Tracking ancient ocean rifting events by using hydrothermal components in ocean sediments

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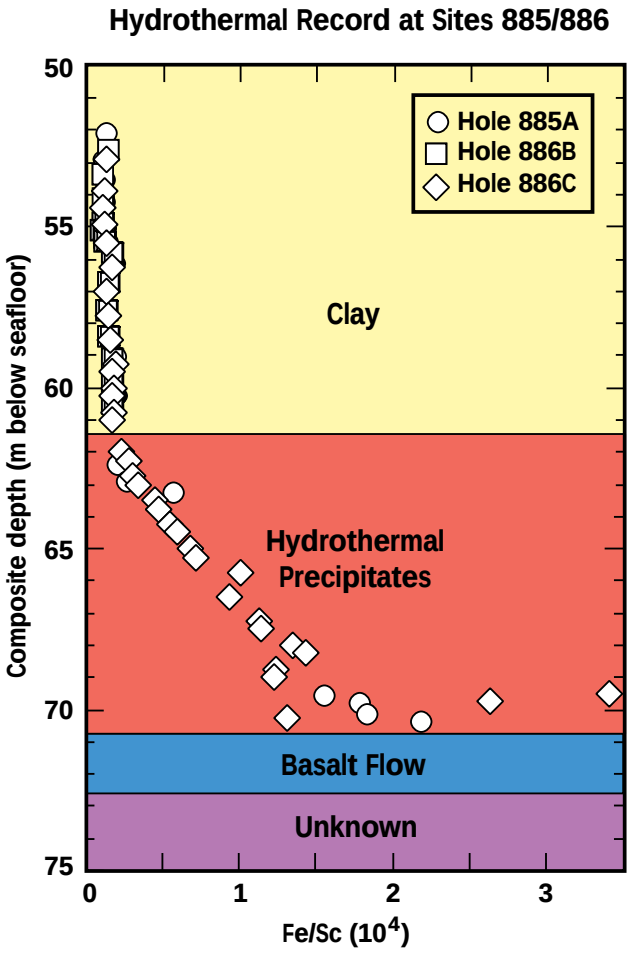

Recognizing ancient oceanic rifts is important for tectonic reconstructions and understanding the geologic histories of ocean basins. While geophysical methods are commonly used to identify ancient ocean rifts, we have used geochemical techniques to provide confirming evidence [*Dickens and Owen,* 1995]. This technique is based on the idea that rifting events are recorded as a dramatic increase in the flux of hydrothermal materials to the sediment within a few hundred km of the new rift. The combined effects of grain size sorting and advective transport cause the accumulation rate of hydrothermal precipitates to decrease in an exponential pattern with increasing distance from the rift. Thus, as a piece of seafloor moves away from an active spreading center, the lateral distribution of hydrothermal precipitates is manifested as an exponential decrease of hydrothermal materials upcore in the sediment column. This method has been exploited in an investigation of the origin of the Chinook Trough, a pronounced deep that spans approximately 1500 km in the central North Pacific Ocean (ODP Leg 145). Using Fe and Sc as proxies for hydrothermal and terrigenous material, respectively, the Fe/Sc ratio at ODP Sites 885 and 886 displays the expected geochemical pattern for sediments deposited near a new oceanic rift. Similar results are obtained using other elements as proxies. These results provide a detailed record of hydrothermal deposition emanating from an intraplate spreading center, and are consistent with earlier geophysical and geomorphological observations suggesting the Chinook Trough is a scarp that marks the initiation of intraplate rifting within the ancient Farallon Plate and the onset of spreading between the Pacific Plate and the now subducted Kula Plate.

Reference:
Dickens, G.R. and R.M. Owen, Chinook Trough Rifting and hydrothermal deposition at Sites 885 and 886, *Proc. ODP Sci. Results, 145,* 413-426, 1995.