



BURIAL DIAGENESIS AND MISSISSIPPI VALLEY-TYPE
MINERALIZATION IN THE UPPER DEVONIAN REEF
COMPLEXES OF THE LENNARD SHELF,
CANNING BASIN, WESTERN AUSTRALIA.

ANDREW M^CMANUS

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This thesis is submitted as a partial fulfilment of the requirements of the Master of Science (Petroleum Geology and Geophysics) Degree at the National Centre for Petroleum Geology and Geophysics, University of Adelaide.

To the best of this author's belief, this thesis contains no material which has been accepted for the award of any other degree or diploma in any University, and contains no material previously published or written by another person, except where due reference is made in the text of this thesis.

Andrew McManus

The author consents to the thesis being made available for photocopying and loan if applicable if accepted for the award of the degree.

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ABSTRACT

Mississippi Valley-type (MVT) lead/zinc mineralization has been discovered within the Late Devonian reef complexes of the Lennard Shelf, in the northern part of the Canning Basin. MVT deposits are carbonate hosted lead/zinc deposits formed from brines at temperatures of 80 to 120°C. A basin brine model is proposed for their development.

Cathodoluminescence (CL) was used to determine the cement stratigraphy of the burial cements. The generalised calcite cementation sequence from non-luminescent, bright-luminescent to dull-luminescent, represents a progression from oxidizing to reducing conditions for the carbonate pore fluids. This sequence represents cementation during Late Devonian- Early Carboniferous burial of the reef complexes. The mineralization event occurs within the bright-luminescent cement zone.

A regional dolomitization event occurred after the non-luminescent calcite cement zone. This dolomite is a burial dolomite and created secondary moldic and intercrystalline porosity. Saddle dolomites occur as pore filling cements and post-date mineralization. The saddle dolomite is closely associated with the mineralization event.

The MVT mineralization on the Lennard Shelf was formed during the early burial of the reef complexes (latest Devonian or Early Carboniferous). This period corresponds to rapid subsidence in the nearby Fitzroy Trough. Hot brines, driven by sediment compaction, migrated along aquifers into porous zones within the carbonates on the Lennard Shelf. Fracture porosity was generated by the mineralizing fluids and dissolution of the host carbonates also enhanced porosity. Fluid inclusions indicate temperatures of 90°C for pore fluids at the time of sulphide precipitation. The carbonates contain progressively more radiogenic strontium with younger generations, further supporting an evolving basinal derived fluid. The availability of reduced sulphur appears to be important to the formation of the MVT deposits.

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