Paleomagnetic Investigations of Non-Brittle Deformation along Active Faults

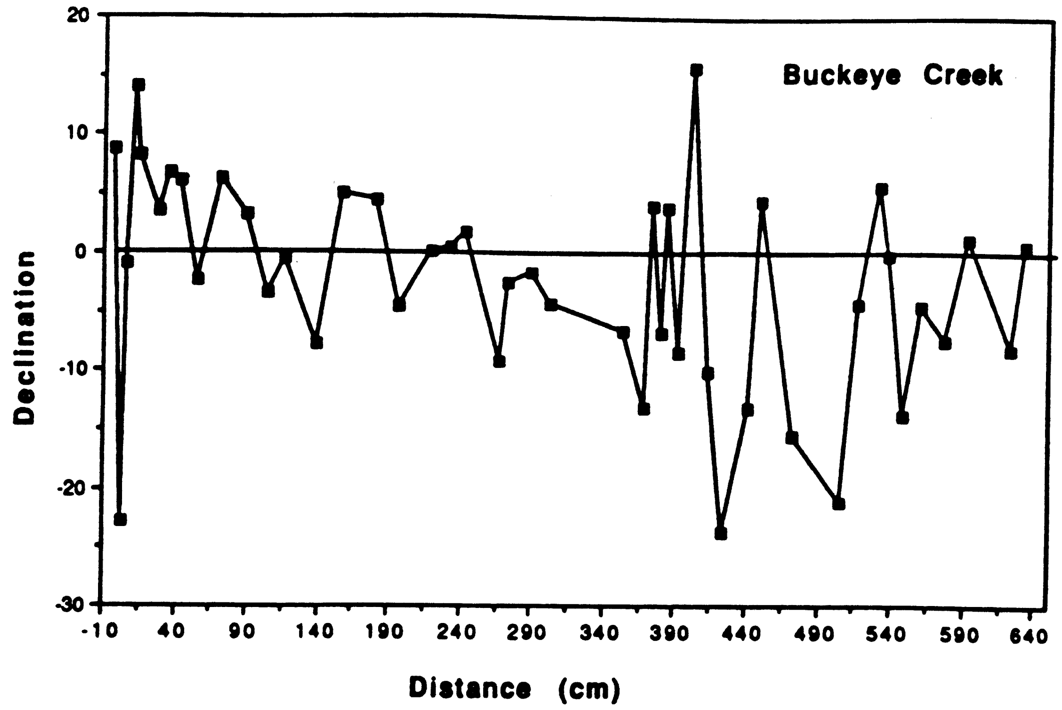
Agreement No. 14-08-0001-G814

Kenneth L. Verosub
Department of Geology
University of California - Davis
Davis, California 95616

(916) 752-6911 or 0350

We have found what appears to be non-brittle deformation in sediments adjacent to an active fault other than the San Andreas Fault at Pallett Creek. The fault is exposed in the cut bank of a stream channel along Buckeye Creek in Yolo County, California. The fault was discovered recently by UC-Davis researchers during field investigations related to the 1892 Winters-Vacaville earthquake series. The fault has a significant normal component, but it appears to have a strike-slip component as well. It has not been previously mapped, and we doubt that it is the causative fault of the 1892 earthquakes. Nevertheless, the fault is almost certainly active because it displaces deposits of the present floodplain of Buckeye Creek, an actively meandering stream. The exposure that we studied consists of alluvial plain deposits of the Plio-Pleistocene Tehama Formation, which has been deeply incised by Buckeye Creek. In the vicinity of the fault, the sediments contain small vertical cracks indicating that there may be distributed shear. Forty-nine paleomagnetic samples were collected along a line that was parallel to bedding and perpendicular to the fault. Adjacent to the fault, the samples were collected with a spacing of 3-5 cm; farther from the fault the spacing increased to about 20 cm. The farthest sample was 6.3 m from the fault. All samples were subjected to stepwise alternating field demagnetization at levels of 0, 5, 10, 15, 20, 25, 30, 40, 50 and 60 mT. The samples were strongly magnetized, and a few had very minor secondary components of magnetization. All of the samples had very stable primary components of magnetization with well-defined endpoints. Initial rock magnetic studies indicate that the magnetic carrier is single-domain or pseudo-single domain magnetite.

The declinations of these samples as a function of distance from the fault are shown in Figure 1. These data are our initial results, and clearly more work must be done at this site. For example, some of the directions appear to be anomalous, and these directions must be verified by additional sampling. In addition, there is some scatter in the data which might be reduced if we had more samples at each distance. Despite these problems there does seem to be a clear trend in the data which imply progressive counterclockwise deflection of the declinations as we approach the fault. Until we have collected more samples and have more information about the sense of motion on the fault, we cannot speculate on how this deflection might be interpreted in terms of a specific model of non-brittle deformation. What our results do demonstrate is that the declinations observed at Pallett Creek can not be dismissed as an isolated or unique situation and that non-brittle deformation may indeed be a common phenomenon associated with active faulting.



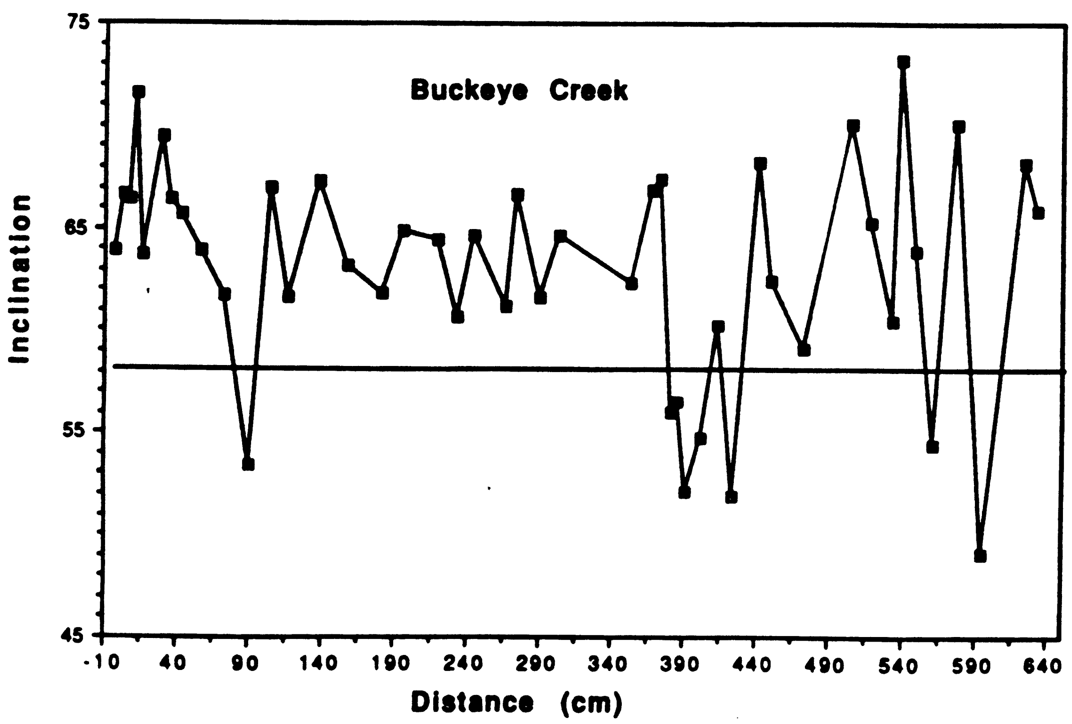


Figure 1. Preliminary paleomagnetic results from Buckeye Creek, Yolo County, California. The graphs show the declinations (top) and inclinations (bottom) of demagnetized samples located at various distances from a fault along a line that is perpendicular to the fault and parallel to the bedding. The solid line on the inclination graph is the inclination of a geocentric axial dipole field.