IRIDIUM ANOMALY IN THE IVANHOE CREEK SECTION NEW JERSEY COASTAL PLAIN K/Pg BOUNDARY.

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Introduction: The Cretaceous/Paleogene (K/Pg boundary on the New Jersey Coastal Plain was deposited in gently dipping offshore environments of varying depth, and has been recrystallized to a series of poorly consolidated glauconite- and fossil-rich layers [1-3]. The local offshore regional environment, the temporal relations between stratigraphic layers, and the exact location of the K/Pg boundary present a complicated puzzle. Recent research has been focused on synthesizing the relative locations of the chemical [4-7], biostratigraphic [1-3], and mineralogical indicators at multiple localities in sediments at the K/Pg boundary on the New Jersey Coastal Plain.

Previous work at Agony Creek in the Manasquan River Basin (~30m paleodepth) revealed a ~500 pg/g Ir spike above a ~100 pg/g background [1], in a thin layer ~20 cm below the last occurrence of ammonites and co-occurring fauna, all of which were buried in life positions [1]. This layer, known as the Pinna layer [1,4], lies at the top of the late Cretaceous Tinton formation. For this prior work, Ir analyses were made on bulk samples at 2 cm intervals using INAA [1]. Miller et al. confirmed these measurements at the same locality using an isotope dilution technique [3].

Locality: Here, we report on the position of the Ir anomaly in a section taken from the Ivanhoe Creek area of Monmouth County, New Jersey, which is geographically near previous sites [1-5], but at a shallower paleodepth of ~20m. Samples from the Ivanhoe Creek section were taken from a trench about 2m deep, dug for this purpose, as opposed to an outcrop.

Fig. 1 illustrates the wall of the trench that was sampled at Ivanhoe Creek. The Pinna layer identified at Agony Creek is not burrowed. At Ivanhoe Creek, it is similarly ammonite rich, but disturbed by burrowing (bioturbation) from above, and it is identified here as the "Pinna layer equivalent". The sample was taken to avoid burrows as much as possible.

Methods: Oriented box-cores that included an inferred K/Pg boundary were collected in a 8×12×3 cm steel box, then isolated in plastic wrap to prevent oxidation. The resulting wet, friable samples were wrapped tightly in aluminum foil to keep them consolidated. The sampled core was split into two horizontal halves. One half of the core was set aside for future studies, while the other was divided into half cm slices perpendicular to the stratigraphic horizon.

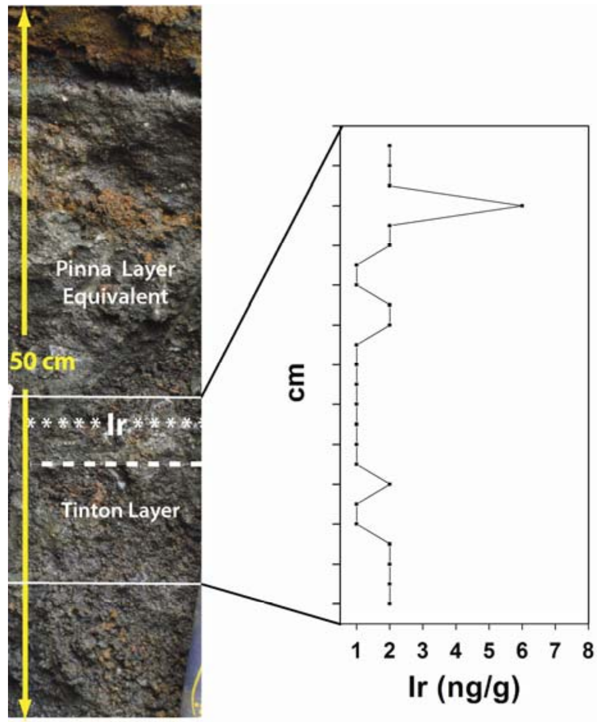

Figure 1. Photograph of the sampled Ivanhoe Creek trench side showing the relative positions of the Tinton formation and Pinna layer. The dashed line shows the approximate boundary between these stratographic units while the solid horizontal lines show the region sampled for elemental analysis. The position of the Ir irregularity is shown where it was discovered near the bottom of the Pinna Layer.

The material comprising each slice was placed into a glass vial and 1 gram of the material was dried in a ceramic crucible at 125°C for 8 hours. It was determined that 8 hours was sufficient for all water to be evaporated from the sampled material. Next, the dried material was homogenized in a clean agate mortar and pestle. A 100 mg aliquot of the homogenized material was digested with microwave-assisted techniques and taken up in 25 mL of 2% HNO_3. Quantification of the Ir was performed with the standard addition method on a ThermoElement X-Series II ICPMS. Procedural blanks yielded Ir concentrations between 0.01 and 0.03 ng/g, significantly above the typical Ir concentrations (≥ 1 ng/g) found in the glauconitic sediments from Ivanhoe creek analyzed for this study.

Results: We found a 6 ppb Ir anomaly above a 1-2 ng/g local background in the Ivanhoe Creek Section. The location is 3-4 cm above the base of the Pinna Layer. Our results are higher than previously measured Ir abundances in nearby localities [1, 3] by a factor of about ×10 – we are currently examining these preliminary results by verifying our analytical methodology.

Conclusions: Although this work is preliminary, we are confident that there is an iridium spike at the base of the Pinna layer equivalent at Ivanhoe Creek, as found below the Pinna layer at Agony Creek [1, 3].

Two hypotheses can explain the location of the Ir layer here and at Agony Creek, and the co-location of Ni and Co anomalies in framboidal pyrite found with the Ir anomaly at the base of the Pinna layer at Agony Creek. It is possible that the Ir, Ni, and Co in these sections was mobilized by water and reprecipitated at the base of the Pinna layer, as illustrated in the cartoon of Fig. 2. Alternatively, the Ir (and Ni and Co at Agony Creek) are in situ, subject only to isochemical recrystallization, with Ni, Co, and Ir originating in condensates from the impact plume [8]. In that case, the Pinna ammonite community represents a community that survived the fireball reentry 'kill event' [9], thrived for a brief time after the Chicxulub impact, and was buried in life positions, presumably by fine sediments from a denuded terrestrial landscape. If that is so, this is a unique locality that may shed light on the details of the aftermath of the Chicxulub impact.

Plenty of work remains to be done on extensive samples taken throughout the section at Ivanhoe Creek, including measurement of Ir above and below the layers reported here, and a search for shocked mineral grains through the section.

References: [1] Landman N.H. et al. (2007) *Bulletin of the AMNH 303*. [2] Ebel D.S., Mac Low M-M., Landman N.H. (2008) *39th Lunar & Planetary Science Conference*, Abs. #1454. [3] Bigolski J.N. et al. (2010) *GSA Abstracts w/ Program 42*, 305. [4] Ebel D.S. et al. (2010) *GSA Abstracts w/ Program 42*, 305. [5] Hsieh C.-T. et al. (2010) *Meteoritics and Planetary Science Suppl. 45*, A85. [6] Olsson R. et al. 1997) *Geology 25*, 759-762. [7] Miller K.G. et al. (2010) *Geology 38*, 867-870. [8] Robertson D.S. et al. (2004) *GSA Bulletin 116*, 760-768. [9] Ebel D.S. and Grossman L. (2005) *Geology 33*, 293-296.

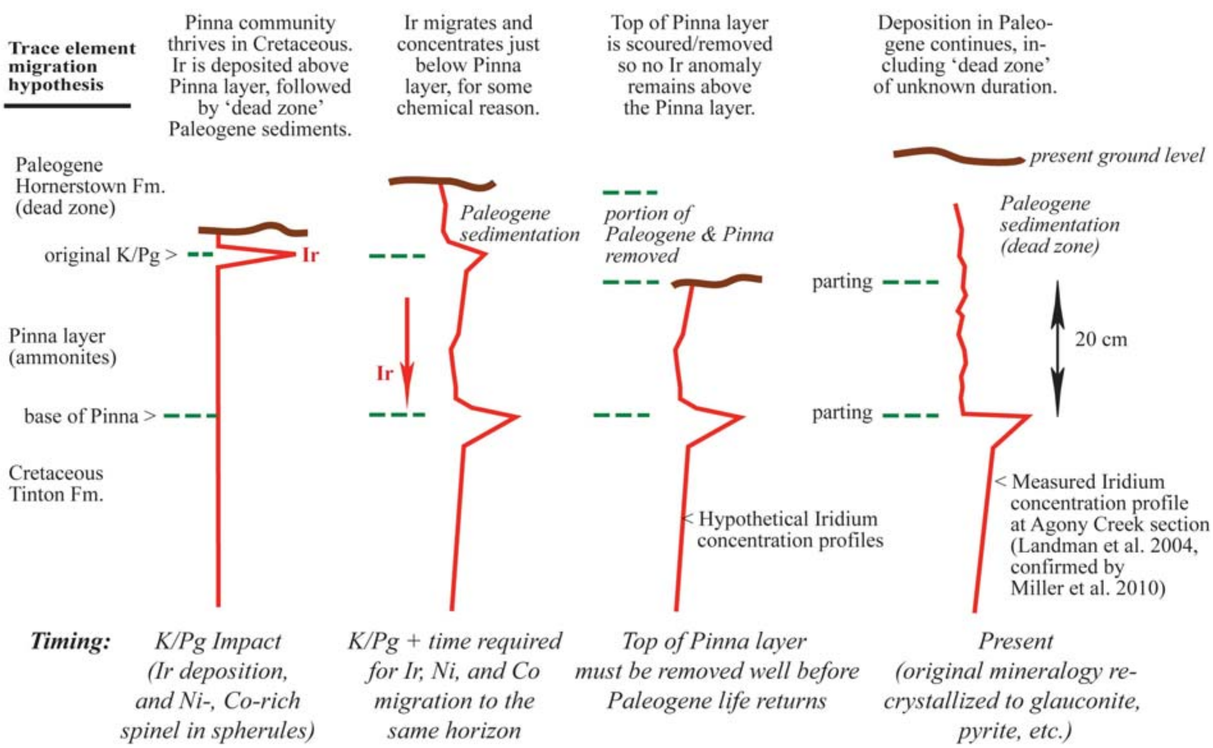

Figure 2. Cartoon illustrating a possible sequence of events ***if*** the Ir layer was originally at the biostratigraphic K/Pg boundary (top of Pinna layer), and subsequently migrated to the bottom of that layer.