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THERMAL HISTORY OF A METAMORPHIC CORE COMPLEX.

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Fission track (FT) thermochronology studies of lower plate rocks of the Ruby Mountains-East Humbolt Range metamorphic core complex provide important constraints on the timing and nature of major middle Tertiary extension of northeast Nevada. Rocks analyzed include several varieties of mylonitic orthogneiss as well as amphibolitic orthogneisses from the non-mylonitic infrastructural core. Oligocene-age porphyritic biotite granodiorite of the Harrison Pass pluton was also studied. The minerals dated include apatite, zircon, and sphene and were obtained from the same rocks that have been previously studied using the ^{40}Ar-^{39}Ar method (1).

FT ages are concordant and range in age from 26.4 Ma to 23.8 Ma, with all showing overlap at 1 sigma between 25.4-23.4 Ma (Figure 1). Concordancy of all FT ages from all structural levels indicates that the lower plate cooled rapidly from temperatures above ~285°C (assumed sphene closure temperature; (2)) to below ~150°C (assumed apatite closure temperature; (2)) near the beginning of the Miocene. This suggests that the lower plate cooled at a rate of at least ~36°C/Ma during this event. The general concordance of FT with ^{40}Ar-^{39}Ar biotite and hornblende plateau ages (1) suggests an even more pronounced cooling during this event (above ~500°C to below 150°C) during latest Oligocene-earliest Miocene time.

Rapid cooling of the region is considered to reflect large-scale tectonic denudation (intracrustal thinning), the vertical complement to intense crustal extension. Rocks originating in the middle crust (10-15 km) were quickly brought near the surface along detachment faults (brittle-ductile shear zones) and juxtaposed against brittlely extended rocks deformed under upper crustal conditions. FT data firmly establish the upper limit on the timing of mylonitization during detachment faulting and also coincide with the age of extensive landscape disruption.

References

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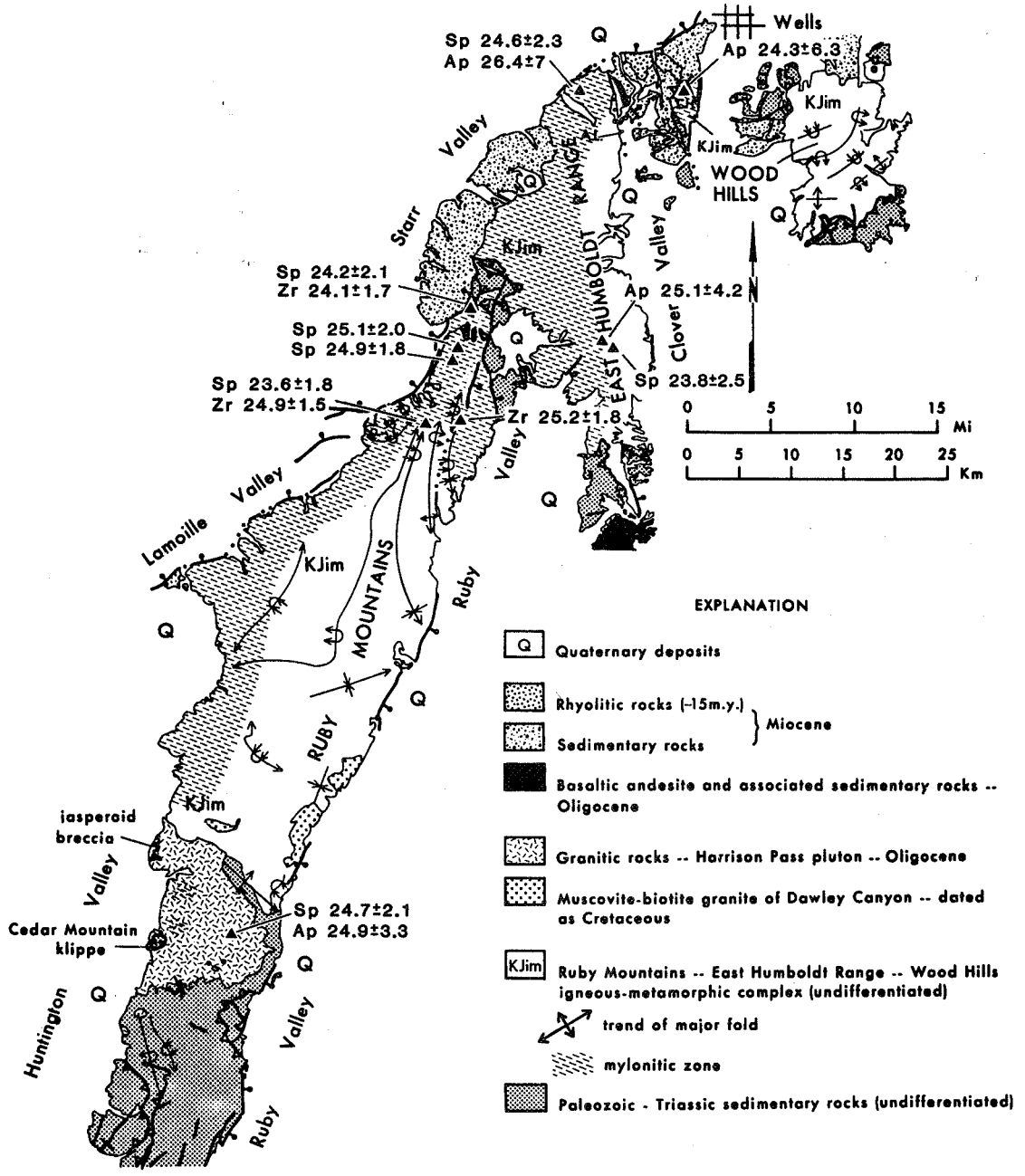

Figure 1. Generalized geological map of the Ruby Mountains-East Humbolt Range, Nevada (3). Triangles show location of FT samples; age (±error) and mineral dated (Sp=sphene; Zr=zircon; Ap=apatite) is shown at each locality.