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## Concluding Remarks

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## Concluding remarks

BY D. G. KING-HELE F.R.S.

It would be very difficult to produce a coherent summary of such a wide-ranging meeting, with so many excellent individual contributions, and I shall not try. Instead I should like to discuss certain features of the meeting that particularly appealed to me; and on this occasion I speak as a semi-mathematician and semi-astronomer, without any specialized knowledge of antiquity.

This meeting was intended to help in building bridges between science and history, or to be more accurate, between scientists and historians; and to convince both groups that bridges improve the quality of life – that each subject is enriched by an injection of the other. There were many examples, of which I will mention just three. First, Dr Needham, whose great work on *Science and civilization in China* is an example to us all, in the very best sense. Then there is Dr Newton's work on the Earth's rotation rate. This depends essentially on ancient manuscripts and similar material. But his results are of great scientific importance in the study of the Earth–Moon system, because the slowing down of the Earth's rotation depends on the orbital behaviour of the Moon, the shape of the oceans (which affects the tides), the goings-on in the Earth's interior, and probably other unknown factors. A decision between the conflicting theories of the Moon's origin, and an understanding of the Earth's internal workings, may well be brought nearer by studies similar to Dr Newton's: he has shown scientists how they must not neglect history. My third example is Professor Lamb's paper on climate and forest cover in the ancient world. Although he needed his expert knowledge in meteorology, over 80 % of the references in his paper are primarily concerned not with meteorology at all, but with fossil coleoptera, Welsh and Irish bogs, sightings of comets, the Nile floods, deep-sea oozes, analysing plant pollen, changes in sea level, the spread of spruce trees, and so on. And his results are also wide-ranging in implication, being important not only for solar physicists trying to decide how and why the Sun's radiation varies, but also for historians, because changes in climate have certainly contributed to the fall of empires in historical times, as well as governing the migrations of prehistoric peoples.

In the past many academic disciplines tended to become intellectual islands, on which were cultivated more and more specialized plants. Each island had a resident professor, and he and his islanders rarely looked outwards. (To judge from Dr Lewis's paper, this metaphor is literally true in Polynesia, where they live on islands and have academic secrecy about navigation.) To return from Polynesia to Academia, it is as well to recognize that this divisive insularity is still quite strong, not because anyone is being wicked but because it is so tidy and self-perpetuating, both administratively and intellectually, to have islands and avoid the traumatic experience of emigration. But a major advance in science most often comes when a bright scientist crosses a bridge to another island and applies what may be old skills to throw light on a new area. The same, I think, will happen more and more in archaeology. Many of the bridges already exist, including some new ones built in the course of this meeting, and the young archaeologists who find the right bridges to cross will arrive in pastures worth ploughing – or more likely in muddy fields!

The second feature of the meeting I should like to discuss is the question of an astronomical

culture in non-literate ancient societies. Many people find this idea difficult to credit, but I do not find any difficulty, for three reasons. First, there is the obvious but often forgotten point that these stone-age people probably had very nearly as much brain power as we have (it seems best to avoid using the word ‘intelligent’ now that it has become so culture-linked and emotive). Human evolution goes back 2 or 3 million years, and it would be surprising if we had made great advances in brain power during the past 2 or 3 thousand years – 0.1 % of our total span. My second reason comes from the impression that we are today rather drunk with words: language was certainly a great invention, but words have perhaps attained too great a dominance, and this tends to blind us to more instinctive forms of culture. The founders of the Royal Society were conscious of this danger when they chose the motto *Nullius in verba*. My third and strongest reason for accepting the idea of an astronomical culture comes from personal experience, in that I find it natural myself to notice the setting points of the Sun and Moon, on the western horizon. For people living an outdoor life with fairly clear skies on a treeless plain or near a coast with hilly islands to the west, I can understand that some of them might feel a compulsion to set up markers – exercising their nascent scientific curiosity, you might say.

As the years went by, they might easily become fascinated with this ‘cosmic game’, and elaborate it to the limits of their intellectual power by defining the extreme limits of the sunset and moonset points, and perhaps detecting the small perturbation in lunar declination. This implies of course that they had leisure and security, or, as Professor Atkinson remarked in referring to Silbury Hill, a small percentage of their national income was a surplus, which later, in Roman times, would have had to go on defence expenditure. This reminds us that the supreme militarist, Caesar, has much to answer for: his *Gallic Wars*, though badly written, has brain-washed generations of schoolboy Latinists – including archaeologists? – into thinking that the Romans were ‘superior’ to the barbarians, just because they were more literate (and more efficient at slaughter). This tacit equating of literacy with intelligence now seems in need of drastic revision. It looks as though, more than a thousand years earlier, these ‘barbarians’ had probably hit upon an azimuthal astronomical sighting method which was far more accurate than the techniques developed in literate societies, such as the method of heliacal risings favoured by Babylonians and Egyptians, and beyond the intellectual grasp of a mere militarist like Caesar.

‘Numeracy’ is not needed when measuring setting points on the horizon. The arrangement of the stones is the system of numeration, as Professor Renfrew remarked.

The further steps required for eclipse prediction, though possible, seem to me less likely. The time scales are long, and it is not clear how the information would have been transmitted. Also the neolithic peoples of northwest Europe may have been relatively free of the religious imperatives which provoked the obsessive interest in eclipses in many early literate societies.

Another of Professor Thom’s ideas, his concept of the megalithic yard of 1.65 m, is now more securely based as a result of Professor Kendall’s expert quantum-hunting.

As this meeting went on, I felt that it somehow took on a life of its own and grew into a kind of commemoration, a tribute, to all those nameless but ingenious proto-scientists of antiquity: the Europeans who placed stones to mark astronomical sight-lines; the Maya who achieved an accuracy of 1 part in 2 million in timing Venus; the Polynesian navigators; the megalith builders who lifted slabs weighing 50 tonnes without smashing them; and those unknown Babylonians and Egyptians who still rule our daily lives as we divide the hours and minutes into 60 parts, and divide our years into months and weeks.

Finally, I should like to express the sincere thanks of the Royal Society to those who have come to this meeting, often from far away and at some personal inconvenience, and have presented so many excellent papers or contributed to the discussion. I am sure the Organizing Committee would wish me to voice our gratitude to Dr Roy Hodson, who has from the very beginning taken on much of the burden of organization; and also to the Royal Society's staff and especially Miss Ritchie, for providing such a smooth run-up to the finishing line. Everyone who attended will, I am sure, depart with wider horizons; I also hope everyone found the meeting as enjoyable as I did.

CONCLUDING REMARKS BY S. PIGGOTT F.B.A.

Like Mr King-Hele, I find it quite impossible to summarize even a part of our two-day meeting. He has touched on certain points of particular interest to him, and some of these were features which I found equally outstanding, so here I need mention only briefly our areas of coincidence or overlap. Engagingly, he introduced himself as a 'semi-mathematician and semi-astronomer without any specialized knowledge of antiquity': I can only say of myself that the British Academy could not have chosen among its prehistorians one less numerate than I.

But our hope in planning this meeting, as King-Hele has said, was that we might find common ground between disciplines too long thought to be wholly disparate; to see whether on closer and dispassionate inspection that yawning crevasse between the Two Cultures turned out to be only a crack in the snow. Dr Newton, lucid (as was Professor Kendall later) even to *me*, was of course deeply involved in history, and I shall come back to his reference to Archilochos; Dr Needham is as great an historian as he is a scientist, and with Babylonia, Egypt and the Maya we were involved in history, if only marginally so by reason of conditional literacy.

King-Hele also spoke of the unconscious tribute we paid to 'the nameless but ingenious proto-scientists of antiquity' and it was on these that the most controversial part of our programme centred. This afternoon we paid tribute not only to them, but also to the long, patient, accurate and modestly pursued work of Professor Alexander Thom, on which he has based a thesis which if accepted demands the recognition of considerable mathematical skills among the non-literate societies of northwestern Europe from the fourth to the second millennia B.C.; mute inglorious Newtons who somehow managed to command the labour and organization necessary to construct stone circles or alinements from the Bay of Biscay to the Arctic Ocean. Here, as subsequent discussion showed, however cogent his reasoning may be on purely mathematical grounds, many archaeologists, including myself, would feel that a great number of difficulties have not yet been faced in an evaluation of this hypothesis.

One such problem was touched on by both Professor Atkinson and Professor Lamb – not only the likely heavy incidence of cloudy skies in the north, but even more certainly, the heavy forest cover of all Europe in the temperate botanical climax of the Atlantic and Sub-Boreal phases. A glance for instance at McVean and Ratcliffe's maps in their *Plant communities of the Scottish Highlands* (1962) shows the density of natural woodland over the areas in which so many of the monuments under discussion lie, and the same goes for other regions of their occurrence: indeed Professor Thom's own slides forcibly demonstrated the difficulty of modern survey in the secondary woodland growths of parts of Brittany. And clear skies – how often were they to be