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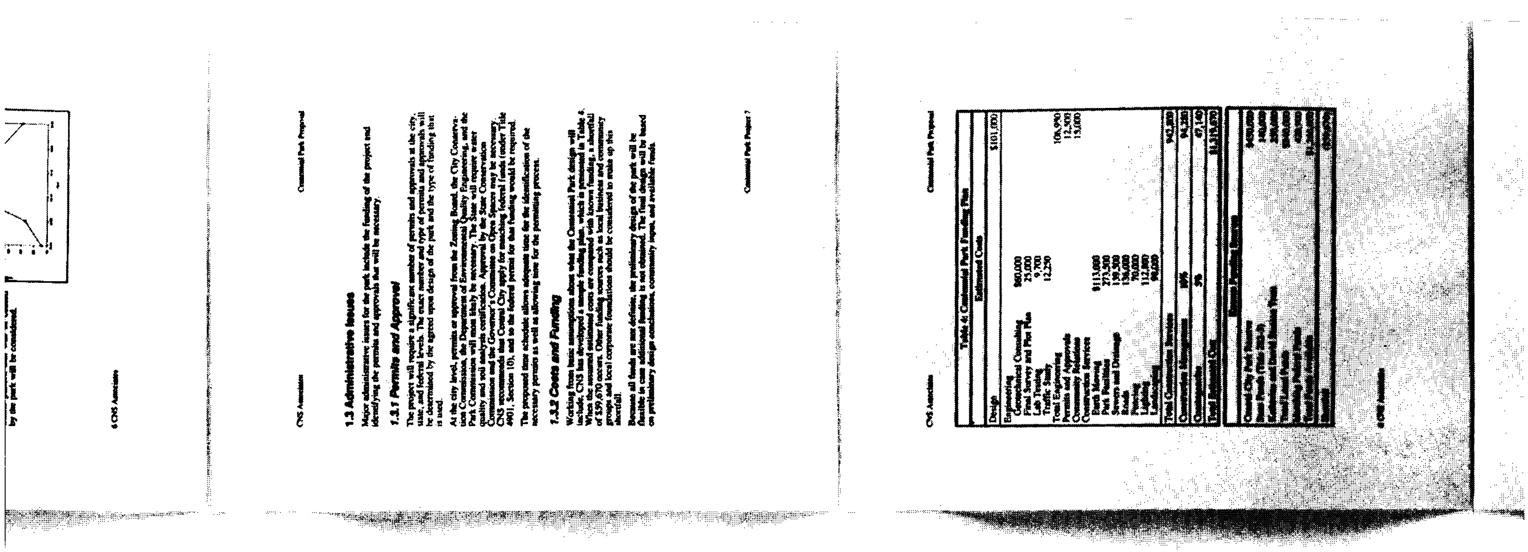
Response: There are six major events recorded in the upper Hell Creek Formation of McCone County, all within chron 29r [the 0.6-million-year reversed magnetic interval, including the Cretaceous-Tertiary (K-T) boundary], and at least four of them are discrete. The oldest is the latest Maastrichtian sea level lowering (*1*) and consequent minor unconformity; closely associated with this are the introductions of ungulates and of multituberculates of Asian origin and perhaps the introduction of *Leptoceratops* from Asia and *Alamosaurus* from South America. A lowering of sea level would make intercontinental migrations across a filter bridge easier. Also associated with this is part of the reduction of pollen taxa. Retallack and Leahy's interval of deep weathering follows. The next identifiable event is the K-T boundary, marked by the iridium-rich layer in some but not all sections, principally those in contemporary oxbow lakes. This is also marked by the abrupt termination of several Cretaceous pollen taxa. Immediately following this is a short stratigraphic interval with an enrichment of fern spores, in turn followed by the great increase in conifer pollen and wood. The next event is the deposition of the continuous upper Z coal, the top of the Hell Creek Formation, followed by the major change in sedimentation type that results in the typical and definitive Tullock shales of distinctly yellowish color. This color change is due to the deposition of many closely spaced layers of siderite cemented clay, separated by layers of light gray clay. These siderite bands are mainly absent from the Hell Creek Formation. We presume this change is due to the Danian sea level rise and consequent change in base level and water table. The final event is the terminal extinction of dinosaurs in Montana. The last dinosaurs occur in a channel that does not cut down into the Hell Creek Formation. Since our report was submitted we have demonstrated that Bug Creek West (BCW), Scmenge Point and Harbicht Hill (HH) are Paleocene channels using the same criteria that we used for Ferguson Ranch (FR). We have also located two more Paleocene localities, By George and Wounded Toe, within the Hell Creek Formation, and one not yet named in the basal Tullock Formation (*2*). The K-T boundary thus falls between Bug Creek Anthills (BCA) and BCW. Only one dinosaur genus disappeared at the K-T boundary, and 11 dinosaur genera survived into the Paleocene in Montana.

The possible sources for the fossils found in the channels are (i) reworking from older and lower channels, (ii) reworking from adjacent older floodplain deposits, (iii) being swept off the surface of the floodplains, and (iv) drowning in the channels. The question is, Are all of the dinosaur teeth in the Paleocene channels of sources (i) and (ii), or are at least some of them from source (iii)? Source (iv) could of course produce semiarticulated skeletons, but we have not found any in 18 field seasons. A possible reason for the lack of articulated skeletons of dinosaurs is the lower sedimentation rate of the Hell Creek Formation and the lower Tullock formations as compared with the Lance Formation or the Judith River Formation of Alberta containing the classic Oldman fauna. Depositional units in the lower Tullock Formation are only 1 to 10 centimeters thick, too thin for the burial of skeletons other than small vertebrates. The known Tullock fossils come dominantly from coals and the channel sands. The major



source of mammal remains (and we presume dinosaur teeth) in the Paleocene channels is (iii). All the listed channels have dinosaur teeth within them. A minor source for the mammal and dinosaur teeth is (i); we think this is no more than 5% of the included fossils. We think (ii) is unlikely because we have not found teeth in the floodplain shales despite many field seasons of prospecting. The deep cavities of small theropod teeth do not have floodplain sediments in them, only channel sands, as in the interiors of the turtle skulls.

We repeat our assertion that if dinosaur teeth are reworked, so must be the more common teeth of Cretaceous mammals. For example, *Didelphodon vorax*, the largest marsupial, is routinely known from most Cretaceous localities in the Hell Creek Formation, including BCA. It makes up on average, 2% of the number of mammalian specimens and is more common than any theropod dinosaur at most localities in the Hell Creek Formation. It is quite unknown from any of the Paleocene localities in either Garfield (*3*) or McCone counties. On the other hand *Meniscoessus borealis* is routinely present in all localities through FR, and in fact increases in abundance from BCA to BCW and HH. This is a strange kind of selective "reworking." One would expect reworking to homogenize the relict faunas. Instead, dinosaur teeth are enriched with respect to Lancian mammals in the Paleocene channels, and those mammals themselves differ from channel to channel. These faunas are not the result of a progressive dilution of reworked Cretaceous fossils.

Retallack and Leahy present useful new results on the distribution and types of paleosols in the Bug Creek area. We were aware of their work at the time of revision of our report, but could not in good conscience discuss it until they presented it. The FR channel cuts only 3 meters below the event Z, the K-T boundary. This is the interval that Retallack and Leahy point out as bleached by acid soil weathering, in which bones and teeth are missing in the floodplain silts and clays. The FR channel does not cut into a lower channel for at least 1.5 kilometers in the upstream direction. We do not see how the FR dinosaur teeth can be reworked.

On the matter of the bleached zone reducing the interval in which dinosaurs become scarce, we are in the process of reoccupying the University of Minnesota and Milwaukee Public Museum sites of dinosaurs and hand leveling the distance to the K-T boundary. Present results continue to show the trend stated in our report.

Sheehan and Morse suggest that it is more reasonable to combine all the Maastrichtian dinosaur faunas we cite as one unit of 3.3-million-years duration and compare them with the late Campanian faunas of 2.5-million-years duration on the basis of similar intervals of time. We do not think this is reasonable for the following reasons. The Oldman fauna includes some 320 semiarticulated dinosaur specimens (*4*) that have an approximate range in age of 1.5 million years. The slightly older Judith River fauna add three additional genera known only from isolated teeth and as yet not collected from the Oldman fauna, mainly because no extensive sediment-washing operations have been conducted except for those of Richard Fox of the University of Alberta, Edmonton, who has not reported on the reptilian remains. These taxa do occur later in the region. This means the augmented Oldman fauna is 30 genera over 1.5 million years. By combining the Lance, Hell Creek, and Scollard formation samples, the number of Lancian semiarticulated dinosaur specimens becomes 139 (*4*) over a total of 2 million years. To this we add the 52 Milwaukee Public Museum and University of Minnesota specimens and the genera known mainly from teeth. The Lancian faunas total 19 genera over a span of 2 million years. The compari-

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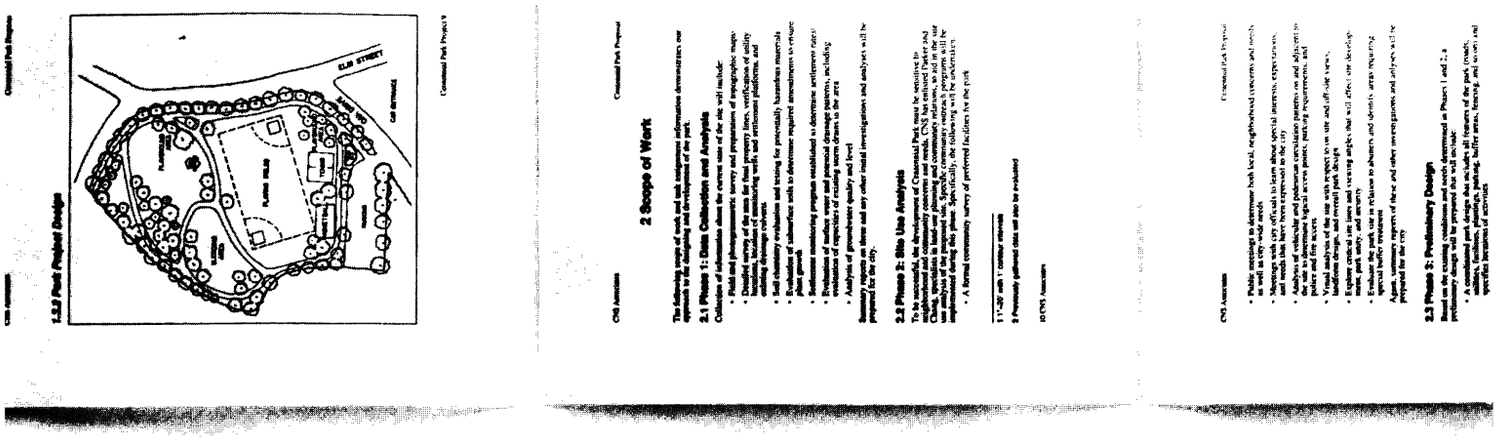

son is thus between 30 genera and 19 genera, not 30 and 28. However, there is a great difference between the faunas of the lower and upper parts of the Hell Creek Formation. Our collections of teeth from the upper part of the Hell Creek Formation are significantly larger than any other collections in the world. While not all our specimens are counted as yet, they have been identified. We estimate that more than 3000 dinosaur teeth have been collected from only five of our localities in the upper 20 meters of the formation. Twelve genera are all we can identify in these collections. We invite others to produce a similar body of data from another area for comparison. Lumping data will only confuse the results. Fossils with formation occurrence data only and not stratigraphic position are of little use. We did err in the calculation of χ^2. The probability is slightly more than 0.05 rather than slightly less.

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Alachlor Removal from Drinking Water

A recent News & Comment article by Marjorie Sun (12 Sept., p. 1143) about the Environmental Protection Agency's (EPA's) proposal for alachlor contains the statement, "alachlor, for the most part, is not eliminated by purification at conventional city water treatment plants or even activated charcoal filters."

David Baker of Heidelberg College in Tiffin, Ohio, has observed significant removal of alachlor and other popular herbicides after water has been treated with granular activated carbon (GAC) filters (*1*). Laboratory-scale experiments by the Ontario Ministry of the Environment have demonstrated effective removal of alachlor with GAC filters and with powdered activated carbon (PAC). PAC (25 to 75 milligrams per liter) was successful in removing alachlor and other herbicides from raw water at several southwest Ontario plants in 1985 (*2*). PAC is commonly used at many community water systems for taste and odor control and, as the Canadian data demonstrate, could be used for herbicide removal without the need for installation of capital-intensive filters. Additional work in Louisiana funded by the EPA has shown quantitative removal of alachlor by GAC filters and substantial removal after ozonization (*3*).

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Erratum: In the summary of the article "What has happened to productivity growth?" by Martin Neil Baily (24 Oct., p. 443), the second sentence should have read, "Unless there is an increase in growth, American living standards will remain stagnant and problems such as the budget deficit will plague policy-makers."