SEDIMENTOLOGY OF THE LATE PRECAMBRIAN MUNDALLIO SUBGROUP : A CLASTIC-CARBONATE (DOLOMITE, MAGNESITE) SEQUENCE IN THE MT. LOFTY AND FLINDERS RANGES, SOUTH AUSTRALIA.

(VOLUME I)

by

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This thesis is submitted as fulfilment of the requirements for the degree of Doctor of Philosophy in Geology at the University of Adelaide.

January, 1980.

Awarded 13th June 1980

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SUMMARY

During deposition of the mixed carbonate-clastic sequence of the Mundallio Subgroup, the "Adelaide Geosyncline" was a very shallow, elongate sedimentary basin, flanked to the west and east by older Precambrian basement.

In much of the southern and northern Flinders Ranges, clastic deposition predominated in the lower Mundallio Subgroup. In the north, alternating development of shallow mudflats and sandflats (Nankabunyana Formation) depended on the interplay between the sediment supply and winnowing processes, while dolomite mudstones were locally deposited in the shallowest areas. In the eastern half of the Willouran Ranges, massive shales were deposited as the environment remained persistently below wave base (Camel Flat Shale), but a renewed sand influx led to deposition of the Tilterana Sandstone. In the southern Flinders Ranges, terrigenous clay and silt were deposited on submergent mudflats which shallowed into intermittently exposed dolomite mudflats (Nathaltee Formation). Dolomite mudflats were a more persistent feature in areas more distal from the terrigenous source, and sometimes contained isolated, ephemeral lakes which were sites of magnesite deposition (Yadlamalka Formation). Dolomite and magnesite mudstone deposition of the Yadlamalka Formation became widespread in the northern and southern Flinders Ranges in the upper Mundallio Subgroup, as shallowing and retreat of the basin margin led to the formation of semi-isolated lakes, separated and enclosed by exposed carbonate mudflats. The clastics deposited in association with these carbonate mudstones consisted largely of sand sized detritus, probably derived from the reworking of aeolian deposits. In the eastern Willouran Ranges, the greater influx of sand and the slightly deeper, largely submergent environments, led to the deposition of the sandstones, dolomites and siltstones of the Mirra Formation.

Because of little clastic influx into the northern Mt. Lofty Ranges, shallow to occasionally exposed environments were largely sites of dolomite

deposition (Skillogalee Dolomite). To the south, shales were deposited in slightly deeper environments (Woolshed Flat Shale), although local dolomite deposition occurred in the Adelaide region (Castambul Formation, Montacute Dolomite). In the uppermost part of the subgroup, the area of shale deposition extended northward, encroaching over the dolomite mudflats of the upper Skillogalee Dolomite.

Dolomite, occurring largely as mudstones, is the major carbonate mineral present in the Mundallio Subgroup, but magnesite is also widespread. Limestones are not present. The carbonates experienced minor replacement by early diagenetic chert, initially precipitated as both crystalline and amorphous phases. Within the upper Mundallio Subgroup, the preservation of fine details of the detrital texture of dolomite mudstones and peloidal dolomites, and the high Sr contents of dolomites (largely in the range of 400-650 ppm), suggest that these sediments consisted of Ca-Mg carbonates (protodolomite, Mg-calcite) at the time of deposition. Slightly greater recrystallisation of dolomites in the lower Mundallio Subgroup resulted in their lower Sr and higher Mn and Fe contents.

Magnesite mudstones may have initially precipitated as hydrated Mg-carbonates. Lithification of surface sediments as a result of subaerial exposure, led to the formation of micritic magnesite. Much of this magnesite was subsequently reworked into intraclastic beds.

The carbonate mineralogy of this sequence, and the evidence of only rare sulphates, indicate that the carbonates were precipitated from alkaline, Mg-Ca-CO_3 waters, with a higher carbonate and lower sulphate content than seawater.

ACKNOWLEDGEMENTS

This thesis was undertaken during the tenure of a Commonwealth Postgraduate Research Award, and its production and completion were assisted by many people.

Initial thanks must go to my supervisors Dr. Brian Daily and Dr. John Jones for their support throughout this study. Other members and former members of the Department of Geology and Mineralogy to whom I extend my thanks are Dr. Victor Gostin, Mr. Jim Gehling, Mr. David Gravestock, Mr. Peter Moore and Dr. Phillip Plummer for discussions of many aspects of this thesis as well as other sedimentological problems; Mr. Graham Teale for an introduction to, and discussions concerning the Arkaroola region; Dr. Burton Murrell for detailed background to the Willouran Ranges; Mr. Michael Fitzgerald for assistance with computer programs used in the analysis of geochemical data; Jeff Trevelyan and Sepp Trzicky for preparation of the many excellent thin sections; Dr. Keith Turnbull, Phillip McDuie and John Stanley for assistance with geochemical analysis and carrying out carbon analyses; Margy Wright for assistance with X-Ray diffraction proceedures; Dr. Karl Bartusek for an introduction to the use of the Scanning Electron Microscope and assistance in sample preparation; Richard Barrett for photographic work; and to all other members of this department who assisted me during the course of this study.

The following people from outside the Geology Department, also kindly assisted; Dr. Brian Forbes and Dr. Wolfgang Preiss of the South Australian Department of Mines and Energy; and John Lynch of Metals Exploration (formerly of North Broken Hill Pty. Ltd.). North Broken Hill Pty. Ltd. allowed me to examine drill core from the Port Pirie region and gave permission for the inclusion of data derived from the drill core in this thesis. The South Australian Department of Mines and Energy also allowed examination and sampling of drill core from Copley and Torrens Gorge.

Visitors to this department who contributed helpful discussions include Dr. Ken Errikson, University of Texas at Dallas, Dr. Robert Ginsburg, University of Miami, Dr. Doug Shearman, Imperial College and Dr. Jan Veizer, University of Ottawa.

Many land owners allowed access to their properties, and in particular thanks must go to Mr. and Mrs. John Fitzgerald of Nacoona Station, Port Augusta, and Jim and Barbara Hart of Witchelina Station.

The excellent typing of Mrs. Joan Howe is gratefully acknowledged.

Lastly I wish to thank my husband Adrian for his assistance with field work in the Willouran Ranges in November, 1977, and in several other locations, as well as for the drafting of some of the figures presented in this thesis, and for his encouragement throughout.