[Utah] ripple. 10/7/1994

THE UNIVERSITY OF UTAH

An Open Letter

TO: J. Bourgeois, E. Clifton, V. Courtillot, B. Dott, A. Fischer, B. Ginsburg, H. J. Hansen, K. Hsü, D. Lowe, B. Ward, J. Warme, and other interested "sedimentologists"

FROM: Tony Ekdale

RE: KT "Mimbral Beds"

DATE: June 30, 1994

I've just returned from a one-week return visit to see the KT "Mimbral Beds" again, and especially to take a closer look at the trace fossils. I thought you might be interested in my ichnologic up-date, so I am sending an informal open letter to all of you. As I suspected in February, I think the trace fossils provide some pertinent info about the nature and timing of the emplacement of these clastic units within the largely hemipelagic Mendez basin at the end of the Cretaceous.

Wolfgang Stinnesbeck kindly took me back to El Mimbral and El Peñon, but we were turned away from La Lijilla by a violent thunderstorm. We also saw the equivalent KT beds at Rancho Canales and Los Ramones, as well as some clastic beds within the Upper Mendez Fm. at two sites near Linares, which our group did not visit in February. Here are some of my observations and current thoughts; you can take 'em or leave 'em for whatever you think they're worth.

[La Jilla] Los Ramones Rancho Canales & Linares

(1) I no longer believe that the "burrows" I thought I saw at the top of the Unit 1 spherule layer at Mimbral are actually Cretaceous burrows. Closer examination of the structures in the field and lab reveal that they in fact are modern or pre-modern rhizocretions, as suggested in the field by the astute John Warme, Bill Ward and Ed Clifton last February. (Thanks, guys, for keeping me honest!)

< John Warme?

Peñon

(2) At Peñon (Outcrop #1) Wolfgang and I did find a few real (Cretaceous) burrows in the lower part of the massive to planar-laminated Unit 2 sandstone. The burrows are small (<1 cm diameter) and poorly formed (non-uniform diameter; no distinct burrow wall), but they almost certainly are burrows. They are subvertical to subhorizontal, cylindrical structures that are filled with both broken and unbroken spherules. Their shape, composition and occurrence mode suggest that they are not merely rip-up clasts from the underlying Unit 1 spherule layer. In fact, the tops of some are truncated by sand laminae within Unit 2, indicating that the structures were excavated as open burrows in basal Unit 2 sand, filled with spherules, and then scoured and overlain by more Unit 2 sand. How much of a time hiatus is represented by this mini-scour surface is uncertain. It may not have been very long.

"almost certainly"

(3) The well-developed trace fossils in the alternating sandstone, siltstone and shale of Unit 3 certainly were produced during several successive colonization episodes of the accreting substrate. I am now very clear on this point, which of course contradicts what was printed in our

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field guidebook. In the ripple cross-laminated sands of Unit 3 at Peñon, we found several instances of *Chondrites* populations and (separately) *Ophiomorpha* populations that were truncated by overlying sand layers. Within Unit 3 at Rancho Canales, we found repetitive "lam-scram" beds (John Warme's term for layers that are laminated at the base and scrambled by burrows at the top). Thus, the trace fossils provide fairly convincing evidence that Unit 3 was deposited episodically; I'm pretty sure that it's not a single-event deposit.

(4) The trace fossil assemblage in Unit 3, by the way, is not at all exotic or unexpected for an offshore marine sand body of late Cretaceous age. The *Ophiomorpha* (including both *O. nodosa* and *O. annulata*), *Thalassinoides* (mostly *T. suevicus*), *Zoophycos* and *Chondrites* certainly are common in Upper Cretaceous rocks elsewhere in North America (e.g., in the Difunta Group of northern Mexico, Book Cliffs Cretaceous of Utah, Point Loma Formation near San Diego, etc.).

(5) The late Cretaceous regional stratigraphy and paleogeography in NE Mexico was mentioned only briefly on our February field trip and in the guidebook. That was very unfortunate, I think, because it turns out that there are some very relevant points in these respects for us to consider. One of the most important is that the late Cretaceous Difunta Group near Monterrey (described by Grover Murray, Earle McBride and Al Weidie, among others) represents a very major deltaic depocenter carrying lots of clastic material into the Gulf of Mexico at this same time, and presumably sending it southward and eastward towards our beloved KT outcrops. In fact, back in 1975 McBride et al. (in Martha Lou Broussard's *Deltas* book) wrote about (A) "conspicuous calcite nodules" of spherical to elongate shapes and ranging in size from 0.1 mm to several cm's in diameter, which form channel lags in Difunta delta plain facies (probably not the same as the Unit 1 spherules, but intriguing nevertheless); (B) bedding-parallel *Ophiomorpha* in Difunta delta front sands (like those we see so prominently displayed in the KT Unit 3 sands); (C) *Ophiomorpha-Chondrites* associations in Difunta prodelta (turbidite?) siltstones and sandstones (also similar to what we see in Unit 3 deposits); and (D) wood fragments and other plant debris concentrated at the base of channel-fill sandstones (as seen at the base of Unit 2 at Mimbral).

(6) At a couple sites near Linares, Wolfgang and I looked at several prominent sand units within the upper part of the Mendez Fm. (before the KT beds) and lower part of the Velasco Fm. (after the KT beds). These sand units closely resemble the Unit 2 and Unit 3 KT beds in texture (fine to very fine), composition (terrigenous sand), internal structure (massive to planar laminated with ripples at the top), thickness (tens of cm's to 1.5 m), and trace fossils (abundant *Zoophycos* and *Chondrites*, scattered *Ophiomorpha*, and several other common ichnogenera not observed in the KT beds, including *Scolicia*,*Rhizocorallium* and *Schaubcylindrichnus*). All of a sudden it seems to me that the upper two KT clastic beds (i.e., Units 2 and 3) may not be not so unique in this basin after all!

(7) The Los Ramones outcrop is an odd one, because it is not even certain that it represents the KT interval. There is no Paleoecene Velasco Fm. exposed on top of it; the outcrop terminates at the top of a several-meter-thick, massive sandstone that has many (at least a dozen) scoured mudclast horizons throughout and also lots of trace fossils (especially *Ophiomorpha* and *Chondrites*). The unit lies in the uppermost Maastrichtian *A. mayoensis* zone, but I can't tell for sure that it actually represents the end of that zone. Jan Smit apparently found spherules in it, but Wolfgang and I could see none in outcrop. If this sandstone is equivalent to the KT Mimbral Beds, then the numerous erosional hoirizons lined with mudclasts are significant, because they would argue in favor of multiple events. If this unit is not equivalent to the KT Mimbral Beds, then it simply demonstrates that high-energy sands were being dumped into the Mendez basin prior to the end of the Cretaceous Period.

(8) The Unit 1 spherule layer remains an enigma to me, and it could indeed be unique. If anything in this sequence is an "impact tsunami" deposit, I think it would have to be Unit 1 (but

maybe not including Units 2 and 3). The troublesome questions about Unit 1 that stick in my mind include the following: (A) What empirical evidence allows us to differentiate between meteoritic, volcanic, organic (micropaleontologic) or perhaps even pedogenic spherules when they are obviously affected by diagenesis, as are those in the "Mimbral Beds"? (B) By what mechanism might you get the very regular, half-centimeter-thick laminae of alternating spherules and smectite grains deposited during a single sedimentation event, such as a tsunami? (C) If the spherules in Unit 1 are impact-derived, why are they separated so far stratigraphically from the iridium anomaly, which occurs a couple meters above them at the top of Unit 3? (D) How did the convoluted sandstone bed and the lenticular Mendez marl layers come to be sandwiched in the middle of the planar laminae of spherules in Unit 1? These seem to be rather tricky questions to me, and I'd be interested in hearing if any of you have any good answers!

I must say that I've been fascinated by the entire KT boundary problem ever since I started working on the Danish KT boundary sites some fourteen years ago, and as you can see from the above, my mind is still full of questions! I was highly stimulated by both the field trip to Mexico in February and my return trip there last week. However, I'm sorry to say that I was somewhat disturbed by the tone of some of the things that I heard uttered from the floor of the LPI meeting room in Houston following our field trip. Forgive me for saying this, but I don't believe that much of the confrontational posturing that I witnessed in Houston was either necessary or helpful in achieving objective scientific consensus. I prefer instead to try to keep an even temper and to just focus on empirical data that we all agree can be relied upon (preferably seen with my own two eyes)! I'd love to hear your feelings about any of the above-mentioned matters.

Best regards,

A. A. Ekdale

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