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Poster Presentation 40

IS THE SOOT LAYER AT THE KT BOUNDARY REALLY GLOBAL?

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Significant quantities of elemental carbon and soot have been found in twelve Cretaceous-Tertiary (KT) boundary sites. Because of the wide geographic distribution of these sites, the data was interpreted to indicate that deposition of soot was a global phenomenon, coincident with the Ir-rich fallout layer. The likely source of the global soot deposit is eolian deposition from global wildfires directly associated with the KT impact event, estimated at 2.2 ± 0.7 mg/cm^2. At 65 Ma, these sites were situated where fine-grained detritus from continental margins might be concentrated from run-off, so soot might not be representative of a global airfall deposit.

To test this, we measured soot in five KT boundary sites which were situated in the central portion of the paleoPacific basin at 65 Ma. Reduced carbon was isolated from sediments using HCl and HCl/HF. Elemental carbon was separated from organic carbon by acidic dichromate oxidation under controlled conditions. The elemental carbon was identified and characterized using SEM imaging and quantified by weighing and particle size analysis. Iridium concentrations were measured in splits of most of these samples.

The KT boundaries from four cores were from oxidized sediments and we considered it possible that soot might not be preserved at these sites. This proved to be correct as no soot or elemental carbon was recovered. Upper limits on soot ranged from <2 to <18 ppm in these samples.

However, in a fifth core, the KT boundary is marked by a thin, black, pyrite-rich clay that should contain a record of global soot fallout if such existed in the central North Pacific. This sample contained 3600 ± 400 ppm elemental carbon and 1800 ± 200 ppm soot, at least two orders-of-magnitude higher concentration than the upper limits measured in the oxidized KT boundaries. Seven additional samples from this core were analyzed to determine whether soot was abundant in lower Tertiary sediments. Soot was detected in three of these, the highest being 500 ± 70 ppm, probably from very near the KT boundary. Because of severe drilling disturbance, we cannot rule out the possibility that these samples might have contained small fragments of boundary clay.

We conclude that the global wildfire hypothesis has passed this test. The only reduced KT boundary sediments known in the Pacific basin contain abundant elemental carbon and soot. An estimate of the carbon flux to this site was calculated to be 3.6 ± 0.7 mg/cm^2, somewhat less than the 11 ± 3 mg/cm^2 average estimated from the continental sites, but close to some individual measured values. The calculated flux of soot to this site is 1.8 ± 0.3 mg/cm^2, well within the average range of 2.2 ± 0.7 mg/cm^2 estimated from other sites. Since the soot is the more fine-grained component of wildfire smoke, it may be more likely to be globally dispersed and the close agreement of these estimates may be quite significant.