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Galli has provided a scholastic assessment of what constitutes malignancy in the eyes of clinical pathologists. The point of our report (*1*), however, was to provide empirical evidence for a significantly different interpretation of currently accepted mechanisms of carcinogenesis (*2*). For example, rats in groups 1 and 2 given a single intraperitoneal *N*-nitroso-*N*-methylurea (NMU) injection developed tumors at the site where a stainless steel wire irritated the buccal mucosa; no such tumors developed on the contralateral side of the same animals where no wire was placed. Also, rats without the irritating wire but given the same intraperitoneal dose of NMU, had no tumors in the buccal mucosa (group 3). Additionally, no tumors developed in rats when the wire was placed in the mouth, but no NMU was injected (group 4). The two control groups of rats were observed for periods of time comparable to the times for the test groups. From our perspective, the significantly increased rate of tumor formation in our test groups in comparison with control groups was sufficient to suggest that the carcinogen affected an event controlling cell proliferation and generated in a centrally located organ (the liver?); this, plus undefined local interactions of NMU on epithelial and fibroblast stem cells, together with the iterative nonspecific proliferative effect of the irritation by the wire, resulted in tumor formation. This was the extent of our claims resulting from the data collected. We realize that the diagnosis of a malignant lesion in a clinical setting has immediate prognostic and therapeutic implications. Our understanding of the "state of the art" in this context is that honest disagreements are not infrequent in judging whether histologic features represent actual or potential threats leading to the premature death of the host. Our report, however, was not intended to address clinical considerations.

Galli's comments detail more than was written or implied in our report (*1*); our reference 4 neither stated nor implied that rats died as a result of malignancies. We agree that the predictive value of histologic features of suspected malignant tumors varies with tumor types, organs, and species. We also share his concern regarding the need for more detailed studies to document the chronological events occurring prior to tumor formation, and we did this in a subsequent publication (*3*). Finally, Galli kindly and correctly states that our observations "may have important implications," and we share his recommendation regarding a more extensive follow-up on this research approach.

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## Impact Event at the Cretaceous-Tertiary Boundary: A Possible Site

The discovery of shock-metamorphosed quartz grains in the Cretaceous-Tertiary (K-T) boundary clay in eastern Montana (*1*) provides evidence for an extraterrestrial impact at that time. The site of the impact, however, remains a challenging question.

The site may be on the North American continent. The presence of quartz and sanidine in the target rock (*1*) indicates continental rather than oceanic target rock, and the unusually large size (for fallout material) of the mineral fragments (50 to 100 μm) implies that they were deposited relatively close to the impact site. Grains this large would have settling velocities in air of about 100 cm/sec (*3*) and would settle from stratospheric heights (30 to 50 km) in 18 to 36 hours. If the impact cloud spread at velocities observed for volcanic eruptions (about 100 km/hour) (*4*), then the grains would settle out within 3600 km of the impact site, again implying an impact site on the North American continent. Previously proposed sites (*5*) are all much farther from the eastern Montana collection site than 3600 km; for example, the two structures in the Soviet Union are about 15,000 km away.

At least two candidate impact structures do exist in North America: the Sierra Madera structure, Texas (*6*), and the Manson structure, Iowa (*7, 8*). Both structures have definite shock-metamorphic characteristics, and both are more than 10 km in diameter. Both are of less than Lower Cretaceous age, although neither structure has been accurately dated.

Of the two, Manson seems the stronger candidate. It is larger (minimum diameter, 32 km), closer to the collecting site (about 1150 km), and emplaced in granitic crustal rocks. Sierra Madera is smaller (16 km), farther from the collecting site (about 1850 km), and emplaced in sediments (chiefly limestones and shales) that contain little quartz. Manson is covered by about 30 m of glacial drift (*7*) and could be much larger than its current estimated diameter.

The volcanic cloud analogy may be inappropriate if the impact-produced dust was more widely distributed along ballistic trajectories (*9*) or by global atmospheric turbulence created by the impact event. Preliminary data on grain sizes of shock-metamorphosed quartz from K-T boundary sediments elsewhere (*10*) suggest that such mechanisms may indeed have operated. Such studies may also provide important data about atmospheric conditions immediately after the impact.

The Manson structure in particular should be studied in more detail to determine its true extent, its exact age, and its possible connection to the K-T impact event.

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# Uncertainty of histologic classification of experimental tumors

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