

"semi-microlithic" tools such as crescents and trapezes. The stratigraphic position of this material is unequivocal. Discussion of the dating and geological correlations of the Klasies sequence allows for "long" and "short" chronologies at this stage; the shorter reading would make the Howieson's Poort industry 30–50,000 years old, but the authors prefer a longer chronology, which would entail an even more surprising age of c. 95,000. When work at Klasies River Mouth began, the few Howieson's Poort occurrences known were regarded as transitional between the Middle and Late Stone Ages.

In spite of Upper Pleistocene marine fluctuations, the site remained on or near the coast throughout the MSA; its long abandonment after MSA IV probably corresponds to the main regression of the Last Glaciation. The MSA levels document in detail the evidently highly successful

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Changing our perception of the past — the Klasies River Mouth cave and shelter complex.

human exploitation of coastal resources, for which there is little evidence anywhere from earlier sites. Collecting of shellfish predominated; marine mammals and sea birds were hunted and stranded fish taken, but there seems to have been no regular fishing.

Various hominid remains also came from the MSA levels: no burials, alas, but quite a worthwhile aggregate of bits and pieces. The authors are satisfied not merely that *Homo sapiens sapiens* was established in this area by the end of the MSA, but also that he made the earliest MSA industry at the site. If so, we presumably see here the earliest representatives of that sub-species yet discovered; their presence in southernmost Africa so early will clearly need to be taken into account in all theories of the final stages of human evolution further north. Sadly, no hominid remains occurred with the Howieson's Poort industries, which present a classic interpretive dilemma: do the innovative changes in the tool-kits represent indigenous adaptations to new ecological circumstances, or do they imply a new and intrusive population? The authors clearly prefer the latter interpretation, and associated hominid material might have offered decisive evidence.

These, then, are some of the far-reaching

results achieved at Klasies River Mouth, which may indicate the importance of this publication. Excavation at Klasies began in 1966 and marks, with the work of certain others at about that time, the start of a new and extremely fruitful period in South African archaeology, which has since seen many excavations of high quality, backed by painstaking and imaginative laboratory work of many kinds. A tremendous amount of new information has been won, with consequent radical changes in our understanding of the local sequence over

almost the whole prehistoric period. The surge forward is continuing and there will be much more to come even during the present decade. Meanwhile, Ronald Singer, John Wymer and their colleagues are to be congratulated on their achievements at Klasies River Mouth, so clearly set out in this handsome and well-illustrated volume. □

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Shaking behaviour

Chi-Yu King

When the Snakes Awake: Animals and Earthquake Prediction.

By Helmut Tributsch.

MIT Press: 1982. Pp. 248. \$27, £18.

REPORTS of strange behaviour by animals shortly before earthquakes are common. For example, cats picked up kittens and left houses; dogs barked madly; pigs bit each other; fish jumped out of water; and snakes awoke from hibernation, crawled from their burrows and, in some cases, froze to death on snow-covered surfaces.

Until recent years such reports and suggestions that abnormal behaviour might be related to earthquakes were largely ignored by Western scientists, primarily because most of the observations were anecdotal in nature and made by people who were not scientifically trained and might have been biased by the excitement after the earthquakes. Besides, it was not clear how animals could sense the coming of an earthquake, while human beings and their instruments commonly could not.

However, as more and more observations of this kind were made known, a small but growing number of scientists began to examine the possibility of animals' earthquake premonition. In 1976 and 1979, the US Geological Survey, the Government agency in charge of the national earthquake-hazard-reduction programme in the United States, convened two separate scientific conferences on this topic. In China, abnormal animal behaviour not only was observed by numerous people before earthquakes but also has actually been used as one of the very few methods to predict earthquakes on a short-term (hours to days) basis since the 1966 Xingtai earthquake.

One of the scientists who have been recently intrigued by this phenomenon is Helmut Tributsch, a physical chemist, who learned of abnormal animal behaviour from the survivors of the 1976 Friuli earthquake that destroyed his home village in northern Italy. He then diligently searched the literature and collected anecdotal reports on 77 other earthquakes. His findings are presented in *When the Snakes*

Awake, originally published in German in 1978. In the book he also describes observations of several other phenomena thought to precede earthquakes — fog, lights and sounds — and discusses various hypotheses. On the basis of the available circumstantial evidence, he makes a strong argument for the attribution of these phenomena to an increase in the number of electrostatically charged particles in the atmosphere, generated by the tectonically stressed crust.

Written for laymen as well as the scientist, the book contains some simplified geophysical statements that may not be rigorous enough for the experts. Seismologists, for example, will probably be annoyed by Tributsch's frequent use of the words "force", "intensity" and "strength" interchangeably with "magnitude" in describing the size of earthquakes; volcanologists may disagree with the statement that "volcanic eruptions are special cases of earthquake activity" (p. 55); and physicists will be dissatisfied by the absence of direct evidence for the postulated release of charged aerosols from the crust and by the absence of a credible mechanism to account for such a process. In addition, more consideration should probably have been given to the possibility that animals react to several geophysical and geochemical stimuli, and of a tectonically induced increase in the outgassing rate before earthquakes. Production in the biosphere of a significant amount of deep-earth gas, which differs considerably in chemical composition from the normal atmosphere — less oxygen and more methane, water vapour and radon — seems to be quite capable of causing not only most of the above-mentioned pre-earthquake phenomena but in addition the postulated charged-aerosol increase itself.

Irrespective of the above-mentioned criticisms, this book is, to my knowledge, the most comprehensive treatment on the subject in English; Tributsch's writing is rational, lucid and interesting. I expect that the book will stimulate further studies by scientists, as well as catch the attention of the general public living in earthquake-prone countries. □

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