

7R5.179-185

NOTES ON THE GEOLOGY OF PORTION OF SOUTH-WEST TASMANIA

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These notes are offered with the following objects in mind:

(1) To draw attention to the importance of the area from a geological point of view.

(2) To suggest some correlations between formations already mapped.

(3) To bring together some of the opposing views held by various workers.

It will be obvious to most readers that this note is of a preliminary nature and that the views offered here have yet to be completely examined by critical mapping. Indeed, a vast number of complex problems of all kinds remain, but a start has been made toward mapping this area thoroughly and it is felt worthwhile that some information should be made available at this stage. Doubtless as mapping proceeds these views will have to be critically reviewed as, in fact, have many of the earlier interpretations. The area concerned in these notes lies chiefly in the vicinity of Bathurst Harbour, along the Bathurst Channel toward Port Davey and in the Iron-bound Range district.

STRATIGRAPHY

The age of all units in this area is open to some doubt. However there seems good evidence to suggest that at least four major rock successions, separated by three unconformities are present. The general succession suggested is as follows:—

Unit	Possible Age
"Gordon" Limestone	
"Owen" Conglomerate	Ordovician
	Unconformity
Long Bay "Shale"	
McKenzie Conglomerate and	Cambrian (?)
Rugby Conglomerate	
	Unconformity
"Younger" Precambrian sand-	Upper Precambrian to
stones, sericite and quartz	Lower Cambrian
sericite schists and phyllites	
	Unconformity
"Older" Precambrian	Precambrian
Black, albite-bearing schists	

The nomenclature used above for the Cambrian(?) formations follows that already used by various workers. It is admittedly not rigidly established, or indeed, particularly satisfactory, but at this stage it appears inadvisable to introduce further formation names.

ORDOVICIAN

Presumed Gordon Limestone occurs in the vicinity of New River Lagoon apparently conformably overlying a quartz-conglomerate, containing wormcasts and similar to the Owen Conglomerate, at the west end of Prion Bay. No suspected Ordovician rocks have been recorded in the vicinity of Bathurst Harbour.

CAMBRIAN (?)

Around the shores of Bathurst Harbour and on Mts. Rugby, McKenzie, Beattie and others as well as on the Ironbound Range there occur suites of orthoquartzite and greywacke rocks which the author considers to be probably of Cambrian age. This opinion is based on the following observations.

(1) The Ironbound Range sequence is underlain unconformably by Precambrian rocks and is overlain unconformably by Owen type conglomerate at the west end of Prion Bay.

(2) Around Bathurst Harbour, correlates of the Ironbound Range rocks are underlain unconformably by presumed Upper Precambrian rocks (probably equivalents of the Rocky Cape Group.)

(3) The facies of both these sequences are different from the surrounding Precambrian rocks and similar to that of the Dundas Group.

(4) In metamorphic and tectonic grade these sequences resemble the Dundas Group and its correlates. They have been folded at least twice but lack the dynamic alteration of known Precambrian rocks.

(5) The basal breccias of this sequence on the Ironbound Range contain fragments of dolomite.

In both of these areas, Bathurst Harbour and the Ironbound Range, the structural problems have not been fully resolved. The thicknesses given are therefore approximate and indicate only the general order of thickness involved. The complex folding also makes the precise sequence in the Bathurst Harbour area uncertain, but all evidence accumulated to date supports the following:—

Bathurst Harbour Area

Formation	Lithology	Approx. Thickness	Locality
Long Bay "Shale"	Laminated mudstones slate, greywacke and greywacke conglomerate	1000 feet	Long Bay Clyte Bay South Bathurst Bramble Cove
McKenzie Conglomerate	Sandstones, siltstones and conglomerate	2000 feet	Lower slopes of Mts. McKenzie and Rugby and Bathurst Channel
Rugby Conglomerate	Quartz conglomerate and sandstone	2000 feet	Summits of Mts. Rugby, McKenzie, Misery, Berry and Beattie
Unconformity Precambrian Succession			

FIELD DESCRIPTIONS

Long Bay Shale

The rocks assigned to this formation in this report are those outcropping around the eastern shore of Long Bay from the headland opposite Pauline Point around Farrell Point almost to the entrance to Ila Bay, and their correlates. This differs somewhat from earlier workers, mainly Stefanski and Baker. Stefanski referred to these rocks, together with part of what I consider to be McKenzie Conglomerate, as the "Varvoid Bay Group" (Tech. Rep. No. 2 p. 91-92). Baker (unpublished thesis) included considerable thicknesses of rocks of quite different tectonic grade together with the rocks described above in his Long Bay Shale formation. I consider that part of Baker's Long Bay Shale is probably much older rocks belonging to a different group.

The Long Bay Shale consists of a variable sequence of greywackes, greywacke conglomerate, finely laminated mudstones and slates. The greywackes and conglomerates show very well preserved graded bedding, flow casts, load casts and slump structures. The abundant sedimentary structures, the greywacke facies and the disrupted framework of the conglomerates, seem to point clearly to a turbidite origin for the greywacke members, whilst the mudstone-slate association represents the "normal" sediment. The proportion of greywacke to "normal" sediment seems to vary a good deal from place to place.

The formation is perfectly exposed along a mile or so of shoreline and possibly represents the most perfectly developed and exposed sequence of its kind in Tasmania. Although the sedimentary folds in the formation are intricate, the rocks have been comparatively little disturbed by tectonic processes. They are locally overturned and small scale flexural type folds are well exposed, but no regional cleavage or schistosity has developed. Generally speaking the rocks have suffered little more deformation than our Permian sequence.

McKenzie Conglomerate

This formation is roughly equivalent to part of Stefanski's "fine" conglomerate. It underlies the Long Bay Shale and overlies the Rugby Conglomerate around the lower slopes of Mts. Rugby, McKenzie, Beattie, &c. and consists of about 2000 feet of interbedded conglomerate, siltstone and orthoquartzite. The conglomerates typically, but not universally, show a disrupted framework having pebbles chiefly of quartz and quartzite, but with some splintery fragments of black shale, suspended in a fine grained sub-greywacke matrix. Both graded and cross bedding seem to be absent as are the other sedimentary features common in the greywacke of the Long Bay Shale. Some of the conglomerates show cut and fill and washout structures and such members lense out rapidly along the strike. Rapid changes of grain size occur both within the beds laterally and between adjacent beds. The orthoquartzite members frequently have a schistose appearance, being made up of small flaky quartz fragments laid down in an imbricate fashion. Pebbles of quartz schists in the conglomerate beds are usually strongly disoriented.

The formation defines a change in sedimentation conditions from the well sorted, reworked shallow water or continental conglomerate below, to the greywacke facies above.

Rugby Conglomerate

This formation outcrops boldly along the main ridges which form Mts. Rugby, McKenzie, Misery and Berry. It consists of up to 2000 feet of dense massive quartz conglomerate and orthoquartzite, but the thickness varies considerably from place to place, it seems to be missing entirely at the north-east end of Long Bay and there the Long Bay Shale seems to overlie the basement rocks directly. The formation generally is strongly reminiscent of the Owen Conglomerate but lacks the pink colouration of the latter. It consists of thick beds of white siliceous conglomerate made up of sub-rounded pebbles of white quartz and quartzite with occasional pebbles of pink quartzite and black shale. The matrix is universally siliceous. A few pebbles and ramifying veinlets of haematite are sometimes present. The pebbles generally are disoriented and in contact with one another but some of the fine beds contain blocks of quartzite scattered through a fine grained matrix. No cross bedding or graded bedding has been observed in this formation. The pebbles vary in size from a fraction of an inch up to blocks two feet or so across. Stretched pebbles, recorded by both Baker and Stefanski, together with some well rounded pebbles among the angular breccia type basal conglomerate point to a recycled origin for some of the pebbles.

Regionally the Rugby Conglomerate overlies several presumed Precambrian formations with angular discordance.

Ironbound Range Area

Stefanski (unpublished memo.) has recorded the following succession in the Ironbound Range area. No individual formational thicknesses have been calculated, but the total thickness seems to be comparable with the probable Cambrian sequence in the Bathurst Harbour Area.

Owen (?) Conglomerate

Unconformity

- (1) Gritty sandstones and conglomerates.
- (2) Green shales and greywackes with slumps, load casts, graded bedding, &c.
- (3) Grey quartz sandstones and shales.
- (4) Greywackes, sandstones and siltstones.
- (5) Quartz sandstones, conglomerate and slates.
- (6) Breccia conglomerate and orthoquartzite.

Unconformity

Precambrian schists &c.

Of the sequence the writer has briefly examined formations (2), (3) and (6). It is suggested that formation (6) is equivalent to the Rugby Conglomerate and that (2) and (3) are equivalent to part of the Long Bay Shale. The following correlations of probable Cambrian rocks in the whole area are therefore postulated:—

Bathurst Harbour

Long Bay Shale
McKenzie Conglomerate
Rugby Conglomerate

Ironbound Range

Owen (?) Conglomerate

Unconformity

Formation (1 to 3)
Formation (4 and 5)
Formation (6)

Unconformity

Precambrian Schists, &c.

It may be noted that the top of the Long Bay Shale has not been located in the Bathurst Harbour area.

"Younger" Precambrian

Beneath the Rugby Conglomerate and its correlates various formations of Precambrian sandstone, phyllites and schists occur at different places. The succession within these formations has not been established and only general remarks can be offered concerning them. From the field mapping carried out so far it is clear that the probable Cambrian sequence was laid down onto an area of considerable relief. The thickness of the Rugby Conglomerate and its correlates varies considerably from place to place and the unconformity transgresses up through the sequence as high as the Long Bay Shale in some areas. There is some evidence to suggest that the Cambrian sedimentation was tectonically controlled in at least the Bathurst Harbour area.

The least altered of the presumed Precambrian rocks are the white porous sandstones along the east side of the Spring River north of Long Bay. These sandstones consist of clean, white porous, quartz sandstones made up of well rounded medium grain sand particles. Very occasionally well rounded pebbles of quartz and quartzite occur, these may be up to a couple of inches across. The rocks are well jointed and fairly gently folded into flexural type folds; no strong shearing, cleavage or schistosity was noted. These sandstones are notable in that they contain wormcasts which suggest a possible correlation with similar rocks in the Rocky Cape Group.

Flaggy and blocky quartz sandstones and siltstones outcropping east of the mouth of the Old River seem to be of about the same tectonic grade and are shallow water sediments of the same general facies. These rocks exhibit abundant cross bedding, current ripple marks and infilled mud cracks.

Laminated Quartzite and Black Phyllites

This unit underlies the probable Cambrian sequence on the eastern shore of Long Bay, in the vicinity of Pauline Point and at several other localities.

These rocks are black to grey, slaty to somewhat schistose, siltstones and shales. They are typically intensely brecciated and contorted. They show well developed chevron type folding, plastic folding and generally a fairly high grade of dynamic alteration. Unlike the Cambrian (?) rocks some of the quartz veining in this formation is affected by the crushing and brecciation.

Associated with the black phyllite is a sequence of somewhat curious, white quartzites. The typical rock type is a well crystallized, dense, white quartzite possessing a well marked lamination or cleavage which has subsequently been fairly highly contorted. This appears to be the formation described by Stefanski as a "silicified shale". It does in fact, resemble a rather contorted shale or slate which has been converted into a white finely laminated quartzite, but the writer could find no convincing contacts between these rocks and the phyllites and shales which demonstrated the wholesale conversion of phyllite into quartzite. The writer's impression was

that these slaty quartzites were derived from the recrystallisation of finely bedded quartz sandstones and that the black slates were interbedded with them. However the problem is far from being satisfactorily resolved at this time.

Contorted sandstones, phyllites, &c.

Along Melaleuca Creek and around much of the country north and south of Bathurst Harbour there are extensive outcrops of contorted quartz sandstones interbedded with phyllites, sericite schists and quartz sericite schists. This formation forms the bulk of the "Younger" Precambrian sequence in the area, but not enough is known about it at this stage to offer any reliable opinion as to its relationship to the other Precambrian units. An interesting feature is the occurrence of plug-like "intrusions" of stretched pebble conglomerate into these rocks. One such mass occurs near the mouth of Melaleuca Creek and others have been reported from the vicinity of the Ironbound Range by Stefanski.

The "Younger" Precambrian sequences generally resemble part of the Rocky Cape Group. The regional metamorphic grade is low, but locally alteration along tectonic zones may be quite intense.

Much has been written concerning the silicification of the Precambrian sequence in this area. As a general rule, it is a fact that most of the high country is occupied by dense quartzite whilst the lower lying areas are occupied by softer rocks. Also some of the quartzites do have a superficial resemblance to silicified slates or shales. These features have been interpreted by Stefanski as being due to wholesale silicification proceeding from the top downwards and by Baker as being due to leaching by acid ground and surface waters. In the author's opinion we have not nearly enough evidence to begin to resolve the question. Until the structure and stratigraphy of the "Younger" Precambrian sequence is worked out we cannot begin to discuss this point properly. Unfortunately, up to this stage, all attempts to work out a satisfactory stratigraphy have involved basic assumptions concerning the silicification and structure of the formations concerned. Obviously a new approach is required; the problem is universal among workers on Precambrian rocks throughout Tasmania.

"Older" Precambrian

Around the shores of north Bathurst Harbour there are extensive outcrops of black schists which seem to be of higher metamorphic grade than the rocks described above. They are tentatively assigned to the "older" Precambrian. The rocks consist of glossy black and grey schists often containing numerous augen structures of quartz. The schists are frequently studded with holes due to the leaching out of some secondary mineral, probably albite. Like the "younger" Precambrian rocks the schists seem to contain two generations of quartz veining.

STRUCTURE

South of Port Davey and Bathurst Harbour, to the south-west coast, the Precambrian rocks are folded mainly along north-south axes. This trend persists north of Bathurst Harbour but there it is less marked due to the interference by cross folding trending north-east. Strong north-east trends are present on Mt. Parry and south-west to Hannant Inlet as well as to the north-east of Bathurst Harbour.

East of Bathurst there is a fairly strong belt of east-west folding which seems to persist to the west as far as Bathurst Channel and affects all rocks up to and including the Cambrian (?).

Precise information on the relative ages of the folding is lacking, but the overall pattern seems to indicate that the north-south folding has been disrupted by the later trends. However, in the vicinity of Clyde Cove and Ila Bay the Cambrian (?) succession is also folded along north-south axes. Accompanying these fold systems, there are faults of considerable magnitude about which comparatively little is known. The structure seems to demand several faults trending north-south having large vertical displacements. In addition to this, Stefanski has mapped an interesting pattern of linears trending north-west and north-east some of which he indicates as wrench faults. They appear to fit into the structural pattern neatly as conjugate shears associated with the north-south folding. The boundary of the Cambrian (?) and Precambrian sequences on the Celery Top Islands is a breakthrust and faulting of this kind appears to have occurred along this boundary also in the vicinity of Horse-shoe Inlet and at South Bathurst.

Fold styles vary considerably and in the younger rocks they are strongly affected by the competency of the various formations. The Cambrian (?) rocks occur mainly along north-north-west trending structures in the vicinity of Bathurst Harbour. The folds in this sequence are largely flexural type folds, but in the less competent formations a slaty cleavage is developed accompanied by a change in fold style to the similar type folds. In most areas at least two fold directions are present, but the north-west trend is dominant, with the folds facing north-east. Although information is incomplete yet it seems that in this sequence the north-west folds are earliest and they have been deformed later by north-east, east-west and north-south folding, but the relative ages of these later folds is unknown. The thick massive conglomerates on Mt. Rugby, &c., tend to yield as slightly deformed and broken slabs rather than to conform to the general fold style. This undoubtedly produces wholesale decollement action between the Cambrian and Precambrian sequences wherever the conglomerates are thick, and accounts for the breakthrusts mentioned earlier.

The "younger" Precambrian rocks show all fold styles from open flexural type folding to similar folds with slaty cleavage and thickening of the crestal regions, to locally, along zones of tectonic disturbance, shear folding, probably with local diapiric intrusions, and intense deformation. The general style for these rocks however, is similar folding, frequently isoclinal, and west facing.

The "Older" Precambrian rocks are almost universally shear folded with local deformation resulting in chevron type folds, zones of intense crushing and flow folding. In these zones the early quartz veins and structures have been crushed and refolded. Such folds penetrate up to, and affect, the Cambrian sequence. Stretched pebble "conglomerates" similar to the Goat Island rocks are present apparently "intruded" into the Upper Precambrian sequence near the mouth of Melaleuca Inlet and in the vicinity of the Iron-bound Range.