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Uraniferous quartz — hematite breccias at Mt Painter (South Australia): Palaeomagnetic dating of hydrothermal activity

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The Radium Ridge Breccias are an unusual sequence of coarse terrestial clastics which contain a major amount of hydrothermally precipitated quartz and hematite, and locally host uranium and base metal deposits (Drexel and Major, 1987). The breccias are up to 500 m thick, are distributed over an area of at least 100 km^2, and unconformably overly multiply deformed and metamorphosed Proterozic to early Palaeozoic rocks of the Mount Painter Inlier. The dominant lithological type is a granitic breccia that comprises dominantly clasts of local basement granite, gneiss and schist. Uranium mineralization occurs mostly in lens-shaped bodies of hematitic breccia within the granitic breccia pile. The granitic breccia also contains a diamictite comprising well-rounded clasts of rocks not found in the local basement, and is capped at some localities by a quartz-hematite-rich sedimentary rock, the Mount Gee Sinter. At Mount Gee the sinter was deformed, apparently while still plastic, into metre-scale domes and basins. The origin of the breccias, their age, and association with the diamictite and sinter have been poorly understood.

Palaeomagnetic measurements indicate that the Radium Ridge Breccias have been magnetized twice, both times in the Permo-Carboniferous. The palaeomagnetic south pole for one of the remanences was estimated as 165.1°E, 65.7°S (α_{95} =11.5°). The other remanence direction was not well defined; however samples collected from the enclosed diamictite bodies gave 133.9°E, 33.1°S (α_{95} =6.9°) as the probable pole for the overprint. The latter is similar to overprint poles published from central Australia, which are generally attributed to the Alice Springs Orogeny (Fig. 1).

Magnetization directions interpreted as Permo-Carboniferous were obtained also from the Mount Gee Sinter and from U-mineralized hematitic ironstone bodies within the breccias. The magnetization of the units is probably coeval with the younger magnetization of the Radium Ridge Breccias. A positive fold test (Fig. 2) demonstrated that the remanence

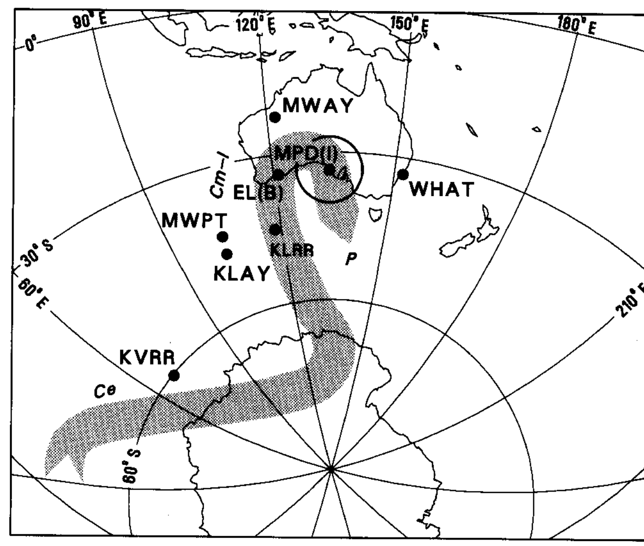

FIGURE 1
Diamictite pole MPD(I) for intermediate temperature component compared with overprint poles from central Australia (Li *et al.*, 1989). (From Idnurm and Heinrich, 1993, Fig. 11).

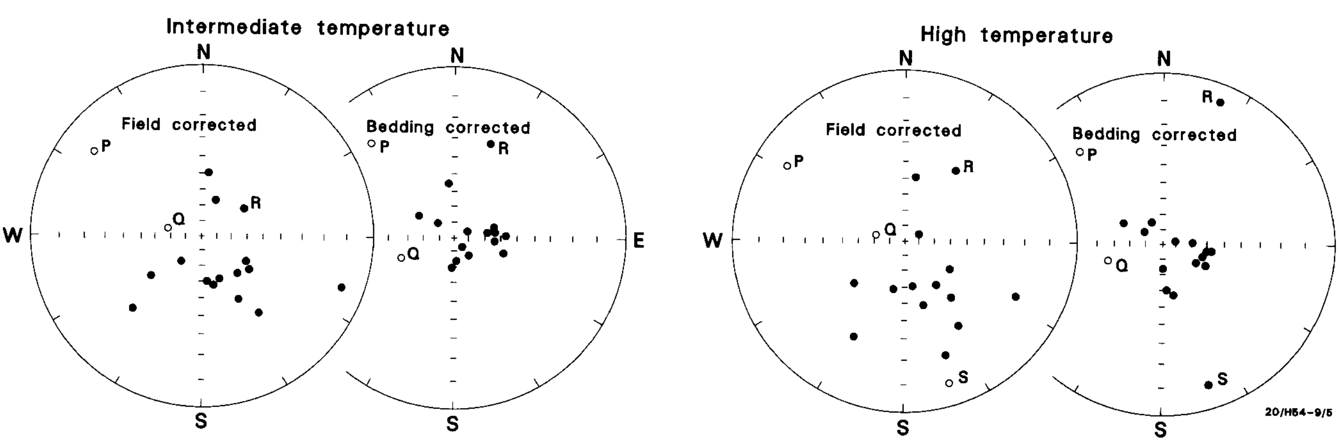

FIGURE 2
Equal angle stereographic projections showing intermediate and high unblocking temperature directions for fine-grained siliceous sinter. Increased clustering of directions as a result of bedding-correction provides evidence at 99% confidence level for a primary, pre-folding magnetization of the youngest unit in the Mount Gee Sinter. Open (closed) circles denote upper (lower) hemisphere. (From Idnurm and Heinrich, 1993, Fig. 4b).

of the sinter is primary, thus indicating a major hydrothermal event in the Permo-Carboniferous.

It is not clear by how much this event postdates the deposition of the underlying Radium Ridge Breccias and hematitic ironstone. The latter may be Ordovician or older if earlier monazite U-Pb data are correct, and may have been formed by granite-related hydrothermal fluids. In that case, the older remanence in the breccias is also an overprint. Epithermal sinter formation and chemical (rather than purely thermal) resetting of the remanence in the underlying breccias were probably due to deep circulation of oxidised fluids during Permo-Carboniferous tectonic activity. Chemical reaction of these fluids with pre-existing magnetite-bearing ironstones may have been responsible for uranium mineralization during the Permo-Carboniferous. This interpretation is consistent with published textural, isotopic and fluid inclusion data, but an older age for the uranium concentration, as a primary part of the ironstone formation, cannot be excluded. Alternatively, if the monazite data are discarded, the entire hydrothermal process including iron, uranium and silica deposition could have occurred in the Permo-Carboniferous.

References

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