forming boudins ranging in scale from 30 m to microscopic. Many early-formed veins are preserved as quartz-carbonate boudins and isolated lenticules. The highest-grade mineralisation is in fuchsitic selvedges surrounding large boudins. The geometry of the boudins is consistent with their having formed during the early shearing event. Although several crenulation cleavage surfaces are present, they overprint the mineralisation; the latest is an upright surface correlated with the second regional deformation. Richly mineralised veins are also folded with axial surfaces parallel to Skwarnecki (Advances in Understanding Precambrian Ore Deposits, Vol. 2, University of WA Geology & University Extension, Publication 12, 1988, p. 111) that the bulk of the Harbour Lights mineralisation is synchronous with the early deformation. As at Sons of Gwalia, there is no evidence of overprinting by structures related to the MGSZ.

It has been suggested by the gold research group of the University of Western Australia that much of the mineralisation in the Leonora area is late in the structural history and related to the MGSZ. The regional deformation history established during the current mapping does not support this view. Although at Tower Hill and Harbour Lights several undeformed or weakly deformed veins contain high gold values (and at King of the Hills late tension veins, essentially undeformed, also host high-grade ore), in all these areas the orientation of the veins is consistent with the overall sense of movement on the dominant early shear zones. We prefer an interpretation of these veins as forming late in the deformation history of the early shears, and not during late overprinting by late strike-slip events. This late-stage continuation of mineralisation and hydrothermal activity also resulted in local retrogression of the peak amphibolite metamorphic assemblage that formed during the early deformation.

Summing up, this study has provided a framework within which to place detailed structural studies of individual deposits, and has led to the conclusion that the zone of mineralisation extending from Sons of Gwalia north to King of the Hills is hosted by a regional early, dip-slip shear zone and is genetically related to that shear zone. Regional and mine-scale evidence shows that this early shear zone is folded by upright north-trending open folds. The regional strike-slip faults (e.g. MGSZ) and associated folds and cleavage overprint the early shear zones and early cleavage, and in the Leonora area are not significant hosts for mineralisation.

For further information contact Dr Peter Williams or Dr Mike Etheridge at BMR or Dr Wally Witt or Dr Cees Swager at GSWA, Kalgoorlie Office.

Kalgoorlie regolith results

Initial results from the Kalgoorlie Regolith Project (see BMR Research Newsletter, 6, p. 9) are now available. Data for 59 regolith terrain units covering the Kalgoorlie 1:1 000 000 Sheet area (120°126W, 28°32S) are recorded under 16 primary headings. These group into provinces, and major mineralisation are shown on the preliminary Regolith Terrain Map at 1:1 000 000 scale (BMR Record 1988/3). Details of the landscape history and regolith of the Kalgoorlie region of the Yilgarn Block were published in the BMR Journal of Australian Geology & Geophysics (Volume 10, Number 4) in June 1988. Results include a new geomorphic chronology (extending back to the Permian) and a new model of landscape evolution.

The methodology of regolith terrain mapping and its application to mineral exploration are discussed in a paper by R. Chan recently published in Zeitschrifl für Geomorphologie (Supplementband 68). A paper on this topic was presented at the Second International Conference on Prospecting in Arid Terrain held in Perth in April 1988.

For details, contact Ms Roslyn Chan at BMR (Division of Petrology & Geochemistry).

Major new platinum-group metals report


This latest BMR Resource Report, published in March, opens with a chapter on the economics of platinum-group metals, including their applications, world supply and demand, political-economic-strategic factors affecting production and marketing, and the economics of possible future production in Australia. The chapter, 'Worldwide Geological Setting', includes a classification of deposit types, together with descriptions of the Bushveld Complex, Stillwater Complex, New Rambler mine in Wyoming, and the gold-palladium-platinum deposit at Coronation Hill, NT.

The major section, 'Geology of Platinum-Group Metals in Australia', concludes with a recommended exploration strategy and summary descriptions of all known Australian occurrences, together with a location map. Listed in an appendix are all known layered mafic-ultramafic complexes in Australia (also with a location map). There is an extensive bibliography and an index to prospects, locations, and deposit types.
New publications on SW Pacific geology and mineral resources

Since 1982, Australia, New Zealand, and the USA have co-operated in a Tripartite Marine Geoscience Research Program involving the offshore areas of the Southwest Pacific island nations of Cook Islands, Fiji, Kiribati, Papua New Guinea, Solomon Islands, Tonga, Tuvalu, Vanuatu, and Western Samoa.

Sixteen research cruises have been mounted under the auspices of CCOP/SOPAC (the regional marine geoscience body) averaging 20 days each. One set of cruises, using the USGS vessel, S.P. Lee, was petroleum-oriented and consisted predominantly of multichannel seismic profiling. The second set was oriented towards offshore minerals and regional tectonics and made extensive use of geological sampling as well as under-way geophysics.

The work has led to a much better understanding of the sedimentary basins of the region and their petroleum potential, and the mineral resources potential of adjacent oceanic basins (manganese nodules, cobalt-rich manganese crusts, and hydrothermal polymetallic sulphides). Basins with more than 5000 m of sediment are now known to exist offshore in Tonga, Fiji, Vanuatu, Solomon Islands, and northern Papua New Guinea, and all have petroleum prospects as frontier areas. The exciting results of the Tripartite Program have acted as a catalyst for other research in the area, so that the scientific database for the region has expanded faster than expected. All of the data from the petroleum-oriented cruises will be in the public domain and will be available in hard copy from BMR's Copy Service or as data tapes from the Marketing Manager of BMR's Division of Marine Geosciences & Petroleum Geology.

BMR scientists have been heavily involved in the work, and reports on the Tripartite Program have appeared in several issues of the BMR Yearbook and BMR Research Newsletter. BMR 82 and BMR 87 (yearbooks) contain articles with maps showing all the areas studied.

The results from the cruises are generally published in the Earth Science Series of the Circum-Pacific Council for Energy & Mineral Resources. These Circum-Pacific Council Publications are available at very reasonable prices from the AAPG Bookstore, PO Box 979, Tulsa, Oklahoma 74101-0979, USA, and in some cases from the Australian Mineral Foundation, PB 97, Glenislea, SA. Two new South-west Pacific Tripartite volumes came out in 1988—Volumes 8 and 9. The following Tripartite volumes have been published so far:


The volumes contain a broad spectrum of articles: onshore geology and organic geochemistry; and offshore tectonics, structure, stratigraphy, sedimentology, sediment geochemistry, gas geochemistry, palaeontology, igneous petrology, igneous geochemistry, and heat flow. Special emphasis has been placed on reviews of petroleum potential and of offshore mineral occurrences. Most volumes also contain an excellent regional synthesis chapter using all available information from both onshore and offshore.

For further information, contact Dr Neville Exxon or Mr Jim Coolwell at BMR (Division of Marine Geosciences & Petroleum Geology).

**Sequence-stratigraphy, rifts, and tides at Mount Isa**

![Geological map of the area of detailed study of the Quilalar Formation, showing locations of measured sections.](image)

A new field study of the Haslingden Group and Quilalar Formation, near Mount Isa in north-west Queensland, has provided a wealth of detail on the environmental setting and sedimentological evolution of these major Proterozoic units. The relatively new concept of ‘sequence-stratigraphy’ (Bally, 1987: *Atlas of Seismic Stratigraphy*; AAPG, *Studies in Geology*, 27, 1–10), has been successfully applied to the study of the Quilalar Formation, and a well-constrained model of its palaeogeographical evolution is now available. These results have implications for regional stratigraphic/structural interpretations and for mineral exploration, and will be critical in later basin-evolution modelling.

The volcano-sedimentary Haslingden Group is the oldest cover sequence in the Mount Isa Orogen; it is between 1800 and 1710 Ma old and may be as much as 18 km thick. It was previously interpreted as a single-stage rift sequence. The overlying Quilalar Formation was interpreted as the succeeding sag phase of sedimentation caused by the thermal contraction of the lithosphere. The recent detailed studies of parts of this sequence by a BMR-US group (M.J. Jackson, BMR; Prof. K. Eriksson, Virginia Polytechnic; and Dr E. Simpson, Kutztown University, Pennsylvania) suggest a multiple rifting history, including periods of gentle sag sedimentation, for the Haslingden Group, and confirm a thermo-tectonic origin for the Quilalar Formation.

The Bottletree Formation locally underlies the Haslingden Group, and the Mount Guide Quartzite is the oldest formation in the Group. Although rift-related conglomeratic alluvial-fan sediments occur in the Bottletree Formation, and braided stream deposits are present in the lower part of the Mount Guide Quartzite, much of the upper Mount Guide Quartzite con-