A recently discovered unconformity near the base of the Proterozoic Cloncurry Complex south of Mount Isa, northwestern Queensland

*R. J. Bultitude, C. M. Gardner, and T. A. Noon**

Recent mapping of Precambrian rocks in the southwestern part of the Mount Isa-Cloncurry region has revealed for the first time a major unconformity between the Kalkadoon Granite-Leichhardt Metamorphics basement complex and overlying regionally metamorphosed basic and acid volcanic units tentatively correlated with the Magna Lynn Metabasalt and Argylla Formation, respectively. These units flank the western margin of the basement complex, and are overlain, apparently conformably, by the Mount Guide Quartzite.

Introduction

This paper presents preliminary results of semi-detailed mapping, by joint Bureau of Mineral Resources and Geological Survey of Queensland field parties, of the Precambrian rocks south of Mount Isa, in the northwestern part of the Duchess 1:100000 Sheet area, Queensland (Fig. 1). In this area, a hitherto unreported major unconformity was found in the part of the basement sequence mapped as the Tewinga Group in the adjoining Mary Kathleen 1:100000 Sheet area to the north (Derrick and others, 1974). The mapping was carried out, mainly by the senior author (RJB), in August and September 1975, and between July and November 1976, and updates the results of the BMR-GSQ regional reconnaissance survey of 1950-58 (Carter, Brooks & Walker, 1961; Carter & Opik, 1963). Other BMR-GSQ field parties have been working in sheet areas to the north since 1969 (Derrick and others, 1971, 1974; Hill, Wilson & Derrick, 1975).

An account of the early history of the Mount Isa-Cloncurry region and a summary of geological investigations up to 1960 have been presented by Carter, Brooks & Walker (1961). Exploration company activity in the Duchess 1:250000 Sheet area has been summarised by Noon (1976).

General geology

The Precambrian rocks of the region form part of the Cloncurry Complex (Carter and others, 1961). They can be readily separated into three main groups—an eastern and a western succession of Carpentarian metasedimentary and metavolcanic rocks (Derrick, Wilson, & Hill, 1976a, b, 1977) separated by a north-trending belt of Lower Proterozoic to Carpentarian, mainly acid plutonic and acid to basic metavolcanic rocks (Page, 1976), which form the basement to the eastern and western successions. Part of the western succession crops out in the western part of the Duchess Sheet area (Fig. 2). Basement rocks are extensively exposed in the western and central parts of the sheet area, forming part of the Kalkadoon-Leichhardt Basement Block (Derrick and others, 1974).

In sheet areas to the north the Kalkadoon-Leichhardt Basement Block is mapped as consisting of the Tewinga Group and Kalkadoon Granite (Derrick, Wilson, & Hill, 1976c). The Tewinga Group has been defined as a conformable sequence consisting of, from the base, the Leichhardt Metamorphics, Magna Lynn Metabasalt, and Argylla Formation (Derrick and others, 1976c). Carter and others (1961) considered the Leichhardt Metamorphics to be conformably overlain in most places by the Argylla Formation (they did not delineate the Magna Lynn Metabasalt), although they stated that the relationship had not been satisfactorily established.

Type sections and reference areas for most of the units have been defined in sheet areas to the north, where almost all the formations are better represented than in the area described here. Revision of the stratigraphy and descriptions of type sections in these sheet areas have been made by Derrick, Wilson & Hill (1976a, b, c, 1977).

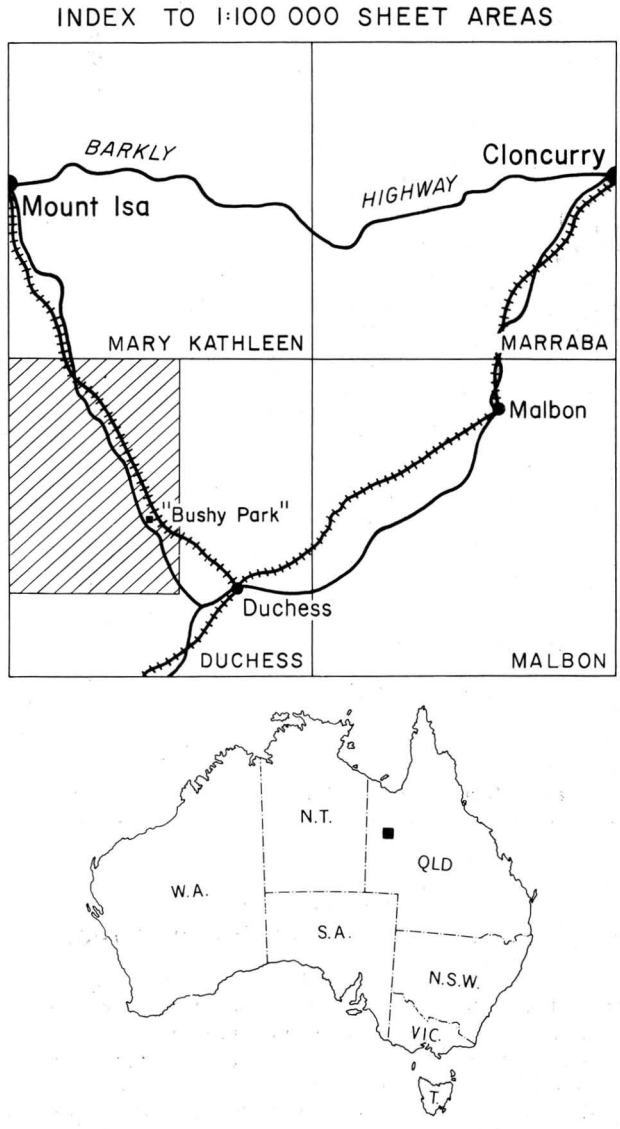

Figure 1. Locality map

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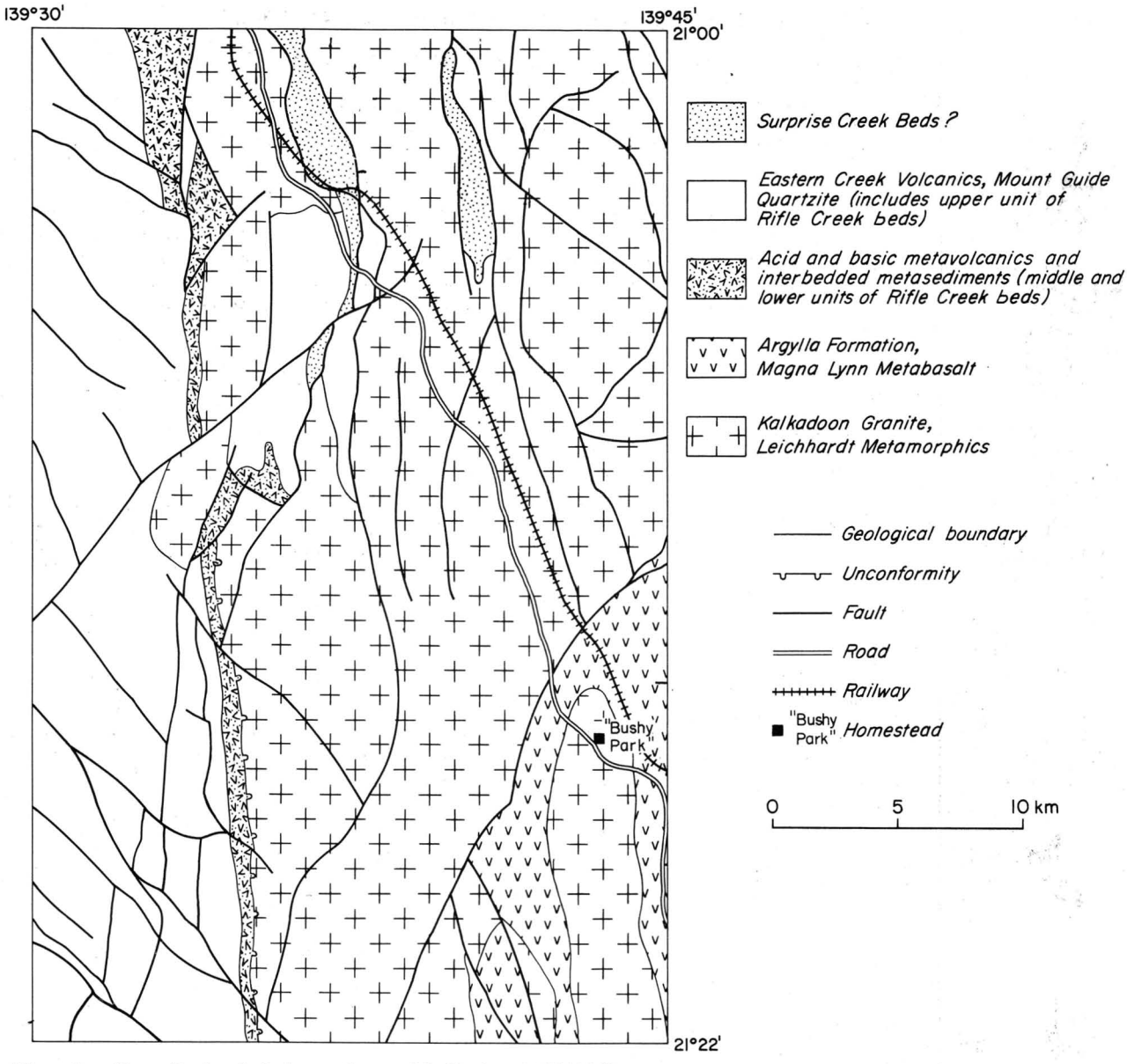

Figure 2. Generalised geological map of parts of the Duchess 1:100 000 Sheet area.

Western part of the Kalkadoon-Leichhardt Basement Block

The oldest rocks exposed in the area—mapped as **Leichhardt Metamorphics** (Carter and others, 1961)—form inclusions and larger remnants in, and north-trending belts closely associated with, granitic rocks assigned to the **Kalkadoon Granite**. On the western side of the Kalkadoon-Leichhardt Basement Block, the Leichhardt Metamorphics appear to have been mainly dark grey porphyritic acid to intermediate volcanics (with small euhedral quartz and feldspar phenocrysts), with minor basalt and possible quartz arenite and conglomerate. These rocks have been regionally metamorphosed, extensively recrystallised, and strongly sheared, and are now schistose to gneissic. The sequence is extensively intruded by cross-cutting and concordant veinlets, veins, and small masses of mainly biotite granite, leucocratic granite, and minor quartz, aplite, and pegmatite. Locally migmatitic rocks resulted, for example, about 15 km west-northwest of Bushy Park homestead, where contaminated biotite-rich granodioritic to dioritic rocks are also present. The granitic rocks are assigned to the Kalkadoon Granite. The regional metamorphism was probably amphibolite grade.

About 16 km west of Bushy Park the Leichhardt Metamorphics and associated granitic rocks of the Kalkadoon Granite are overlain abruptly by a sequence of micaceous labile and feldspathic arenites, laminated fine-grained basic tuffs, cross-bedded arkosic sediments, grit, and labile conglomerate containing angular pebbles and cobbles of vein quartz, feldspar, and pegmatite, rounded pebbles of actinolite schist and amphibolite, and rare rounded cobbles and boulders of granitic rocks. The bulk of the detritus appears to have been derived locally by erosion of the Kalkadoon Granite-Leichhardt Metamorphics complex. This sedimentary sequence ranges from less than 1 m to about 20 m thick. It is *not* intruded by the numerous granite and pegmatite veins that cut the underlying Kalkadoon Granite-Leichhardt Metamorphics complex. The field relations clearly indicate the existence of a major time break between the schistose sedimentary sequence and underlying Kalkadoon Granite-Leichhardt Metamorphics

complex in this area, a time break sufficiently long for probable granite intrusion (the Kalkadoon Granite) and regional metamorphism, and certainly for uplift and erosion to have taken place, exposing crystalline basement rocks.

The schistose sedimentary sequence is overlain by a sequence of basaltic lava flows, acid volcanics, quartose and (?)tuffaceous arenites and pelites, arkose and quartz-poor labile conglomerate. This sequence overlying the Kalkadoon Granite-Leichhardt Metamorphics complex, informally named the Rifle Creek beds (Bultitude, England, & Gardner, 1976; Bultitude, Gardner, & Noon, 1977) ranges in thickness from more than 1000 m to less than 50 m; this is attributed to deposition on a highly irregular surface. Bedding is commonly obscured by a north-trending schistosity developed during regional metamorphism, but although the sequence is sheared and schistose the original lithologies can generally be readily determined, indicating a grade of metamorphism probably no higher than lower to middle greenschist facies.

The balsaltic lava flows and associated sediments overlying the basal conglomeratic sequence west of Bushy Park may be correlatives of the Magna Lynne Metabasalt, mapped in the adjoining Mary Kathleen 1:100 000 Sheet area (Derrick and others, 1974; Derrick and others, 1976c) and in the eastern part of the basement block in the Duchess 1:100 000 Sheet area. Overlying partly spherulitic, porphyritic (in feldspar and less commonly quartz) acid volcanics and interbedded quartzite, labile conglomerate, grit, (?)tuffaceous arenite and pelite, and arkose may be equivalent to the Argylla Formation. These in turn are overlain conformably by a unit of quartz-poor labile conglomerate, arkose, metasiltstone, greywacke, and sericitic feldspathic arenite; this unit corresponds to the lower part of the **Mount Guide Quartzite**, the basal formation of the Haslingden Group, and of the 'western succession' in the Mary Kathleen Sheet area (Derrick and others, 1976a, p. 300). It generally appears poorly sorted, but locally shows cross-bedding and graded bedding, indicating deposition in water. The conglomerate and associated sediments are similar to those present locally within the upper part of the underlying acid volcanic unit. Similar depositional environments are therefore indicated, implying that here there was probably no significant time break between the extrusion of the acid volcanics (Argylla Formation?) and the deposition of labile conglomerates of the lower Mount Guide Quartzite (cf. Carter and others, 1961; Glikson and others, 1976; Derrick and others, 1976a). Also, in places there are several metabasalt lava flows and interlayered quartzite lenses at the top of the acid volcanic unit, and interfingering with the overlying conglomerate unit. The conglomerate beds contain subangular to well-rounded pebbles, cobbles, and boulders of quartzite, acid and minor basic volcanics, and rarely, granitic rocks. They are generally schistose, and most of the constituent acid volcanic clasts are flattened and deformed. The labile, micaceous, quartz-poor matrix commonly forms more than 50 percent of the rock.

The features of the lower Mount Guide Quartzite indicate that it may represent a mixture of alluvial fan and pyroclastic (including volcanic mudflow) deposits that formed adjacent to, and were derived largely from, the Kalkadoon-Leichhardt Basement Block. This conglomeratic unit grades upwards into the upper part of the Mount Guide Quartzite, a ridge-forming sequence of extensively silicified, regionally metamorphosed, cross-bedded, sericitic, feldspathic and quartzose arenites with minor pebbly beds. The arenites have been folded about north-trending axes, and extensively intruded by dolerite dykes that are not folded, and parallel the regional north-trending foliation and strike shown by the sediments.

The Mount Guide Quartzite is overlain, apparently conformably, by the **Eastern Creek Volcanics**, a sequence of regionally metamorphosed, commonly schistose or strongly foliated, basaltic lava flows and interlayered lenses of quartzose and feldspathic arenite, labile arenite, and conglomerate. Some of the conglomerates in the formation contain abundant subangular to rounded clasts of porphyritic acid volcanics, most probably derived locally from the Kalkadoon-Leichhardt Basement Block. The lavas are amygdaloidal, and commonly have brecciated, extensively epidotised tops containing sparse copper mineralisation; no pillow lavas have been positively identified.

Discussion and preliminary interpretations

The oldest rocks exposed in the area are acid to intermediate metavolcanics and rare possible metasediments mapped as Leichhardt Metamorphics which crop out as inclusions within, and larger remnants associated with, the Kalkadoon Granite. Following, and perhaps during, the emplacement of the Kalkadoon Granite, the area was uplifted and subjected to subaerial erosion, and crystalline rocks were exposed over a large area.

Conglomeratic sediments were deposited locally on the crystalline basement and were followed by the eruption of basalts and acid volcanics, accompanied by some clastic sedimentation (forming the lower and middle units of the Rifle Creek beds). The oldest of these rocks were largely or entirely confined to valleys in the existing land surface, and when these were filled, the younger rocks covered increasingly larger areas.

Towards the end of the acid volcanicity deposition of a thick sequence of coarse labile conglomerates and finer grained immature sediments commenced, and was accompanied in places by outpourings of basaltic lava flows. The sediments probably represent mixtures of lahar, alluvial fan and pyroclastic deposits laid down adjacent to the elevated western edge of the basement block. They appear to consist mainly of locally derived detritus, including some granite clasts from the basement. The gradation upwards from conglomerate and arkose of the lower Mount Guide Quartzite (upper unit of the Rifle Creek beds), to feldspathic and quartzose arenites of the upper Mount Guide Quartzite probably indicates the development of a subdued topography in the source area as a result of erosion. Sediments of the upper Mount Guide Quartzite were deposited over a wide area, possibly in a shallow sea under relatively stable conditions.

The Mount Guide Quartzite was succeeded by the Eastern Creek Volcanics, a sequence of possibly subaerial flood basalts and minor intercalated arenite and conglomerate. The area was later subjected to another period of tectonic activity and regional metamorphism—the second recognised in the area. During this period the Eastern Creek Volcanics and older layered rocks were metamorphosed, mainly to schists.

Acknowledgements

We thank G. M. Derrick, D. H. Blake and R. N. England for their significant contributions to this paper, both with field work and helpful discussions. G. M. Derrick and R. M. Hill critically read the original draft and suggested many improvements. We also thank G. Young and J. M. Bultitude for drawing the diagrams.

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Aeolianites in the Jurassic Jurgurra Sandstone, Canning Basin, Western Australia

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Introduction

During the geological mapping of the Mount Anderson Sheet area of the Canning Basin in 1976, an exposure of the Jurassic Jurgurra Sandstone about 20 km north of the type locality was examined and found to contain evidence of aeolian deposition. This note presents an environmental analysis of the section.

The Jurgurra Sandstone, the lowest Jurassic unit in the Edgar Range area, was defined by Brunnschweiler (1954) as a massive, medium-grained quartz sandstone, commonly cross-bedded, and containing fossil wood and friable clay pellets. It has been considered to be a marine deposit as it contains poorly preserved marine bivalves. It has been tentatively correlated with the Wallal Sandstone (McWhae, 1961), a subsurface unit recognised during petroleum exploration, which is thought to have a paralic origin and to represent the transgressive deposits of a Jurassic marine advance. Only the upper part of the Jurgurra Sandstone is exposed. The Wallal Sandstone is 120 m thick in the Babrongan No. 1 exploration well (lat. 18° 23′ 23″ S, long. 123° 35′ 37″ E), which is the nearest complete section to the area considered here. It thickens to a maximum recorded thickness of 369 m in Munro No. 1 well (lat. 19° 51′ 47″ S, long. 122° 28′ 28″ E).

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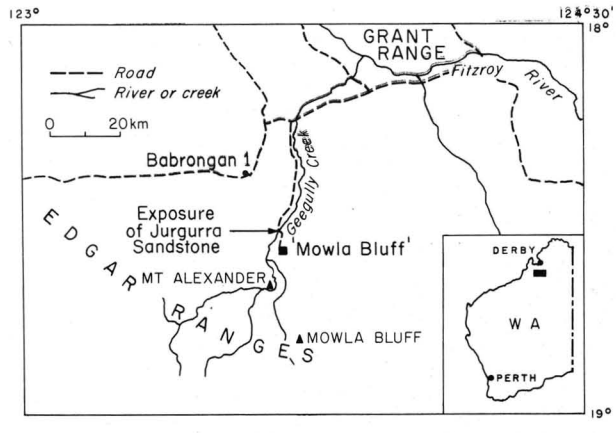

Figure 1. Sketch map of Mount Anderson 1:250 000 Sheet area.

The exposure described occurs just south of the point at which the road to Mowla Bluff station crosses Geegully Creek (Fig. 1), about 7 km north of Mowla Bluff Homestead (lat. 18° 32′ 30″ S, long. 123° 40′ 55″ E). It consists of clean, fluted surfaces in the floor and banks of the creek; the vertical thickness exposed averages about 5 m.

Facies description

Figure 2 is a composite section of the exposed sediments. Three facies are distinguished; A, B, and C (Fig. 3).