A Possible Long-Term Paleoseismic Earthquake Record Along the Northern San Andreas Fault Based on Turbidite Stratigraphy

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During June and July, 2002, we collected 60 cores from channel and canyon systems draining the northern California continental margin. The objective of this project is to test the hypothesis that many of the turbidites deposited in these channels result from turbid flows triggered by earthquakes on the northern San Andreas Fault (SAF). Along the northern coast of California between San Francisco and Point Delgada, the San Andreas lies close to the coast or just offshore. No regional stratigraphic datum has yet been found in our cores, however correlation of individual turbidites both along individual channels and across non-connecting channels is robust, providing numerous stratigraphic ties between these systems. We are using Gamma density, p-wave velocity, high-resolution magnetics, x-ray, mineralogic, and color reflectance data to build a comprehensive regional correlation along the length of the northern San Andreas. That we are able to correlate individual turbidites along channels is not surprising, however correlating turbidites from one channel to another, some as much as 300 km apart, is surprising. Correlation of events along the margin for large distances suggests an earthquake origin for these turbidites, since other potential triggering mechanisms (except perhaps very large storms) operate in only single channels. Such synchronous triggering over a wide region is shown for many events. Channels from separate mineralogic provenances come together at confluences, below which we see either doublets, with no intervening time (hemipelagic sediment) between them, or bimodal coarse fractions in single turbidites, each density and magnetic peak representing a separate provenance. The mixing of flows from distinct provenances into single turbid flows below confluences also demonstrates synchronous triggering of separate channel systems. Similar relationships have been recognized in the Sea of Japan. Perhaps of equal or greater importance, the regional correlation of events implies that the physical property "wiggles" contain information about the earthquakes themselves, since the turbidites located in widely separated and non-communicating channels have, to our knowledge, little else in common. We suggest that the information contained in these wiggles may be the energy signature of the earthquake itself, in effect a geo-seismogram.

Based on assigning initial AMS 14^C results to the regional correlation, we find that regional correlation is possible for the last ~ 6200 years, which will likely be extended to ~ 10,000 years as the project matures. Thus far we are able to correlate 35 events above this age datum for the entire region. Of these, 10 events can be correlated along the length of the study region, from the northern limit of the SAF to south of San Francisco. Twelve events correlate along a northern "segment" and nine events correlate along a southern "segment" We find no events that occur clearly in only one channel, and only four events that are found in two and three channels only. These events are in close proximity to the seismically active Mendocino Triple Junction, and probably are related to local earthquakes there. The "segment boundary" along the SAF, if such exists, lies between Point Reyes and Point Arena.