

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

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DEFINITIONS OF NEW STRATIGRAPHIC UNITS  
IN THE CARRARA RANGE REGION,  
NORTHERN TERRITORY

by

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ABSTRACT

This Report contains definitions of five new formations and redefinitions of two previously named units that were recognised during remapping of parts of the Carrara and Mitchiebo 1:100 000 Sheet areas. The units are all of Proterozoic age. The Carrara Range Formation has been redefined as the Carrara Range Group, comprising three newly named units - from oldest to youngest the Don Creek Sandstone, Mitchiebo Volcanics, and Top Rocky Rhyolite. Overlying the Carrara Range Group unconformably is the McNamara Group, which consists of three units that formerly constituted the Bluff Range beds; they are, from oldest to youngest, the Musselbrook Formation, Plain Creek Formation, and Lawn Hill Formation.

The Lawn Hill Formation has been mapped previously in the Riversleigh, Lawn Hill, and Mount Oscar 1:100 000 Sheet areas, where it is the uppermost unit in the McNamara Group. The Musselbrook and Plain Creek Formations are newly defined units, and the McNamara Group is redefined to include them.

## INTRODUCTION

This Report contains definitions of five new stratigraphic units and redefinitions of two previously named units that were identified as the result of semidetalled mapping of parts of CARRARA\* and MITCHIEBO (referred to in this report as the Carrara Range Region, which is bounded by latitudes 18°30' and 18°47'S and longitudes 137° 11' and 138° 00'E), in the eastern Northern Territory (Fig. 1). The definitions and redefinitions have been approved by the Stratigraphic Nomenclature Subcommittee of the Territories Division of the Geological Society of Australia. The geology of the region is described by Sweet & Mond (1980) and Sweet (in preparation).

The units defined here were previously mapped as the Carrara Range Formation and Bluff Range beds (Smith & Roberts, 1963). The Carrara Range Formation is redefined as the Carrara Range Group, comprising three newly named formations - from oldest to youngest the Don Creek Sandstone, Mitchiebo Volcanics, and Top Rocky Rhyolite. Younger sandstones previously included in the Carrara Range Formation overlie the Top Rocky Rhyolite unconformably, and mark the beginning of a major sequence which includes all of the Bluff Range beds. This sequence has been divided into three formations - from oldest to youngest the Musselbrook Formation (new name), Plain Creek Formation (new name), and Lawn Hill Formation. The Lawn Hill Formation crops out in the Lawn Hill Region (Sweet & Hutton, 1982), 60 km to the east, where it forms the uppermost unit of the McNamara Group (Hutton, Cavaney, & Sweet, 1981; Hutton & Sweet, 1982). The McNamara Group is therefore redefined to include the Musselbrook and Plain Creek Formations.

### CARRARA RANGE GROUP

Names of constituent formations: Don Creek Sandstone (oldest), Mitchiebo Volcanics, and Top Rocky Rhyolite (youngest).

Lithologic affinities of constituent formations: The rocks are a mixed association of quartz-rich clastics and basic to acid volcanics. A similar association has been widely recognised farther east and north in the Lawn Hill Platform (Hutton & Sweet, 1982); it is bounded by regional unconformities throughout the platform.

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\*Names of 1:100 000 Sheet areas are printed in capital letters.

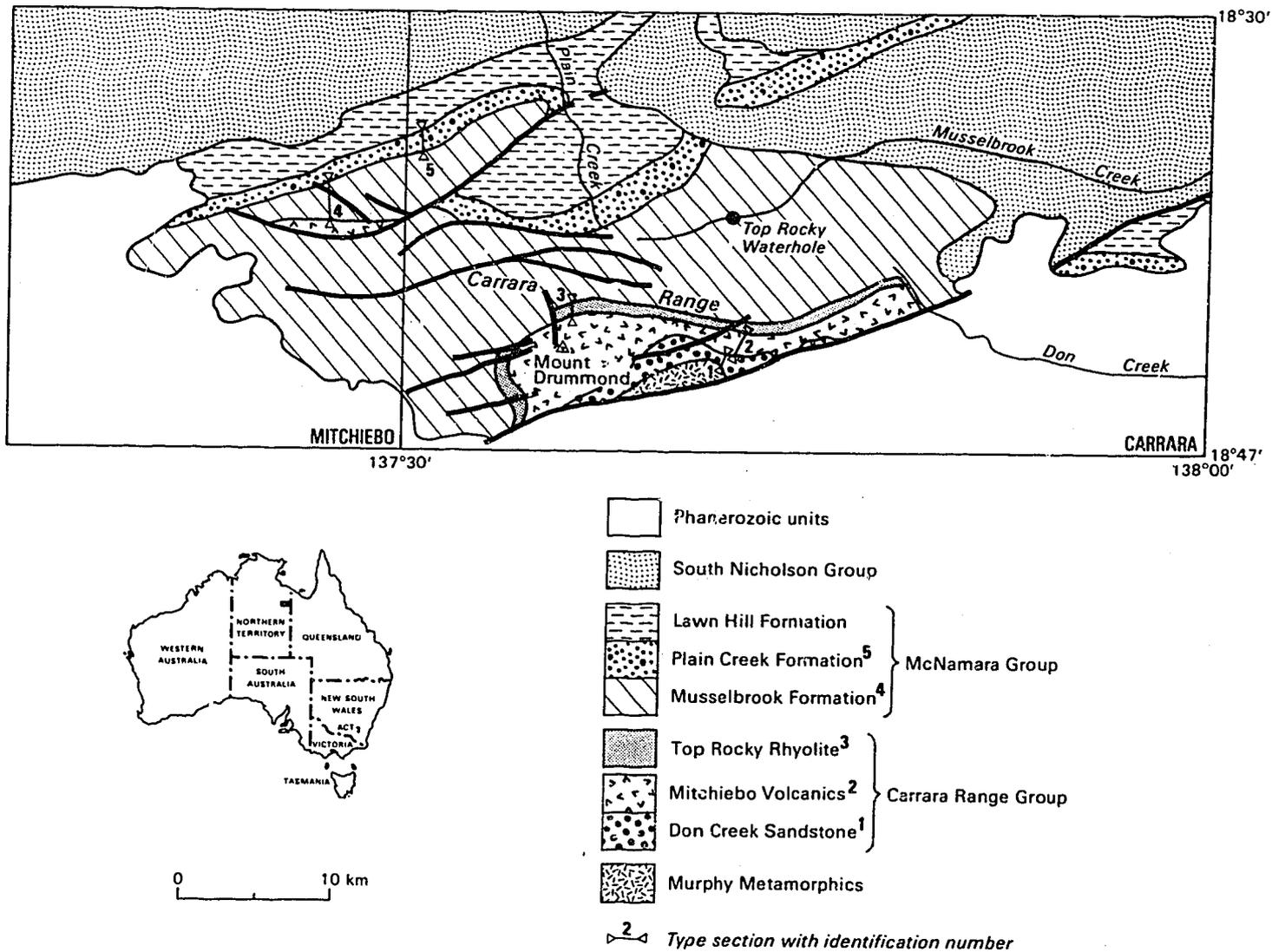


Fig. 1 Location of type sections in the Carrara Range Region

Derivation of name: From the Carrara Range, in CARRARA (Sheet 6460), Northern Territory.

Distribution: Exposed over an area of about 120 km<sup>2</sup> in western CARRARA and eastern MITCHIEBO.

Thickness: The most complete sections, east of Mount Drummond and south of the Carrara Range, are about 1600 m thick. It may be over 2000 m thick southwest of Mount Drummond, where the lower part is faulted and poorly exposed.

Relations and boundary criteria: The Don Creek Sandstone lies unconformably on the Murphy Metamorphics, and the two volcanic formations in the group are overlain unconformably by the Musselbrook Formation, the basal unit of the McNamara Group. An unconformity in the group is believed to be of local significance only.

Age: Proterozoic, Carpentarian.

Synonymy: Almost coincident with the Carrara Range Formation of Smith & Roberts (1963). See discussion.

Discussion: Smith & Roberts (1963) mapped the Carrara Range Formation, in which they identified lower and upper sandstone members separated by an interval rich in volcanics. Recent mapping in the region by Sweet & Mond (1980) has shown that the upper sandstone is the basal unit in a sandstone-siltstone-carbonate sequence which unconformably overlies the volcanics. The lower sandstone and volcanics, which comprise about 80 percent of the old Carrara Range Formation, constitute a sequence that passes up from sandstone through basic and intermediate to acid volcanics. A similar sequence of clastic sediments and volcanics has been recognised throughout the Lawn Hill Platform (Hutton & Sweet, 1982), and it is this sequence of three formations which, in the Carrara Range Region, has been renamed the Carrara Range Group. A disconformity has been recognised within the group, but this is not considered to represent a break in volcanism of sufficient length to justify the abandonment of the concept of a group. The reasons for this are twofold: (a) basic volcanics identical with those in the Mitchiebo Volcanics are interlayered with acid volcanics in one area mapped as Top Rocky Rhyolite; and (b) both types of volcanics are associated throughout the Lawn Hill Platform.

### DON CREEK SANDSTONE

Derivation of name: From Don Creek, which drains part of eastern CARRARA (Sheet 6460), Northern Territory.

Distribution: Scattered outcrops along the southern margin of the Carrara Range, in CARRARA; total outcrop is about 10 km<sup>2</sup>.

Type section: South of the Carrara Range. The base is at grid reference GR 833292, and the top is at GR 835301.

Lithology: Massive, medium to coarse sandstone with scattered quartz granules and pebbles. Cross-bedded, irregularly silicified.

Thickness: 420 m of pebbly quartz sandstone in the type section.

Relations and boundary criteria: The basal formation of the Carrara Range Group. It overlies the Murphy Metamorphics with angular unconformity; the contact is a distinct metamorphic and structural discontinuity. It is overlain conformably by the Mitchiebo Volcanics; the boundary is marked by an abrupt lithological change from sandstone to basalt or trachyte.

Age and evidence: Proterozoic, Carpentarian. It is correlated with Carpentarian sequences by Plumb & Derrick (1975) and Hutton & Sweet (1982).

Synonymy: Formerly an unnamed sandstone member within the Carrara Range Formation (now Group) of Smith & Roberts (1963).

### MITCHIEBO VOLCANICS

Derivation of name: From MITCHIEBO (Sheet 6360), Northern Territory, which contains the westernmost outcrops of the formation.

Distribution: Forms an arcuate belt east of Mount Drummond, in CARRARA, and scattered small outcrops in eastern MITCHIEBO; total outcrop area is about 50 km<sup>2</sup>.

Type section: From GR 835301 (base), to 853313 (top), where the formation is about 900 m thick.

Lithology: Vesicular and amygdaloidal basalt and trachyte, particularly in the lower half of the formation. The upper part is mainly quartzose and lithic sandstone with thin volcanic interbeds. The volcanic rocks are generally much weathered and altered.

Thickness: 900 m in the type section, and possibly 1500 m in western outcrops (Sweet, in preparation).

Relations and boundary criteria: Conformable on the Don Creek Sandstone. The contact is marked by a prominent lithological change from quartz sandstone to basic volcanics. The formation is overlain disconformably by the Top Rocky Rhyolite.

Age and evidence: Proterozoic, Carpentarian. It is correlated with Carpentarian sequences by Plumb & Derrick (1975) and Hutton & Sweet (1982).

Synonymy: Formerly an unnamed volcanic member within the Carrara Range Formation (now Group) of Smith & Roberts (1963).

#### TOP ROCKY RHYOLITE

Derivation of name: From Top Rocky Waterhole, in Musselbrook Creek, at GR 852387 in CARRARA (Sheet 6460).

Distribution: A belt up to 1 km wide extending from 6 km southwest to 20 km east of Mount Drummond; total outcrop area is about 20 km<sup>2</sup>.

Type section: From GR 750324 (base) to 750329 (top) in CARRARA, Northern Territory.

Lithology: Reddish brown feldspar porphyry with spherulites and minor flow bands; some trachyte or basalt 1 km northwest of Mount Drummond; volcanigenic cobble and boulder conglomerate east of the type section.

Thickness: About 400 m thick east of the type section and 100 m thick to the west of it; the type section is 250 m thick.

Relations and boundary criteria: The Top Rocky Rhyolite lies disconformably on the Mitchiebo Volcanics and is overlain disconformably by the Musselbrook Formation. The basal disconformity is highly irregular, with a local relief of up to 130 m, and the upper unconformity is marked by lenses of pebble to cobble conglomerate at the base of the overlying Musselbrook Formation; many of the clasts are of rhyolite from the underlying volcanics.

Age and evidence: Proterozoic, Carpentarian. It is correlated with Carpentarian sequences by Plumb & Derrick (1975) and Hutton & Sweet (1982).

Synonymy: Formerly an unnamed volcanic member within the Carrara Range Formation (now a Group) of Smith & Roberts (1963).

#### McNAMARA GROUP

The definition of the McNamara Group, as published by Hutton, Cavaney, & Sweet (1981), is hereby varied to include two new units which have been recognised in the Carrara Range Region.

Names of new constituent formations: Musselbrook Formation and Plain Creek Formation.

Reasons for including the new formations in the McNamara Group: 1) The Lawn Hill Formation, a constituent formation at the top of the group in its type area in the Lawn Hill Region (Sweet & Hutton, 1982), has been recognised in the Carrara Range Region; and 2) the same broad threefold division of rock types in the group - into a lower mainly clastic sequence, a middle probably carbonate-rich sequence, and an upper clastic sequence (Hutton & others, 1981) - is recognised in both the Lawn Hill and Carrara Range Regions.

The Musselbrook Formation is believed to include the two lower sequences, but has not been subdivided for reasons given below (see the definition of the Musselbrook Formation). The Plain Creek and Lawn Hill Formations together probably represent the upper clastic sequence in the Carrara Range Region.

## MUSSELBROOK FORMATION

Derivation of name: From Musselbrook Creek, whose headwaters drain the area underlain by the formation in CARRARA (Sheet 6460), Northern Territory.

Distribution: A series of faulted outcrops in northeastern MITCHIEBO and central-northern CARRARA; total outcrop area is about 400 km<sup>2</sup>.

Type section: In northeastern MITCHIEBO; it extends from GR 603386 (base) to GR 602420 (top).

Lithology: Interbedded sandstone, siltstone, chert, and minor dolomite and conglomerate. Many chert beds are stromatolitic, and may be silicified dolomite. The proportion of sandstone decreases, and siltstone and chert increase, upwards.

Thickness: 1320 m in the type section; 1600 m or more in central and eastern CARRARA.

Relations and boundary criteria: The Musselbrook Formation is the basal unit of the McNamara Group in the Carrara Range Region. It overlies the Top Rocky Rhyolite disconformably in the Carrara Range. Northwest of the range it overlies the lower part of the Mitchiebo Volcanics with slight angular unconformity. It is overlain conformably by the Plain Creek Formation.

Age and evidence: Proterozoic, Carpentarian. It is correlated with Carpentarian sequences by Plumb & Derrick (1975) and Hutton & Sweet (1982).

Synonymy: Smith & Roberts (1963) previously included the lower, sandstone-rich portion of the formation in their Carrara Range Formation, and the upper, siltstone/chert-rich portion in the Bluff Range beds.

Discussion: The formation records the beginning of a major episode of sandstone-siltstone-carbonate deposition which has been recognised in the Lawn Hill (Sweet & Hutton, 1982) and Hedleys Creek (Sweet, Mock, & Mitchell, 1981) regions. Consideration was given to dividing the Musselbrook Formation, as defined above, into a lower sandstone/siltstone unit and an

upper siltstone/ chert unit, but this was rejected because (a) the unit is of mixed lithology throughout, and it would have been difficult to nominate a satisfactory stratigraphic level for the boundary; and (b) the unit as it stands seems to constitute a natural cycle, perhaps reflecting a gradual lessening of relief and tectonic activity (i.e., increasing stability) in both source area and sedimentary basin.

#### PLAIN CREEK FORMATION

Derivation of name: From Plain Creek, a tributary of the South Nicholson River which drains northwestern CARRARA (Sheet 6460), Northern Territory.

Distribution: A series of east to northeast-trending strike ridges in northeastern MITCHIEBO and northern CARRARA.

Type section: Sixteen kilometres north-northwest of Mound Drummond, in northwestern CARRARA. The base is at GR 676444, and the top is at GR 673453.

Lithology: The unit is characterised by alternating micaceous siltstone and shale, and fine to medium well-sorted quartz-rich sandstone. The formation thickens eastwards and contains a higher proportion of sand in the sequence. Three sandstone members, each about 50 m thick, are present in the type section, but to the east, south of the Little Range, at least 10 sandstones, most of them only a few metres thick, are present.

Thickness: 600 m in the type section; at least 800 m south of the Little Range; and 1000 m in northeastern CARRARA.

Relations and boundary criteria: Both the lower and upper contacts of the Plain Creek Formation are conformable; they are marked by a rapid transition from siltstone (uppermost Musselbrook Formation) to sandstone (base) and sandstone to siltstone and shale (top). The sandstone defining the base of the formation is a massive medium-grained orthoquartzite unit about 50 m thick in the type section.

Age and evidence: Proterozoic, Carpentarian. It is correlated with Carpentarian sequences by Plumb & Derrick (1975) and Hutton & Sweet (1982).

Synonymy: Previously included in the Bluff Range beds of Smith & Roberts (1963).

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