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EVOLUTION OF BASIN AND RANGE STRUCTURE IN THE RUBY MOUNTAINS AND VICINITY, NEVADA: D. D. Blackwell, N. M. Reese and S. A. Kelley, Department of Geological Sciences, Southern Methodist University, Dallas, TX 75275

The Ruby Mountains of central Nevada are one of the infrastructure regions exposed in the Basin and Range Province. Geologic studies of the Ruby Mountain have been carried out by Snoke and Howard (1984). We have used the results from various age dating techniques, seismic reflection profiling, hydrocarbon maturation studies, and structural analysis to evaluate the Cenozoic deformation in the Ruby Mountains and adjoining ranges (Pinyon Range and Cortez Range) in Elko and Eureka Counties, Nevada. Age dating techniques used include potassium-argon ages of biotites from granites published by Kistler et al. (1981) and fission track ages from apatite and zircon. Fission track ages from apatite reflect a closing temperature of $100\pm 20^{\circ}\text{C}$, zircon fission track ages reflect a closing temperature of $175\pm 25^{\circ}\text{C}$ and potassium-argon ages from brotite reflect a closing temperature of $250\pm 30^{\circ}\text{C}$. Thus these results allow a reasonably precise tracking of the evolution of the ranges during the Cenozoic. Seismic reflection data are available from Huntington Valley. The northeastern part of the valley is discussed in detail by Smith (1984). We have obtained access to seismic reflection data directly to the west of the Harrison Pass pluton in the central Ruby Mountains. In addition results are available from several deep exploration holes in Huntington Valley.

Age dating traverses across the Ruby Mountains at the latitude of the Harrison Pass pluton and to the north establish a progressive younging of ages from east to west across the range. This trend is reflected in both the apatite, zircon, and potassium-argon ages. Potassium-argon ages along the east flank of the range are about 35 MY. Along the west side of the range the potassium-argon ages are 20 to 25 MY. Apatite ages show a similar trend of

younging from east to west with values of 20 to 25 MY on the east and 10 to 15 MY on the west. Assuming the indicated closing isotherms and a background geothermal gradient $30^{\circ}\text{C}/\text{km}$ (about the present Basin and Range value), the approximate rates of uplift are on the order of 0.5 km/MY.

The younging of ages from east to west across the central Ruby Mountains suggests that rates of uplift along the western side of the range have been faster than on the east side of the range. Our interpretation of the data is that the range block has been rotated to the east about 30° with the rotation beginning approximately 25 MYbp and continuing until at least 15 MYbp. During this period of rotation a set of early west dipping Basin and Range normal faults was truncated and rotated from high angle to low angle dips. As in many other areas the low angle faults have been mapped as thrust faults. However, the age data clearly document the rotation that has turned these high angle faults into low angle structures. Account has been taken in the interpretation of the effect of the emplacement of the Harrison Pass pluton at about 36 MY. The present range is blocked out by a subsequent set of high angle faults that is still active.

An interesting result of this deformation is that a Basin and Range geothermal system along the original high angle faults has been truncated and rotated up to present day exposure along the west-central part of the range. Silicification associated with this fossil geothermal system has been encountered in an exploration test in the Huntington Valley as well (Snoke, personal communication, 1984), documenting the basinward position of the rotated fault.

Interpretation of seismic reflection data extending from the west side of the Harrison Pass pluton for a distance of 22.4 km west across Huntington Valley support the uplift and structural interpretations from the age dating

evidence. In the seismic reflection profile adjacent to Harrison Pass, large scale faults are the dominant structural feature. These faults dip west into the basin cutting the contact between Paleozoic carbonate and Cenozoic clastical volcanic rocks, and terminating in subhorizontal reflectors at depth. In contrast the central and eastern parts of the reflection profile show very little evidence of normal faulting. Where normal faulting is recognized it is restricted to the Cenozoic rocks filling the basin. Eastward dipping reflectors in Cenozoic strata in the basin indicate that tilting may have been accommodated by movement along the normal faults. Associated with the tilting, a shift in sedimentation from the center of the basin eastward has resulted in an asymmetric basin with a thick wedge of sediment developed adjacent to the western front of the Ruby Mountains.

A combination of the relatively precise information on the timing and rate of uplift in the range associated with the structural information of the basin, allow an accurate reconstruction of the nature of Cenozoic deformation in the Ruby Mountains. This reconstruction, in conjunction with the regional setting, suggests that the Ruby Mountains are locally unique in that they reflect rapid erosion and uplift of deep crustal levels to shallow depths. The mechanism responsible for this behavior is postulated to be local ductile and brittle deformation of the crust in response to rapid unloading of a small portion of the crust by erosion or tectonic denudation.

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