predictable, delayed, and miniscule. His result, "less than one fatality per year from all the waste accumulated by a million years of all-nuclear power in the United States," has been seriously questioned previously on a number of grounds (*1*). In the present context, there is no reason why estimates based on Cohen's assumptions should apply to the risks posed by the waste as it is currently managed.

Similarly, for people living close to the burial sites for our major low-level nuclear wastes it must be rather uninteresting to be told what this waste would do to human health if it were distributed uniformly throughout the soil of the United States, as Cohen apparently assumes in estimating the health effects (that is, the absence thereof) caused by this form of nuclear waste. Rather, what these people want to know is whether their land or their rivers may eventually become permanently contaminated by the effluents from the existing burial sites and what should be done to avoid this pollution. The same consideration applies to the waste that leaks from storage tanks. This is precisely what Carter discussed.

Certainly most biologists would discourage anyone from eating fission waste, irrespective of its age, as well as cinnabar (mentioned by Cohen as being more dangerous to eat than fission waste); the difference between the two substances, however, is that nobody has proposed to base our future economy on this compound of mercury. Efforts to belittle the nuclear waste problem with comparisons of this kind are bound to be counterproductive.

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Solar Eclipses and Ancient Artistic Motifs

John A. Eddy is to be congratulated on his article "The Maunder Minimum" (18 June 1976, p. 1189) showing the distinct changes in the behavior of the sun that have been recorded since the invention of the telescope, and for carrying the record further into the past by using the earlier, naked-eye observations. I would like to propose yet another means to

deduce the general outlines of solar activity even further back (albeit sketchily), another three millennia or more.

No other event in nature has the sudden and awe-inspiring impact of a total eclipse of the sun. As the eclipse progresses, the visible portion of the partially eclipsed sun is still recognizable. But at the moment when the total eclipse commences, something entirely new is suddenly seen which is completely outside man's normal experience. The last bright glow disappears, and in its place is a totally black disk, like a hole in the still-blue sky, surrounded by the corona which is seen at no other time. Total eclipses are rare at any one place, and the impact is heightened when the phenomenon is only dimly remembered and not at all expected. Therefore we should look in the early religious and artistic records of different civilizations, not just for eclipse-inspired motifs and references but for their details, and correlate their appearance and reinforcement with the record of eclipses visible to the various cultures and with possible changes in solar activity.

The most notable example is the sun disk, with wings and tail plumes, which first appeared in Egypt as early as the Old Kingdom and then spread through Syria to Babylonia. In Egypt this symbol is mixed with simple unornamented disks, whereas in Babylonian art after about 1200 B.C. the winged disk is so common and stylized as to be practically a trademark. The transition (at least in the well-dated record of cylinder seals) (*1*) is relatively sudden. Several authors have suggested that this symbol is eclipse-inspired because of its close resemblance to the corona seen at sunspot minimum (*2*).

To use such a record, we would first have to correlate the appearance of the corona to the naked eye with the underlying solar activity, using the detailed sketches of prephotographic eclipse observations (*3*). The photographic recording of eclipses must be modified because of the eye's greater dynamic range than that of film: a simple photograph of an eclipse never conveys the full extent or impact of the corona. A certain amount of radial-gradient filtering is necessary in photography to reproduce what the eye alone saw, to emphasize the outer portions; after the correct prescription has been determined by comparison of visual and photographic records of the same eclipse, the compilation of eclipse photographs can be used to extend the visual record.

Once this is done, it remains to corre-

late closely the calculated record of ancient eclipses (which at present extends back to 1200 B.C.) (*4*) with stylistic changes and reinforcements in the archeological record. Although at any one spot on the earth a total eclipse is experienced only once every 360 years or so on the average, the eclipses so visible tend to bunch in time (*5*). The artistic record, particularly of Babylonia, can be surprisingly realistic in recording astronomical phenomena (even to the extent of apparently recording partial eclipses) [for example, seals XXV e, XXVI e, and XXVII b, K in (*1*)] and we can assume for a first trial that the corona was recorded factually and use it to infer the corresponding solar activity.

This line of reasoning would have two benefits:

1) It would give us information on solar activity (or at least set bounds on it) up to the time the solar symbols became conventionalized in each culture.

2) It would give us a new point of view in reading the record of the past and help us deduce the reasons for its origins, changes, and maintenance. There is the distinct possibility that the challenge of coming to grips with the enormity of total eclipses—which occurred so rarely as to be of tremendous and unexpected impact, yet just often enough to stay in legend and history and have their effect reinforced—gave rise to concepts of religion and science that altered the course of civilization irrevocably, and raised it to new levels. We already know that recording the frustrating details of the moon's motion became an organizing theme for the people of the British Isles in the second and first millennia B.C. (*6*). And the solution of the apparent motions of the planets—seemingly so regular, and yet irregular enough to be a just-solvable problem—triggered modern science.

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