It does not matter where the review appears. When a scientific work is appraised for its content by another scientist, the "scientific reviewing ethic" must govern. For when one scientist criticizes the work of another, the fact that he stakes his reputation in public, keeping in mind the possibility of a sharp rejoinder, serves to maintain responsible discussion. As Arthur Freeman pointed out in the letter printed below Mead's, a reviewer can do himself discredit, as well as the author, if he is inaccurate or hypercritical. The possibility of an immediate rejoinder thus serves the community well.

RAPHAEL G. KAZMANN
Stuttgart, Arkansas

Is not Margaret Mead's "mare" actually a swarm of hornets [*Science* **141**, 312 (26 July 1963)]?

T. H. JUKES
Bonner Laboratory, University of California, Berkeley

Identity of Organized Elements in Carbonaceous Chondrites

A recent report in *Science* (*1*) highlighted the present controversy about the identity of organized elements found in carbonaceous chondrites. In this regard, it may be observed that none of the reported organized elements appear to be from "out of this world" in terms of morphology, structures, and reaction to stains (*2*). This can be seen by the presence of pores, spines, processes, ornamentation, protist size, canals, plates, necks, collars, tissues, walls, acid-resistant pellicles, apparent pectic substances in some walls, ribs or thickenings, reactions to a broad band of biological stains (*2*, Table 1). At the New York Academy of Sciences Conference on Fossil and Recent Protobionta last spring, I recall a conversation with Bourrelly in which he expressed surprise that many of the organized elements were reminiscent of terrestrial chrysophytes (which are his specialty) (*3*).

It follows that for such organized objects, an equivalent biochemistry to that known on earth is indicated. Thus, we may assume that all such objects are carbon-based, that nucleic material compares with that of similar terrestrial objects, that reproduction (fission and copulation) may closely resemble that of terrestrial equivalents (*2*, Fig. 6a).

This complete terrestriality of the organized elements places a sharp focus on a possible explanation. Either we are dealing with an example of extraterrestrial homeomorphy with terrestrial protists or the terrestrial aspect of the organized elements arises because they are, in fact, terrestrial contaminants (*1*). The latter explanation, being simplest, has first claim on our attention.

1) *Possibility of terrestrial contamination.* Claus *et al.* (*2*, Table 2) recently provided a valuable reference to the biological material found in soil and rock samples in the Orgueil impact area. These objects included various chrysophytes and in one rock fragment from a quarry (location not indicated on map), a fragment of an armored dinoflagellate, *Peridinium*. In addition, there was a varied suite of other protists, pollens, and other organic items.

The new data on the microbiology of the impact area becomes important when viewed in the light of observations of the organized elements made by several specialists. Claus, Bourrelly, and others have noted that several of the organized elements resemble chrysophytes. Staplin, Ross, and others have noted that some of the organized elements suggest hystrichosphaeres, dinoflagellate cysts, or dinoflagellate structures. Clearly, some chrysophytes and dinoflagellates are available in the impact area today (*2*, Fig. 9a-b). If a chondrite impacted in the Orgueil area today, one might reasonably expect incorporation of some of these forms and others listed in Claus's Table 2.

Claus *et al.* (*2*) cited Bourrelly and noted that the present soil microbiota in the impact area should be similar to that of 1864. Hence, we may conclude that such protists were available in the Orgueil area in 1864 at the time of impact. However, none of the organized elements were found to be "identical" with elements of the existing microbiota of the area. Does that close the case for contamination at the time of impact? I do not think so.

Almost a century has elapsed since the original fall in the Orgueil area and some changes in the biota might have occurred. As the next point to be discussed will show, based on the data of Claus, *et al.*, some changes apparently did occur.

2) *Aquatic contaminants in Anders's sample of the Orgueil chondrite.* Having recently processed a sample of the Orgueil meteorite provided by Anders (*4*), I was surprised

to learn that Claus *et al.* (*2*, p. 602) found, in another of Anders's samples, the following items: fragments of *Compsopogan* filament (Rhodophyta), individuals of *Chlorella*, a rare species of *Nägeliella*, cladoceran antennae, and so forth. These authors observed that "although the organized elements were clearly visible, the presence of aquatic contaminants suggested a more recent sediment than that of a carbonaceous meteorite."

The contaminants, with special reference to the cladocerans, clearly occupied a small aquatic situation, perhaps on an alluvial floodplain in the area of impact. This is suggested by the map of the area (*2*, Fig. 14). If not, then they probably represent post-impact contaminants acquired during handling or museum storage. Since *Chlorella* species were also reported in the list of biological specimens found in the surface soil of the impact area at the present time, it is reasonable to conclude that the other aquatic objects found in Anders's specimen also were present in the impact area in 1864. However, according to Claus's Table 2, these other forms are not present in the Orgueil area today.

We may thus infer that some degree of change in the microbiota has occurred in the impact area since 1864. If cladocerans, *Compsopogan*, and others were once in the impact area, why could not other forms belonging to aquatic biotas also have been in the area and since have disappeared?

3) *Organized elements in mineral grains in chondrites.* Some organized elements have been found in mineral grains which suggests that they are indigenous and were not added at impact or subsequently. Brian Mason (*5*) has pointed out that the "environment can affect the 'organized elements' " in various ways, among others, in the amount of bound water in magnesium sulphate in the chondrites. Now, it seems desirable to reconcile these two observations.

If one grants that a given organized element incorporated in a chondrite mineral grain represents a once-living individual, then it becomes important to know about all possible environmental and diagenetic effects on mineral grains in carbonaceous chondrites. Specifically, to advance the argument, if one assumes that a given organized element embedded in a mineral is a terrestrial contaminant, then a plausible explanation is needed for the steps leading to its incorporation. One might even ask whether it is possible to *deliberately* incorporate one or more such contaminants in mineral grains of such chondrites under the prevailing temperature conditions in soil or museum air, or during the preparation of thin sections?

The terrestriality of the organized elements is their most distinctive general characteristic. Either homeomorphy (the least likely possibility) or terrestrial contamination (the most likely possibility) can account for it. Only a vigorous and healthy scepticism about *every detail* of published reports (pro and con) can help to resolve the matter.

PAUL TASCH
Department of Geology, University of Wichita, Wichita, Kansas

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Science in the Humanities

Comments such as those made by Marcel Roche in "The humanities in the scientific curriculum" (*Science* **141**, 698 (23 July 1963)], distract interested observers from the true problem. Scientists *do* know about the humanities, and they understand them, appreciate them, and participate in them. The degree may be less than perfect but it certainly is not zero, as is the case with regard to the comprehension and understanding of science by the nonscientific community—the major portion of our population.

These people are proud of their ignorance! How often one hears a comment such as, "Oh, that's mathematical; I never was any good at figures."

Ask any nonscientific man-in-the-street to explain, even in a rudimentary sense, why an iron gets hot but a refrigerator gets cold when both are plugged into the same outlet; or how a TV set functions or why a satellite stays in orbit. Their ignorance is abysmal.

What *is* needed, desperately, is science in the humanities curriculum—not further additions to the converse.

RICHARD G. DEVANEY
238 Hammond Avenue, Kingsport, Tennessee