Avulsion Deposits and Incipient Paleosols: The Nature of Alluvial Deposits from PETM Sections in the Bighorn Basin, WY

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The Paleocene- Eocene Thermal Maximum (PETM) was a rapid, dramatic episode of global warming which occurred ~55 m.y. ago. The PETM is unusually well represented in rocks preserved and well exposed in sedimentary sections in the Bighorn Basin, Wyoming. The ~40m thick PETM interval is dominated by floodplain paleosols that alternate with mudstones and sandstones attributed to channel avulsion. At the Cabin Fork area, the PETM section can be divided into three distinct intervals. The lowest ~15 m is characterized by thin red beds which lack carbonate nodules. The uppermost ~20 m is characterized by thick, mature paleosols with small scale carbonate nodules.

The middle ~15 m, which is the focus of this study, is characterized by poorly developed paleosols and thin avulsion deposits. Large scale carbonate nodules are abundant throughout this interval. Grain size data show that the middle interval is 'coarser' (siltier vs clay rich) when compared to overlying and underlying intervals. Preliminary isotope data suggest that the middle interval corresponds to the warmest PETM temperatures (Francesca Smith MacInerney, unpublished data).

The weakly developed nature of these paleosols suggests that sedimentation rates increased during deposition of this interval. Abundant carbonate nodules indicate that this unit was deposited in relatively drier conditions. A decrease in weathering processes at the sediment source and throughout the drainage basin may account for the coarseness of this interval.

Shifts in regional precipitation patterns during the warmest time of the PETM explain abrupt changes to sedimentation and weathering rates. More frequent storms and heightened storm intensity would increase sedimentation rates by moving sediment more rapidly downstream. Sediment moving faster through a drainage basin would weather less than sediment which is spending more time disaggregating in slower moving streams. Increases in storm frequency and intensity may not increase the amount of precipitation overall and could occur in semi-arid climates.

Many parallels exist between PETM warming and modern climate change. These include rapid onset and dramatic global change. The findings of this study provide insight into future changes in the hydrologic cycle which may occur as the result of global warming.