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87/86Sr, 143/144Nd, HFSE, REE, and PGE variations across the K-Pg boundary at Site 1259, ODP Leg 207 (Western Atlantic)

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The exceptionally well preserved, not bio-turbated, about 2- to 3-cm-thick spherule layer occurring in 6 of 13 cores from ODP Leg 207 (Demerara Rise, $\tilde{4}$500 km off the Chicxulub crater center) is ideally suited for tracing chemical changes related to the deposition of Chicxulub ejecta at the Cretaceous-Paleogene (K-Pg) boundary. We have analyzed Sr-Nd isotope systematics on hand-picked separates (spherules, matrix; Site 1259B) using TIMS, and the variation of 34 trace elements in the upper 5 mm of the ejecta sequence at Site 1259C using La-ICP-MS with a spot size of 235 μm (Inst. f. Mineralogie WWU). The micro-chemical study allows separation of the different components that have contributed to this spectacular layer. These are (i) projectile matter exemplified in the maximum Pt and Ir concentrations of $\tilde{0}$.1 and 0.04 ppm, respectively, in the uppermost one millimeter of the spherule layer, (ii) ejected mafic material, identified by low Ni/Cr ratios and rather flat chondrite-normalized REE, (iii) ejected silica-rich material (shocked quartz, feldspar, and lithic clasts), (iv) ejected carbonate clasts, (v) wash-off from the nearby Guayana cration, recognized by strongly negative time-corrected epsilon(Nd) of -17, and very exotic Zr/Hf and Nb/Ta ratios of 20.5 +- 1.0, and 5.4 +- 0.8, respectively, as well as by steeper REE patterns, and (vi) the contemporaneous seawater, given by Sr isotope ratios around 0.708. The time-span contained in this layer is constrained by the settling time of the larger spherules (about 2 days), and the residence times of Nd in the ocean (200 to 1000 yrs.; HFSE may a residence time on the same order of magnitude); alteration of the spherules to smectite, and uptake of Sr from the ocean may have happened later. Our reconnaissance study demonstrates the extraordinary potential of isotope studies with a high spatial resolution for unravelling the complexities of ejecta layers.