

A COMPARISON OF RELATIVE AND NUMERICAL DATING TECHNIQUES  
APPLIED TO TECTONICALLY OFFSET FAN SURFACES, OWENS VALLEY, CA

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We used soil development and cosmogenic isotopes to infer timing of fan deposition in Owens Valley, California. Our findings allow us to: 1) establish the age of offset fans and calculate slip rates along the Fish Springs fault and 2) compare relative and numerical dating techniques.

The Fish Springs fault, associated with the right lateral Owens Valley Fault Zone, has displaced a cinder cone and multiple debris fan surfaces vertically, leaving a record of progressive deformation over the late Quaternary. Martel et al. (1987) established the age of the cinder cone ( $314 \pm 36$  ka,  $2\sigma$ ), the displacement of the 3 fan surfaces and cinder cone, and the approximate ages of the fan surfaces by correlating them with the assumed timing of local glaciations.

We used the Profile Development Index (PDI) of Harden (1982) to quantify soil development in 11 backhoe trenches on 3 fans. PDI values rise with increasing fan age as estimated by relative weathering of fan surfaces, cross-cutting relationships, and separation of tectonically offset surfaces. However, we could not assign numerical ages to fan surfaces based on PDI values because existing soil PDI values of known age are lacking in Owens Valley. Differences in geomorphic surface characteristics preclude application of PDI calibrations developed in other, climatically similar locations. Comparison of soil development with cosmogenic fan surface age estimates and other relative weathering data (i.e. boulder weathering) provides valuable information on late Quaternary soil formation rates in Owens Valley.

Despite difficulties assigning independent ages to the fans based on soil development, interpretations of relative weathering data concur with Martel's proposed glacial origins for fan surfaces. From these relations, a long term vertical displacement rate of approximately 0.24 mm/yr of vertical slip is implied, as calculated by Martel et al. (1989), similar to the rate calculated using cosmogenic estimates of fans surface age (See abstract this meeting by Bierman et al.).

Harden, J W., *Geoderma*, 28, 1-28. Martel, S J et al., *Quat. Res.*, 27, 113-129. Martel, S J et al., *Quat. Res.*, 32, 342-343

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