from interstellar clouds. Professor Reddish defends strongly the point of view that star formation results almost exclusively as a by-product of the formation of H_2 molecules on very cold solid particles in interstellar clouds. I agree that this is a major contributing process, but there are regions in the heavens, notably in the Magellanic Clouds, in which cosmic dust particles and even H_2 molecules seem to have played less of a part than neutral atomic hydrogen.

Professor Reddish's independent and honest scholarly considerations have led him to visualise ahead of his time one major process contributing to star formation, but he ignores others. If I were asked to list my favourite processes for star formation, I would list five, which seem to be at work in our galaxy within 1,500 parsecs of the Sun. These are: (1) The formation of OB stars within large dark complexes such as the Ophiuchus Complex, the Taurus Complex, the Greater Orion Complex and the southern Gum Nebula. (2) The Elmegreen–Lada process according to which a large molecular cloud acts as a feedbag for the continuous formation of OB stars in the vicinity of established H II regions and associated young OB groupings such as Messier 8 and Messier 17. (3) Supernovae and pulsars, whose high-energy charged particle emissions, along with the Lin–Shu spiral density waves, contribute materially to the condensing of interstellar clouds, thus leading to star formation. (4) Cloud–cloud collisions and interactions between passing clouds, which may further assist condensation processes. (5) Collapsing large globules (Barnard objects), of low temperature and chockerblock-full with CO (and thus with molecular hydrogen), provide a good basis for the building of less massive stars; two Herbig–Haro Objects have been found associated with a southern globule (see *Publ. Astron. Soc. Pacific*, October, 1978). Professor Reddish alludes vaguely to most of these processes, which were, however, not generally recognised as being as basically important in 1974–75 as they are today. I wish we might persuade him to add an additional volume to his present offering and bring us up to date.

The second half of the book presents the more theoretical aspects of star formation. It is an excellent and comprehensive treatment but it too is dated. He shows nicely that the physical properties of interstellar gas and dust are such that an interstellar cloud structure is inevitable. Chapter 9 is a most readable presentation of the Lin–Shu density wave theory of spiral formation and its effect on interstellar cloud evolution. There follow very fine chapters on cloud contraction, especially on fragmentation and its effects on the distribution of protostar masses. The chapter on the rate of star formation is regrettably brief and the concluding chapter on the evolution of galaxies did not stir this reviewer.

The book is nicely produced and the medium-priced paperback edition handles well. There are a few places in which a little more care in proofreading would have been helpful; I noted that the word "asymmetry" is consistently misspelled (pp153, 164, 165). On page 171, there is a reference to (Roberts, 1969); one finds in the bibliography two such references—one to M. S. Roberts, the other to W. W. Roberts—the second one being the one that is indicated.

Because of its underlying unified personal approach of Professor Reddish, this is a book that should be read by everyone who works in the field of star formation. Once one accepts the obvious limitations, we can all learn from his treatment of star formation. This is a good book to assign to one's students, provided it is supplemented by the other volumes mentioned in my review; it is a good treatment for the beginning graduate student, and it should also appeal to advanced undergraduate students in the physical sciences. Professional physicists will find that this book has much to offer, as will informed amateur astronomers. □

Bart J. Bok is Emeritus Professor of Astronomy at the Steward Observatory, University of Arizona, Tucson, Arizona.