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GEORGINA RESEARCH

SEPTEMBER QUARTER 1979

Compiled by

J.H. SHERGOLD
Project-Coordinator

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Preface:

This issue of Georgina Research includes three reports of 1979 field activities and observations (by P.N. Southgate, ANU, RSES, B.M. Radke, BMR, and D.M. Finlayson, BMR), together with sedimentological palaeontological, geochemical and geophysical progress reports (by P.L. Harrison, K.A. Heighway, P.J. Jones, J.H. Shergold, C.J. Simpson, BMR; P.M. Green, GSQ; and K.G. Mackenzie, Riverina CAE, Wagga Wagga).

1. Sedimentology

A plane of disconformity, represented by a ferruginised phosphatic surface, has been recognised over wide areas of the Thorntonia and Riversleigh districts, northern Georgina Basin. The surface, capping Thorntonia Limestone, has been traced from Thorntonia Station to 4 km south of D-Tree Bore where outcrop of Thorntonia Limestone is lost. The surface has also been found to the west of Thorntonia at Plumtree Bore where it overlies a bimodal grainstone consisting of fine-very fine aeolian grains reworked into a coarse-grained carbonate sand. The bimodal grainstone is underlain by a fine-very fine cross-bedded aeolian dune sand with cross-bed dips of between 6°-10° to the south. This unit is easily confused with the Age Creek Formation which overlies the Thorntonia Limestone.

Further north, on the Riversleigh 1:100 000 Sheet area, near the junction of Victor Creek and the O'Shannasy River, a cross-bedded aeolian dune sand is also overlain by a bimodal grainstone at the top of the Thorntonia Limestone, and is correlated with the dune system at Plumtree Bore. The Thorntonia Limestone near Victor Creek is overlain by a terraced dolomite. If the ferruginised surface and aeolian dune sequence is regarded as the top of the Thorntonia Limestone, the terraced dolomite must be Camooweal Dolomite. The Camooweal Dolomite only crops out on the hilltops and attains a maximum thickness of approximately 20 m. Hilltops are in turn capped by a silcrete breccia in the Victor Creek region which has a prominent red colour on aerial photographs. Consequently, revision is needed of the large portions of Thorntonia Limestone mapped on the Camooweal 1:250 000 Sheet to the north of Thorntonia. Furthermore, the recognition of the large aerial extent of the ferruginised surface on top of the Thorntonia Limestone indicates that it is not simply a local

feature and, consequently, it may prove to be a useful marker horizon for delineating the boundary between Thorntonia Limestone and Camooweal Dolomite in both surface outcrop and drill core.

The ferruginised surface that caps the Thorntonia Limestone also overlies Beetle Creek Formation in the D-Tree area, where Thorntonia Limestone of Xystridura templetonensis age, laterally interfingers with Beetle Creek Formation. Flat pebbles and clasts of ferruginised material occur on the ferruginised surface as a lag, indicating that iron replacement was a Middle Cambrian event (P.N. Southgate, ANU, RSES).

Recent studies of the Georgina Limestone suggest that it is a relatively deep-water facies into which allochthonous materials were deposited. The clasts vary in size and shape, the largest consisting of blocks up to 30 m thick of minor algal (Epiphyton sp.) boundstone in an oolite oncolite grainstone. A micrite matrix is present between the clasts. The deposits usually form sheets or channels of various thicknesses. Early lithification features in the form of micrite nodules are common throughout the unit and the micrite plates present in outcrop may have originally been elongated micrite nodules. Ovoid micrite nodules are common in GSQ Mount Whelan 1, where the lithologies were deposited in quiet, deep water with only a rare input of shallow water material (P.M. Green, GSQ).

The Swift Formation can be divided into a lower sequence of siltstone, sandstone and chert, and an upper breccia unit. The lower unit conformably overlies the Corrie Limestone Member (skeletal limestone lithofacies) of the Ninmaroo Formation and apparently interfingers with the Datson Member (skeletal-peloid carbonate lithofacies). The upper breccia unit,

comprising chert clasts in a red and white mottled silt matrix, unconformably overlies the lower unit of the Swift Formation and the Corrie and Datson Members of the Ninmaroo Formation.

This unconformity surface within the Swift Formation is extremely irregular with a relief of several metres. It has resulted from karstification in the Ninmaroo Formation and the Swift Formation, which produced collapse dolines and colluvial deposits, with clasts derived from silicified beds of both underlying formations. Karstification has continued into the Holocene, and collapse breccias have been repeatedly silicified and brecciated to produce the Digby Peaks Breccia, which shows inverted relief over pre-existing dolines and joints.

Present cave systems are superimposed on earlier infilled systems with debris from the Swift Formation, Hooray Sandstone and Digby Peaks Breccia. In the Smoky Anticline region, where Mesozoic rocks and their lateritized equivalents have collapsed into Ninmaroo dolines, spongy soils and salt crusts in soil occur around these features. This is probably indicative of a present efflux (seasonal) of saline groundwaters from the cavern systems.

An extensive gossan, comprising limonitized breccia, has been recognised with the Ninmaroo Formation west of Mount Ninmaroo. The gossan is generally stratiform, up to 2 metres thick, and is confined to a brecciated, decalcified sandstone within the Corrie Limestone Member. It extends along the western flank of a broad, karstified anticline for at least 1 kilometre. Locally this stratiform gossan interconnects with circular mounds, 50 metres across, of jointed, limonitised breccia. These mounds are rimmed by a silicified chert breccia. This association indicates that the gossan follows an extensive solution-collapse breccia.

No pseudomorphs after sulphides or other indicators of base metals have been recognized in outcrops. In the Digby Peaks area, collapse breccia bodies of undetermined geometry have been observed within cavern chambers. These breccias have been cemented by saddle dolomite, a higher temperature form of dolomite that is commonly associated with base metal sulphides (B.M. Radke, BMR).

2. Palaeontology

Seventeen species of eleven genera of Middle Cambrian bradoriids have been described from the insoluble residues of etched limestones taken from two sites within the Georgina Basin: one south of Duchess in the Monastery Creek Phosphorite Member of the Beetle Creek Formation, of late Templetonian Triplagnostus gibbus age; and the other from the upper (Undillan) part of the Currant Bush Limestone, in the Thorntonia area, northwest of Mt Isa. The Templetonian bradoriids from the first site appear to be part of the biocoenose of the quieter inner margins of an ancient Bahama Banks type environment. They consist of five species previously described by Fleming (1973) - Zepaera rete, Monasterium oepiki, M. dorium, 'Indiana' sipa, and 'Mononotella' sestina, the new taxa Flemingia dua gen. et sp. nov., and 'Dielymella' dubia sp. nov., and nine unnamed species belonging to Bradoria (4), Svealuta (1), Aristaluta? (1), and an unnamed pustulose genus (3). The Undillan bradoriids of the second site consist of one new taxon - Oepikaluta dissuta gen. et sp. nov., of which a single right valve has retained traces of four thoracic segments. Two new families are proposed within the Suborder Phosphatocopina Müller, 1964 - Oepikalutidae for Zepaera Fleming, and the new genera Oepikaluta, and Flemingia, and Monasteriidae for Monasterium Fleming (P.J. Jones, BMR: K.G. MacKenzie, Riverina CAE, Wagga Wagga).

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3. Maps

The Mount Whelan 1:100 000 geological map produced by GSQ, is now complete and ready for publication. The Toko 1:100 000 Sheet requires only the drafting of a legend and section. Drafting of Abudda Lakes 1:100 000 Sheet from overlays is proceeding (J.H. Shergold, C.J. Simpson).

4. Geochemistry

Middle Cambrian black shales (Hay River Formation and lower Marqua Beds) in Hay River coreholes 11 and 11A have been sampled at one-metre intervals to obtain a geochemical profile. These shales are host to anomalously high base metal concentrations, which seem to be related to stratigraphic disconformity. The Hay River Formation at the base of the Middle Cambrian sequence is enriched in Cr, Cu, Ni, Zn, V, Mo, Th, U, Sb, Au and Pd. Two phases of enrichment occur in the lower Marqua Beds which have anomalous Cr, Cu, Zn, V, Mo and Ba. The causes of this mineralisation are yet to be established (J.H. Shergold, K.A. Heighway).

5. Geophysics

P.L. Harrison (BMR) has completed a reinterpretation of seismic and gravity traverses across the western margin of the Toko Syncline and the Toomba Fault. The latter is interpreted as a high-angle reverse fault dipping between 40–70°, and extended 700–4000 m over adjacent Palaeozoic sediments, which are steeply folded to over-turned. In central MOUNT WHELAN they are gently folded in a broad asymmetrical anticline, and in the south they form a monocline. The strata are also faulted, varying from faults with throws less than 50 m, to fracture zones about 4 km wide, and in one area there is a high-angle reverse fault opposite in

direction to the Toomba Fault. There is no simple relationship between the geometry of the Toomba Fault and the geometry of the adjacent Palaeozoic strata. This may be because the latter has resulted from several different movements or basement faults, or compositional changes locally realigned the stresses.

The deformation of the Palaeozoic strata in the Toko Syncline was post-depositional, and occurred in post-Middle Ordovician time, probably during the Late Devonian to Early Carboniferous Alice Springs Orogeny. The deformation followed general northeasterly compression which resulted in the formation of a broad anticline (Mirrica-Ethabuka Structure) followed by reverse movement along the Toomba Fault, with associated steep folding of strata confined to the northern half of MOUNT WHELAN (north of $23^{\circ}30'S$).

A near-surface low-velocity layer, up to 250 m thick, west of the Toomba Fault, and concealed by sand and alluvium, is probably Jurassic to Cretaceous strata seen in outcrop on HAY RIVER and southern MOUNT WHELAN. The layer was important in explaining small-wavelength anomalies on the gravity profiles. Thick Adelaidean strata are indicated within the Toko Syncline and in places just west of the fault, where up to 3.5 km may be present (P.L. Harrison, BMR).

During July and August seismic recordings were made along the road between Tennant Creek and Mt Isa to investigate gross crustal structures. This work was done in cooperation with ANU. A total of 41 seismographs recorded two large shots; the first shot was an open cut quarry shot (40 tonnes) at Mt Isa on 26 July and the second was a special purpose shot (5 tonnes) in an old gold mine near Tennant Creek (Skipper Extended) on 9 August.

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Both shots were successfully recorded by BMR out to 290 km; ANU results are not yet to hand, but it is expected that recordings will be made to at least 450 km. Interpretation of the recordings is proceeding (D.M. Finlayson, BMR).

6. Publications

The following paper was published in abstract during the September quarter.

WYATT, B.W., & TUCKER, D.H. The Georgina Basin: Sixties data, seventies interpretation, for eighties discoveries. Abstract Bulletin of the Society of Australasian Exploration Geophysicists, 10(3): 197-198.

The following papers have been prepared, submitted for publication, or are in press as of September 30th, 1979.

DRAPER, J.J. Rusophycus (early Ordovician) ichnofossil from the Mithaka Formation, Georgina Basin. BMR Journal of Australian Geology & Geophysics.

DRAPER, J.J. The Ethabuka Sandstone, a new Ordovician formation in the Toko Syncline, Georgina Basin, central Australia.

DRUCE, E.C. The Kelly Creek Formation and its conodont faunas, Georgina Basin, western Queensland and Northern Territory. Alcheringa.

GREEN, P.M. Mineral exploration in the Boulia 1:250 000 Sheet area. Queensland Government Mining Journal.

GREEN, P.M., & BALFE, P.E. Stratigraphic drilling in the Mount Whelan 1:250 000 Sheet area, 1977. Queensland Government Mining Journal.

HARRISON, P.L. The Toomba Fault and the western margin of the Toko Syncline, Georgina Basin, Qld. BMR Journal of Australian Geology & Geophysics.

KENNARD, J.M. The Arrinthrunga Formation, Upper Cambrian epeiric carbonates in the Georgina Basin, central Australia. Bureau of Mineral Resources, Australia, Bulletin.

KRUSE, P.D., & WEST, P.W. Early Cambrian Archaeocyatha of the Amadeus and Georgina Basins - an interbasin connection. BMR Journal of Australian Geology & Geophysics.

MacKENZIE, K.G., & JONES, P.J. Partially preserved soft anatomy of a Middle Cambrian bradoriid (Ostracoda) from Queensland. Search.

MacKENZIE, K.G., & JONES, P.J. Biological affinities of Queensland Bradoriida (Middle Cambrian Crustacea). Alcheringa.

RADKE, B.M. Lithostratigraphy of the Ninmaroo Formation (Upper Cambrian-Lower Ordovician), Georgina Basin. Bureau of Mineral Resources, Australia, Report.

RADKE, B.M. Saddle dolomite: an indicator of late diagenetic mineralisation in carbonates. Abstract, 4th Australian Geological Convention, Hobart.

RADKE, B.M. Carbonate textures after Cambro-Ordovician sabhka deposits. Abstract, 4th Australian Geological Convention, Hobart.

RADKE, B.M. Cambro-Ordovician epeiric carbonate sedimentation: the Ninmaroo Formation, Georgina Basin. Abstract, 4th Australian Geological Convention, Hobart.

RADKE, B.M., & MATHIS, R.L. The formation and occurrence of saddle dolomite. Journal of Sedimentary Petrology.

SANDSTROM, M.W. Organic geochemistry of a Cambrian phosphorite. In Advances in organic geochemistry, 8.

SHERGOLD, J.H. Late Cambrian trilobites of the Chatsworth Limestone, western Queensland. Bureau of Mineral Resources, Australia, Bulletin 186.

SHERGOLD, J.H. Late Cambrian, Idamean, trilobites, Burke River area, western Queensland. Bureau of Mineral Resources, Australia, Bulletin 187.

SHERGOLD, J.H., & DRUCE, E.C. Upper Proterozoic and Lower Palaeozoic rocks of the Georgina Basin. In STEPHENSON, P.J., & HENDERSON, R.A. (Eds) Geology and geophysics of northeastern Australia. Proceedings 3rd Australian Geological Convention, Townsville, 1978.

SHERGOLD, J.H., & WALTER, M.R. Stratigraphic drilling in the Georgina Basin, 1977-78. Bureau of Mineral Resources, Australia, Record, 1979/36.

TUCKER, D.H., WYATT, B., DRUCE, E.C., MATHUR, S., & HARRISON, P.L. The upper crustal geology of the Georgina Basin region. BMR Journal of Australian Geology & Geophysics, 4.

WALTER, M.R. Adelaidean and Early Cambrian stratigraphy of the southwestern Georgina Basin: correlation chart and accompanying notes. Bureau of Mineral Resources, Australia, Report 214.

WALTER, M.R. Late Proterozoic tillites of the southwestern Georgina Basin, Australia. In HARLAND, W.B. (ED.) Pre-Pleistocene tillites of the world.

WALTER, M.R., KRYLOV, I., & PREISS, W.V. Adelaidean (late Proterozoic) stromatolites from central and southern Australia. Alcheringa.

WALTER, M.R., SHERGOLD, J.H., MUIR, M.D., & KRUSE, P.D. Early Cambrian and latest Proterozoic stratigraphy, Desert Syncline, southern Georgina Basin. Journal of the Geological Society of Australia, 26(6).

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