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The Petrology of some Mesozoic Sediments from the Tambo, Augathella, Eddystone, and Mitchell 1:250,000 Sheet Areas - Queensland

by

M.C. Galloway

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THE PETROLOGY OF SOME MESOZOIC SEDIMENTS FROM THE TAMBO, AUGATHELLA, EDDYSTONE AND MITCHELL 1:250,000 SHEET AREAS - QUEENSLAND

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Records 1967/81

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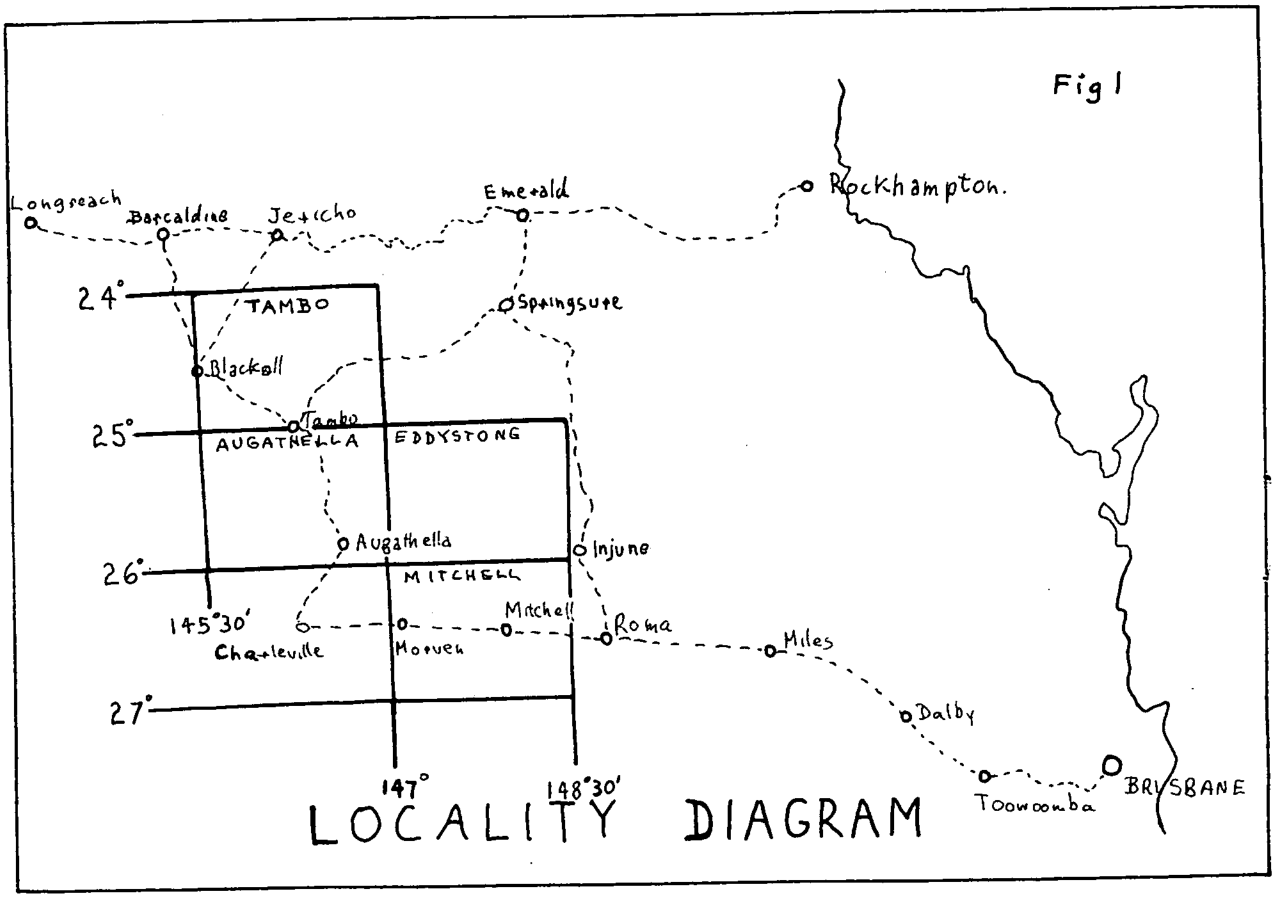


LOCALITY DIAGRAM

G55/A/30

To accompany Record 1967/81

SUMMARY

One hundred and seventy seven sections, cut from outcrop samples collected by the 1965 Great Artesian Basin field party and from cores cut in BMR scout holes during 1964 and 1965, were examined petrologically. The units represented range in age from Triassic to Tertiary.

Of the Triassic units, the Rewan Formation, Dunda Sandstone and Clematis Sandstones are generally lithic sandstones with up to 10% feldspar and up to 70% rock fragments; sandstones of the Moolayember Formation vary from quartzose to lithic. The units show progressively higher maturity with decrease in age.

Lower Jurassic sandstones are mainly porous and quartzose, the units show decreasing maturity with decreasing age.

Injune Creek Group sediments vary from lithic through lithic sublabile to quartzose with decrease in age; there is a corresponding increase in the maturity index.

The Gubberamunda Sandstone is sublabile. It is more mature than the overlying Orallo Formation which consists of lithic and sublabile sandstones. The Southlands Formation is lithic in the lower part and sublabile in the upper part.

The blythesdale Formation consists most commonly of quartzose and lithic sublabile sandstones. At least two glauconitic marine units occur, they are the Minmi Member and Nullawurt Sandstone Member.

The Hooray Sandstone in the Tambo-Augathella area consists most commonly of feldspar-free, lithic sandstone; however, the samples from the Mitchell area have an average of 4.4% feldspar and several contain glauconite.

The sequence between the Westbourne and Wallumbilla Formations in the Surat Basin, which correlates with the Hooray Sandstone of the Eromanga Basin contains feldspar and much less rock fragments than the Hooray Sandstone.

Most of the sandstones of the Rolling Downs Group are calcareous and feldspatholithic; the exceptions are those at the base of the Doncaster Member, which are more quartzose. These are the last representations of the Blythesdale - Hooray type sedimentation.

INTRODUCTION

A petrological examination was carried out on one hundred and seventy seven thin sections cut from outcrop samples collected during the 1965 field season of the Great Artesian Basin Party and from cores from shallow B.M.R. scout holes drilled during 1964 and 1965. The samples come from the Tambo, Augathella, Eddystone and Mitchell 1:250,000 Sheet areas. Formations range in age from Triassic to Tertiary. The samples were selected to be as representative as possible of arenites in the units from which they were taken. They do not necessarily represent all rock types of each formation. The number of slides examined from each unit varies from 1 to 23 thus the conclusions as to provenance are only tentative.

The geology of the area from which the samples were collected is described in Exon, Galloway, Casey and Kirkegaard (1966) and Exon, Milligan, Casey and Galloway (1967). Sepcimen numbers are those of the Bureau of Mineral Resources Museum outcrop samples collection; all have prefix 6558.

Appendix 1 is a list of the BMR museum collection sample numbers together with grid references to the sheet areas on which they occur.

The classification of arenites used is that of Packham (1954) as modified by Crook (1960). Grain sizes used are those of Wentworth (1922). Sphericity and roundness were determined by visual estimation according to Figure 4-10 of Krumbein and Sloss (1963).

Mineralogical percentages quoted are estimates. Generally, percentages less than 5% are classed as a trace. Percentages quoted are probably accurate within 5%.

Results of petrological examination are summarized in Plate 1.

For analysis of the petrography, two types of triangular diagram are used. The first relates matrix, labile grains and quartz (MLQ diagrams). The second uses quartz, feldspar and rock fragments as the three parameters (QFR diagrams).

Mineralogical maturity has been expressed by one, and where possible two, maturity indices. They are calculated as ratios of quartz to feldspar, or quartz plus chert to feldspar plus rock fragments, as outlined by Pettijohn (1957, p. 508). The quartz-feldspar ratio is commonly higher than the quartz plus chert to feldspar plus rock fragments ratio. As some formations are practically feldspar free, yet contain appreciable quantities of rock fragments a falsely high quartz to feldspar maturity index results. This applies in particular to the Hooray Sandstone of the Tambo-Augathella district which has only a trace of feldspar but an average 30% of rock fragments. The quartz plus chert to feldspar plus rock fragments index is used in the following discussions; both are quoted in the petrological table (Plate 1).

TRIASSIC SEDIMENTS

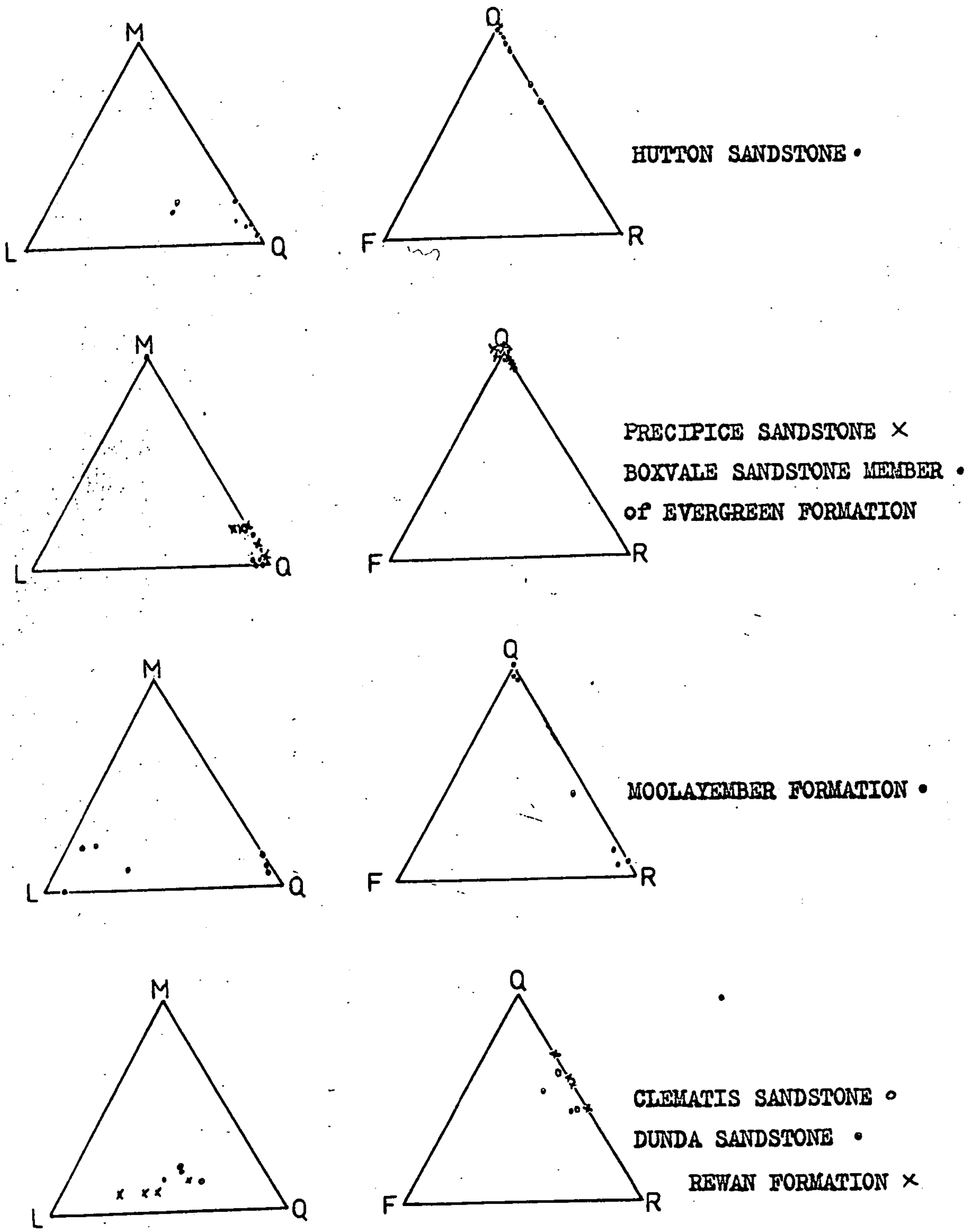
Table 1

QUARTZ, FELDSPAR, ROCK FRAGMENTS AND MATURITY VARIATION FOR TRIASSIC SEDIMENTS

UNIT	Percentage of Total Rock			Maturity Index		Number of sections examined
	Quartz	Feldspar	Rock fragments	Range	Average	
Moolayember Form.	5-90	0- 5	0-70	0.6-45	23	7
Clematis Sandstone	45-55	2- 3	28-30	1.3- 1.8	1.6	2
Dunda Sandstone	40-45	0-10	25-45	0.8- 1.2	1.0	3
Rewan Formation	25-50		35-65	0.4- 1.4	1.0	3

Fig. 2.

MLQ and QFR Diagrams HUTTON SANDSTONE to REWAN FORMATION Inclusive



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Of the lower three formations the Rewan is the least and the Clematis the most mature; the greatest variation in mineralogy and maturity is in the Moolayember Formation. There is a general lack of feldspar in all Triassic formations; where it is present it occurs as stable K feldspar or sodic plagioclase.

Though the Clematis and Dunda Sandstones are shown as lithic, the lithic fraction consists of devitrified acid glass, quartzite or quartz schist fragments which are the most stable of rock fragments. Even so, the Clematis, and to a lesser degree the Dunda Sandstones are not as mature as might be expected from hand specimen examination.

The lowermost three units fall into much the same fields on the MLQ and QFR diagrams (fig. 2).

LOWER JURASSIC SEDIMENTS

Table 2

QUARTZ, ROCK FRAGMENTS AND MATURITY VARIATION FOR LOWER JURASSIC SEDIMENTS				
FORMATION	Percentages of total rock		Maturity Index	Number of sections examined
	Quartz	Rock fragments		
Hutton Sandstone	55-92	Tr-30	1.8-45	7
Boxvale Sandstone Member of Evergreen Formation	80-95	0-5	16-44	5
Precipice Sandstone	85-90	0-3	28-44	5
Maturity indicees range to infinity for a number of samples (see plate 1) where denominator is zero (i.e. neither feldspar nor rock fragments are present)				

Plate 1 and Table 2 demonstrate the slight decrease in maturity with increase in age.

INJUNE CREEK GROUP

Table 3

QUARTZ, ROCK FRAGMENTS AND MATURITY VARIATION FOR LOWER JURASSIC SEDIMENTS					
UNIT	Percentages of total rock			Maturity Index	Number of sections examined
	Quartz	Feldspar	Rock fragments		
Westbourne Formation	35-85	0-15	2-40	6.3	19
Adori Sandstone Birkhead Formation	60-70	0	5-28	4.8	6
Springbok Sandstone Member	10-60	Tr-10	15-65	2.0	4
Undifferentiated	15-60	Tr-10	15-60	1.9	6

Of the three formations of the Injune Creek Group the youngest is more mature than the oldest as is demonstrated in the MLQ and QFR diagrams and the petrographic log.

Glauconite and pelletal chlorite closely resembling glauconite occurs in a number of Birkhead and Westbourne Formation thin sections.

Triplehorn (1966 a and b) defines glauconite as "a field term for any small (up to a few mm in diameter) greenish clay pellets found in sedimentary rocks. This broad definition includes pellets which may contain the clay minerals chlorite, montmorillonite, and kaolinite". Thus, on the accompanying petrological table both glauconite and pelletal chlorite would be regarded by Triplehorn as glauconite. He goes on to describe the variations in morphology and internal structure of glauconite. Triplehorn (1966a) is probably the latest of a long line of persons advocating shallow water marine conditions for formation of glauconite.

The glauconite, as distinct from chlorite, of the Birkhead and Westbourne Formations consists mainly of mammilated and capsule-shaped pellets and some spheroidal or oval forms with random microcrystalline internal structure. Triplehorn claims that the mammilated pellets are formed by shrinkage of aggregation of smaller, rounded pellets. Capsule-shaped pellets were related by Takahashi and Yagi (1929) to glauconitization of faecal pellets in shallow waters.

Potassium is an essential element for glauconite formation; it is of note that both the Westbourne and Birkhead Formations have high radio-activity counts on gamma ray logs indicating a high potassium uranium or thorium content the most likely being potassium. Evans (see appendix 2) located acritarchs in BMR Eddystone 50 in the Westbourne Formation. No microplankton were discovered by Evans but Terpstra (appendix 2 in Galloway and Ingram 1967) found poorly preserved arenaceous foraminifera in the Westbourne Formation at 240 feet in B.M.R. Jericho 9.

The presence of arenaceous formainifera, the record of acritarchs, the high gamma ray count and the presence of glauconite indicate that shallow water marine to brackish conditions possibly existed, at least sporadically during deposition of the Birkhead and Westbourne Formations. This was originally suggested by Vine (1966) for the northern part of the Eromanga Basin.

SEQUENCE BETWEEN WESTBOURNE AND WALLUMBILLA FORMATIONS

The sequence in the stratigraphic interval between the Westbourne and Wallumbilla Formations changes laterally across the Mitchell Sheet area. In the west, in the Eromanga Basin, the Hoorey Sandstone occupies the whole interval. Eastwards in the Surat Basin, the sequences are divisible into several formations and members. The relationships are shown in Table 4, which is after Exon et al (1967).

Fig. 3.

MLQ and QFR Diagrams HOORAY SANDSTONE and INJUNE CREEK GROUP

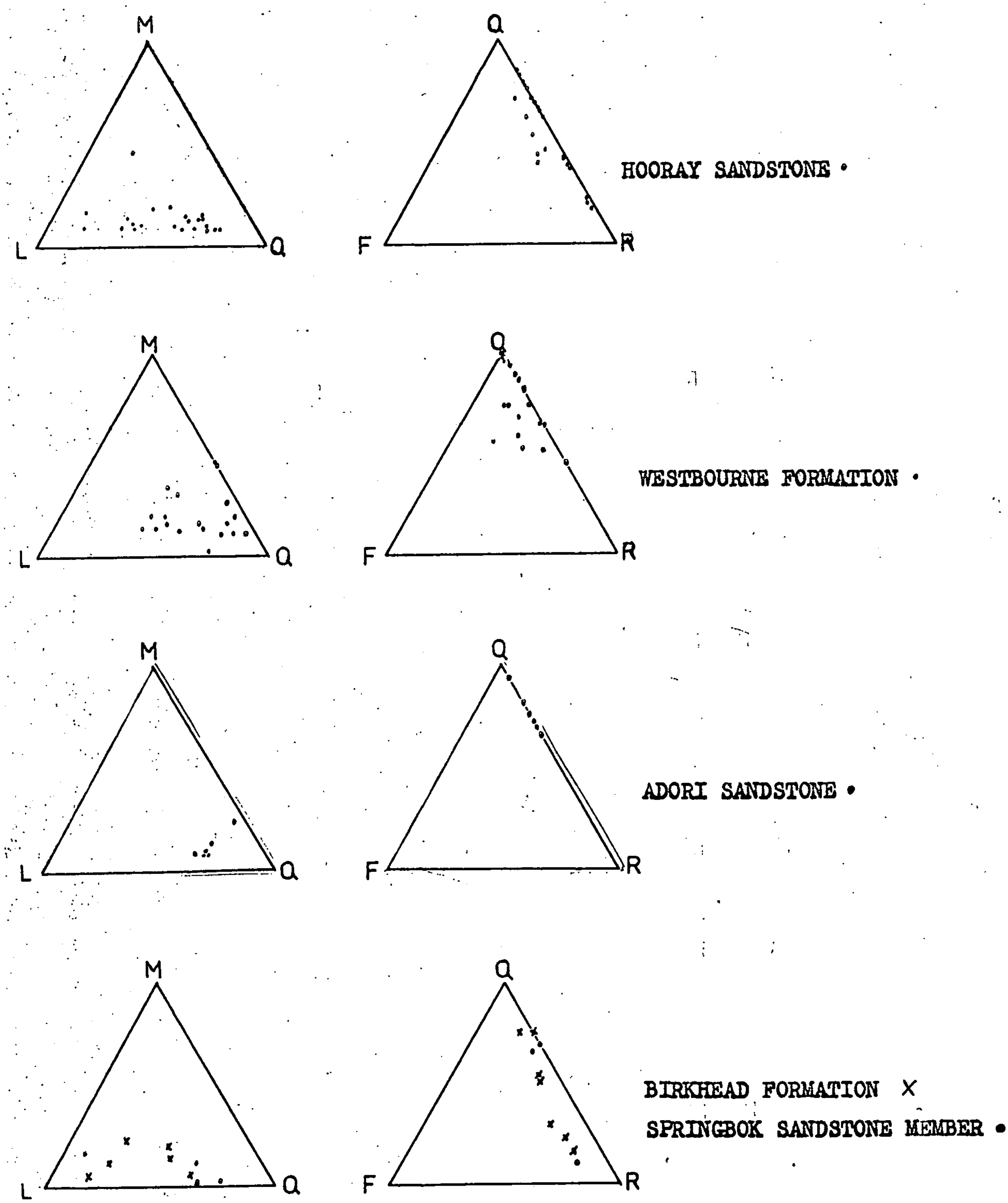
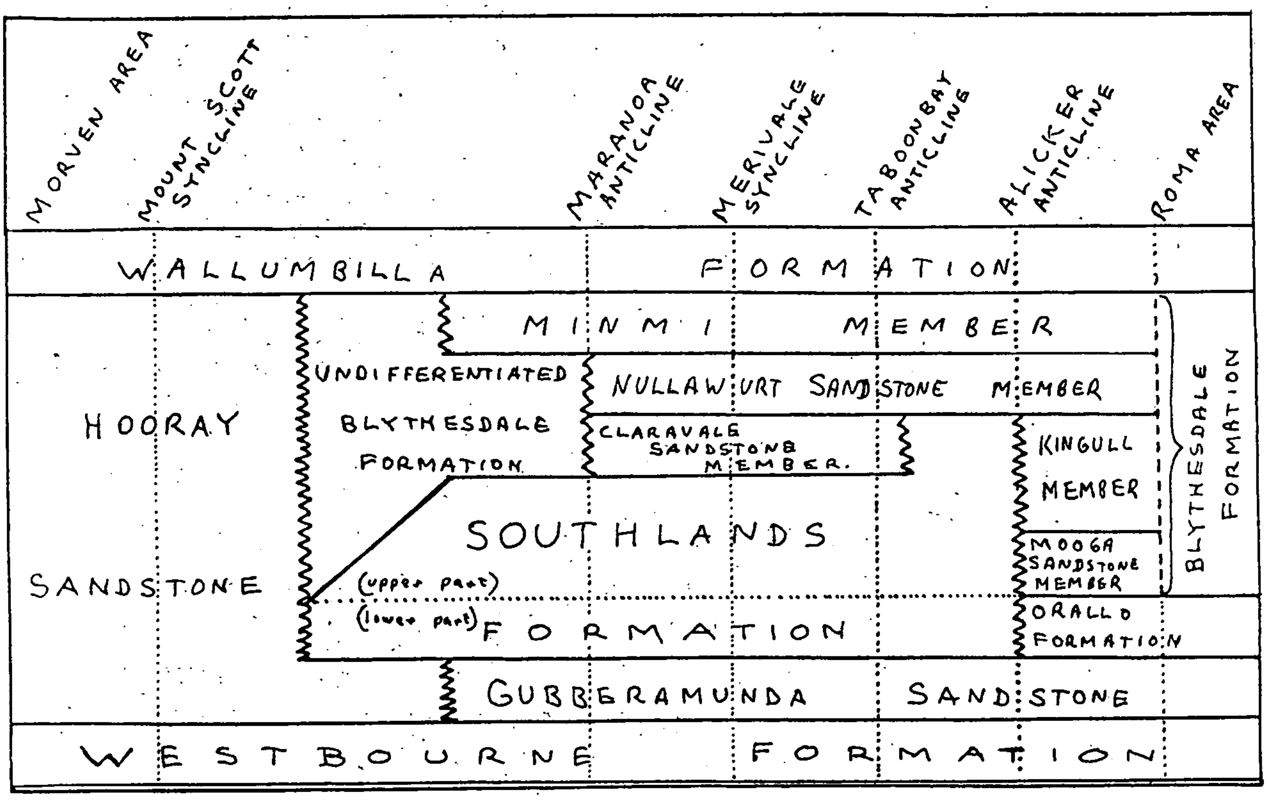


Table 4

Stratigraphic relationship diagram



Surat Basin Sequence

Comparison of the petrography of the eastern (Surat Basin) sequence are shown in Table 5. No samples of the Mooga Sandstone Member were examined. In its type section Day (1964) describes it as a sequence of fine grained quartzose and sublabile sandstone, micaceous and carbonaceous siltstone and mudstone. Away from the type area, particularly eastwards Exon et al (1967) recorded that intervals of soft labile sandstone and mudstone were more common.

Table 5

QUARTZ, FELDSPAR ROCK FRAGMENTS AND MATURITY VARIATION FOR SEQUENCES BETWEEN THE WESTBOURNE AND WALLUMBILLA FORMATIONS.

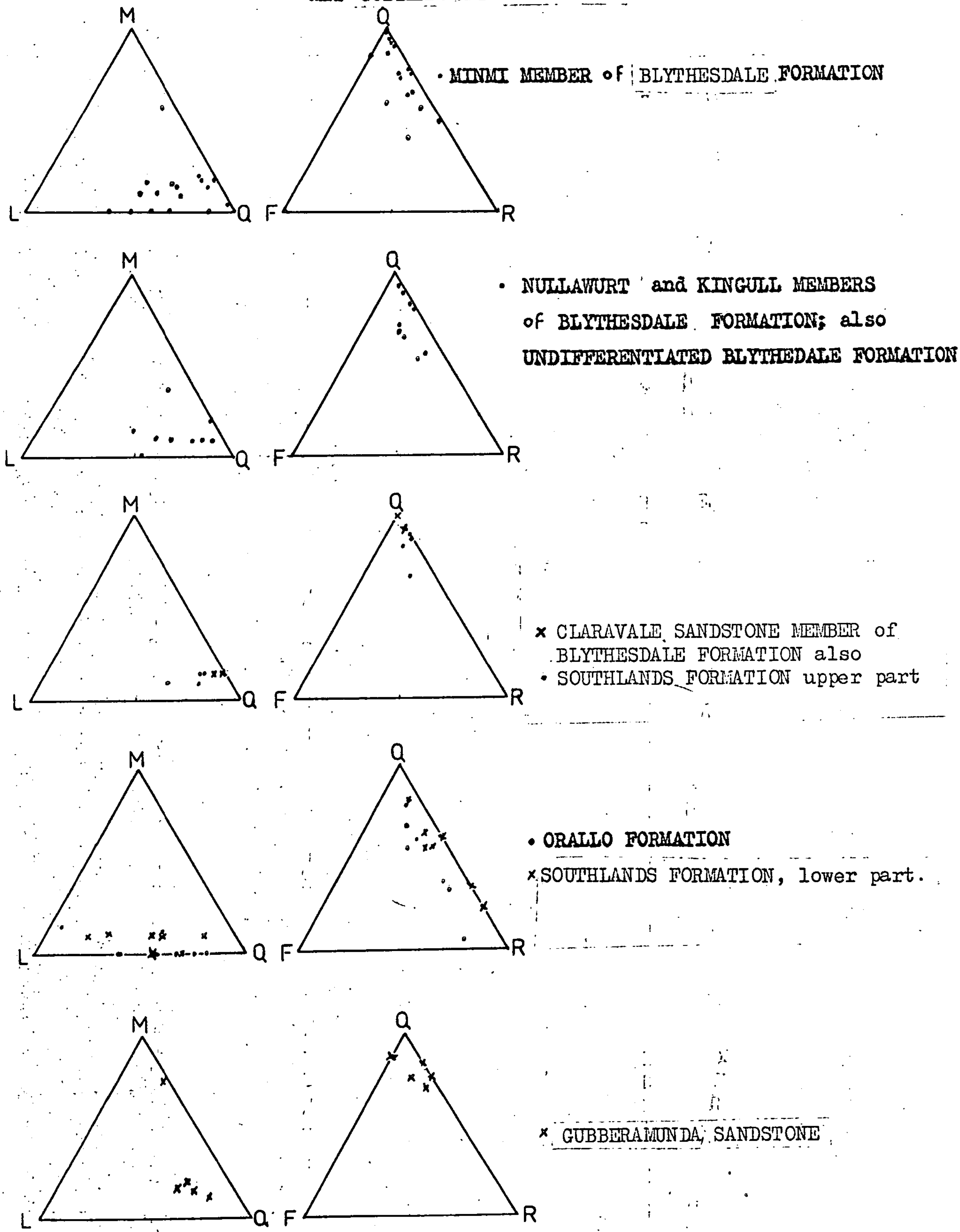
UNIT		Number of samples examined	Percentages of total rock					Maturity Index		
			Quartz	Feldspar		Rock Fragments				
				Range	Average	Range	Average	Range	Average	
BLYTHESDALE FORMATION	Minmi Member	17	15-80	0-10	2.7	0-32	12.5	1.1 -16.0	5.5	8.2 (Minmi to Claravale)
	Undifferentiated	3	40-80	10	4.0 (Undifferentiated to Kingull)	10-30	14.0 (Undifferentiated to Kingull)	1.1 - 8.0	4.3	
	Nullawurt Sandstone Member	5	55-85	Tr-10		5-20		1.8 -17.0	5.7	
	Claravale Sandstone Member	2	80-85	Tr		5		16.0	- 16.0	
	Kingull Member	1	45	5		30				
overall					3.2		13.1		5.9	
Southlands (upper part)		4	75-80	0-5		5-10		5.0 -16.0	9.0	
Formation (lower part)		7	20-75	5-10		10-70		1.3 - 5.0	1.7	
Orallo Formation		8	5-65	5-15		10-65		1.5 - 0.5	1.0	
Gubberamunda Sandstone		5	20-75	3-18		12-20		2.2 - 5.0	3.3	

The most mature unit is the Claravale Sandstone Member of the Blythesdale Formation followed by the upper part of the Southlands Formation. In contrast the most labile units are the Orallo Formation and the lower part of the Southlands Formation. The Gubberamunda Sandstone is not as mature as hand specimen examination would suggest but the labile constituents are devitrified acid volcanics and quartzose siltstone fragments, both of which are relatively stable especially under chemical weathering.

The upper part of the Southlands Formation is thought to be equivalent to the Mooga Sandstone and the Kingull Members of the Blythesdale Formation (Exon et al 1967), see Table 4; the four sections from the upper part of the Southlands Formation are more representative of the Mooga Sandstone than the Kingull Member. This is surprising as the sections were taken from localities scattered throughout the entire outcrop extent of the formation. This suggests that during deposition of the upper part of the Southlands Formation, either the Mooga type sedimentation was more common than the more labile Kingull sedimentation or that the Kingull type sediments, being more labile, are more subject to weathering do not outcrop as well as the quartzose Mooga type sediments (see table 5 and plate 1). The greater maturity of the upper part of the Southlands Formation and the Gubberamunda Sandstone than the Orallo Formation and lower part of the Southlands Formation is demonstrated in the QFR and MLQ diagrams of figure 4.

Fig. 4.

MLQ and QFR Diagrams BLYTHESDALE FORMATION, ORALLO FORMATION and GUBBERAMUNDA SANDSTONE



The Blythesdale Formation has a higher maturity index (both unit by unit and overall) than the preceeding Orallo Formation (see table 5) or the subsequent Wallumbilla Formation (see table 6).

The rock fragments in the Minmi Member are different from those of the preceeding members of the Blythesdale Formation, the Minmi containing an assortment of fragments while the lower members contain almost only acid volcanic fragments.

Table 6

FELDSPAR VARIATION FOR BLYTHESDALE FORMATION			
	Number of section in which Plagioclase recognised	Number of sections in which K-feldspar recognised	Plagioclase / K-feldspar
Minmi Member	15	9	1.6
Pre Minmi Member Sediments of Blythesdale Formation	7	7	1.0

Table 6 shows the greater proportion of plagioclase to K-feldspar in the Minmi Member as compared with the pre Minmi members.

Glauconite and chlorite pellets are characteristic of the Minmi Member but are also present in the Nullawurt Sandstone Member; both these members have a shelly marine fauna.

The difference in rock fragments and proportion of plagioclase to K-feldspar between the Minmi and pre Minmi members is thought to reflect a change from an acid volcanic and plutonic provenance for the pre Minmi units to a more basic volcanic provenance for the Minmi Member.

The MLQ and QFR diagrams (Fig. 4) demonstrate the difference between the members of the Blythesdale Formation. The Minmi Member is shown to have the greatest variation, and the Claravale Sandstone Member the least. The Claravale Sandstone is shown to be more mature than the upper part of the Southlands Formation.

Eromanga Basin Sequence (Hooray Sandstone)

Rock fragments are commonly devitrified acid volcanics or quartzose siltstone fragments and are generally more common than in the Blythesdale Formation (cf table 5).

There is a general lack of feldspar, other than trace amounts, in the Hooray Sandstone from the Tambo-Augathella area compared to the Mitchell area. This is in contrast to the similarity in the quantity of rock fragments from the two areas (cf table 7).

Glauconite was present in 6 of the 9 sections from the Mitchell area.

The MLQ and QFR diagrams for the Horray Sandstone (figure 3) show a considerable spread for the formation.

Comparison of Surat and Eromanga Basin Sequences

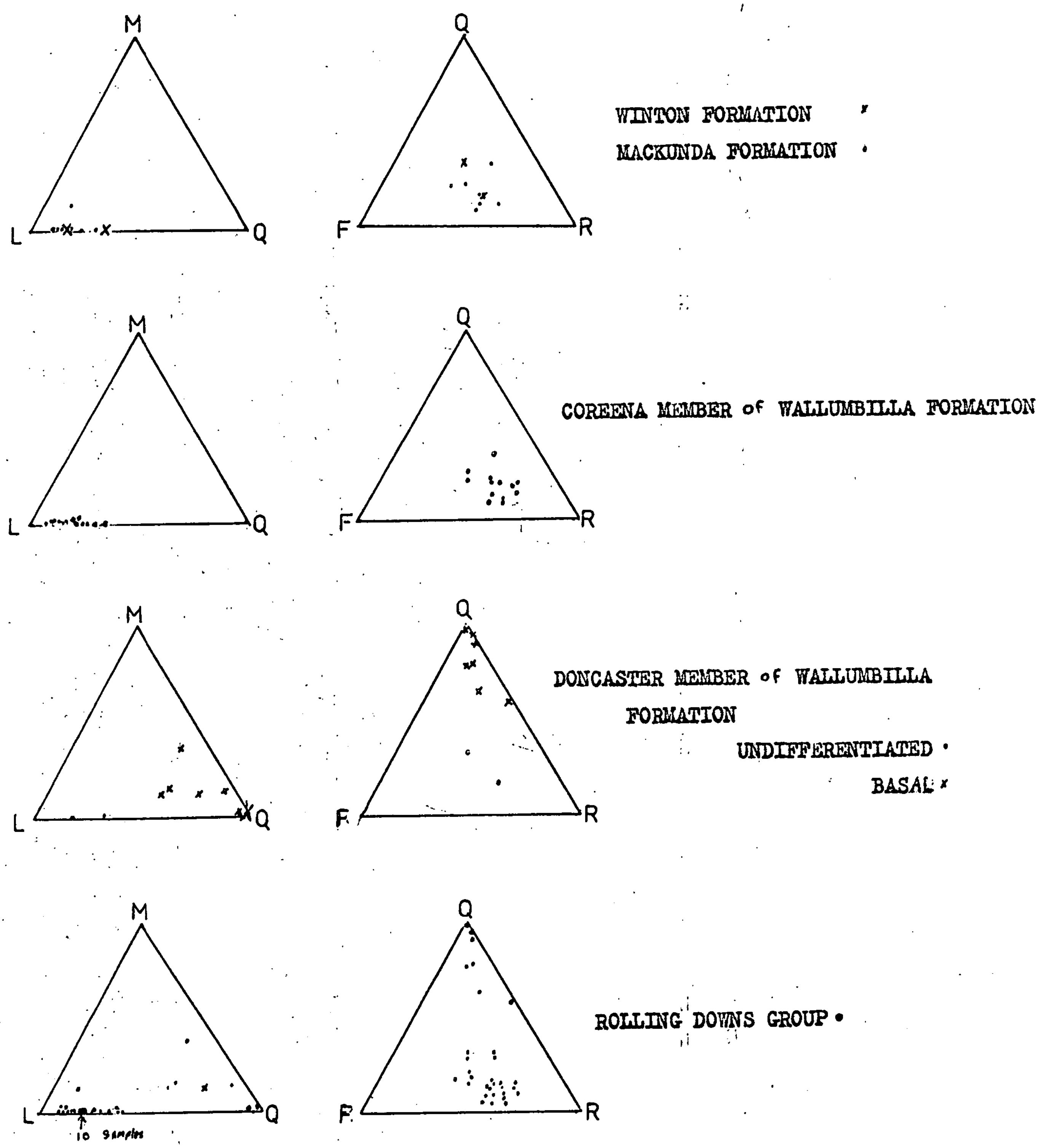
Table 7 summarises the variation in content of feldspar and rock fragments and the maturity index for the post Westbourne pre Wallumbilla Formation units. The Hooray Sandstone is seen to have a lower Maturity than all units of the Surat Basin sequence, both overall and individually, except the lower part of the Southlands Formation and the Orallo Formation. While the Surat Basin sequence has more feldspar than the Eromanga Basin sequence the percentage of rock fragments is higher and the mattrity index (i.e. Quartz/Feldspar plus rock fragments) is much lower for the Eromanga Basin Sequence.

Table 7

FELDSPAR, ROCK FRAGMENTS AND MATURITY VARIATION FOR EROMANGA AND SURAT BASIN SEQUENCES

	UNIT	Number of sections examined	Percentages of total rock: Feldspar	Percentages of total rock: Rock Fragments	Maturity Index: Quartz/Feldspar + Rock Fragments
EROMANGA BASIN SEQUENCE	Hooray Sandstone Tambo-Augathella area	13	tr	31.1	2.3
	Mitchell area	10	4.4	31.6	1.3
	Overall	23	1.8	31.3	1.9
SURAT BASIN SEQUENCE	Blythesdale Formation Minmi Member	17	2.7	12.5	5.5
	Pre Minmi Member	11	4.0	14.0	6.4
	Overall		3.2	13.1	5.9
	Southlands Formation				
	Upper part	4	1.2	8.7	9.0
	Lower part	7	3.6	36.4	1.7
	Orallo Formation	8	8.0	30.0	0.7
	Gubberamunda Sandstone	5	3.2	13.4	3.3
	Overall	52	3.7	18.3	4.6

Fig. 5.
MLQ and QFR Diagrams for ROLLING DOWNS GROUP



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ROLLING DOWNS GROUP

Thirty-four thin sections from the Group were examined; all except eight are calcareous. Excluding the basal Doncaster Member, 18 of the 24 sections are feldspatho lithic sandstones (see plate 1). The sediments of the Group are much more calcareous than the earlier Mesozoic sequence. Calcite corrosion of the quartz and overgrowths of the feldspar are common; rock fragments are commonly replaced by varying proportions of calcite and limonite; variations in texture of the replacing calcite and limonitic relic stains indicate the sites of pre-existing rock fragments. By comparison with material examined from cores of the Doncaster Member it is evident that the beds of the non-calcareous horizons did differ from the calcareous ones. As only calcareous material outcrops in the field, a more accurate picture of the petrology of these units could be obtained by examining the cores held by the B.M.R. from its own scout hole drilling programme. There was insufficient time available to do this.

No reliable maturity indices for the units could be obtained as calcite was so common in the sections.

From plate 1 and the MLQ and QFR diagrams (fig. 5) it is seen that the Mackunda and Winton Formations are petrologically very similar. The Coreena Member appears to be more lithic and have less feldspar than the other units. Rock fragments are partially replaced by calcite, and therefore it is difficult to estimate the original percentage.

Hornblende, augite, garnet and biotite were recognised in the Mackunda Formation; biotite and augite were recognised in the Coreena Member. Authigenic minerals including glauconite and calcite were excluded when plotting the MLQ diagrams. Though calcite had replaced matrix, the calcite was authigenic and was therefore excluded in the calculations.

The provenance for the Mackunda and Winton Formation was discussed by Galloway (1967), it is thought that a similar provenance probably supplied the detritus for the Coreena Member.

The Doncaster Member is much more quartzose than the younger units of the Rolling Downs Group. As the Doncaster Member is mudstone and fine siltstone, except for the basal part, most sections came from the basal 50-100 feet; exceptions are 65582099, which is similar in composition to the Coreena Member and comes from a Coreena-like interbed at the top of the Doncaster Member near Roma, and 65582117 which is 85% calcite and is probably typical of most of the Doncaster member. Sample 65582172 is quartzose schist from a locality where faulting is suspected.

The other sections clearly show that the detritus in the basal part of the Doncaster Member is atypical of the Rolling Downs Group and probably represents the final phases of the Hooray-Blythesdale type sedimentation.

TERTIARY SANDSTONE

One section of a Tertiary sandstone was examined from the Mitchell area. It is a quartzose sandstone with quartz (85%), feldspar (tr) and rock fragments (5%) consisting of metasiltstone fragments. The matrix is green chloritic material. Traces of phengite, mica, zircon and rutile are present.

PALAEOGRAPHIC AND PROVENANCE CONSIDERATIONS

Quartzose sandstone is found in the Precipice Sandstone, the Boxvale Sandstone Member of the Evergreen Formation, the Hutton Sandstone and the Claravale Sandstone Member of the Blythesdale Formation. The mineralogy of these units indicates a provenance providing quartz, almost exclusively with, in the case of some of the Hutton Sandstone, minor devitrified acid glass. It is difficult to visualise a provenance shedding such restricted quartzose detritus. It is likely that the provenance was more varied than suggested by the mineralogy of the sediments but that the labile material which was shed by the provenance was weathered prior to and during transport, destroying all but the most stable clasts of the material. A wide variety of quartz and acid volcanic bearing sources could provide such a provenance. A hot humid climate together with moderately long transport would provide the weathering conditions necessary to destroy the labile material.

Sections from the Triassic Clematis and Dunda Sandstones are classified as labile sandstone.

As the labile grains in these rocks are mainly relatively stable quartzose rock fragments, it indicates that either the provenance contained only rocks that provided this type of detritus or the climate was such that most labile material was destroyed during transport. A hot humid climate together with moderately long transport, similar to but not as severe as that prevailing at the time of formation of the quartzose sandstones described above, would provide these conditions.

As no palaeocurrent information has been collected in the area and only two sections of the Clematis Sandstone and three of the Dunda Sandstone have been examined, little can be said regarding the source of these formations.

The Moolayember and Westbourne Formations, Hooray Sandstone and undifferentiated Blythesdale Formation show considerable variation in maturity and mineralogy. This suggests instability either of the provenance or due to climatic variations during sedimentation.

The Adori and Gubberamunda Sandstone, the upper part of the Southlands Formation and Nullawurt Sandstone member of the Blythesdale Formation are made up dominantly of sublabile sandstone. With the exception of the Nullawurt Sandstone Member they lack feldspar and the rock fragments are devitrified acid glass and microcrystalline quartzose rock fragments. They were probably derived by breakdown of pre-existing fine grained acid volcanics and microcrystalline quartzose rocks. Feldspar was either almost absent or was destroyed prior to deposition, presumably by weathering.

Labile sandstone characterizes the Springbok Sandstone Member of the Birkhead Formation and to a lesser extent the whole of the Birkhead Formation, the Orallo Formation, the lower part of the Southlands Formation and the Kingull Member of the Blythesdale Formation. Intermediate volcanic fragments characterize the Birkhead Formation and are freshest and most common in the Springbok Sandstone Member which probably coincides with contemporaneous volcanism. Both acid and intermediate volcanic detritus occurs in the Orallo Formation and the upper part of the Southlands Formation. Only one section of the Kingull Member of the Blythesdale Formation was examined but it was very similar to the description of sections from the unit in Day (1964).

The Minmi Member of the Blythesdale Formation differs from all the older units examined in that it represents a change from dominantly arenitic terrestrial sedimentation to argillaceous marine (Exon et al 1967). The arenaceous material in the unit represents a mixture of the final pulses of quartz-bearing detritus, more typical of the Jurassic sequence, and the first of the Cretaceous andesitic quartz-free detritus. There is a greater proportion of plagioclase to K-feldspar and a greater assortment of rock fragments, including the appearance of intermediate to basic volcanic rock fragments as compared with the preceeding sequence.

The Rolling Downs Group sediments are argillaceous and most are calcareous. The sediments appear to have been derived from a contemporaneous andesitic source (plate 1, & Galloway, 1967). Quartz is significantly deficient; the percentages of rock fragments and feldspar each constitute amounts either equal to or up to four times as much as the percentage of quartz.

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APPENDIX I

Sample localities:-

SAMPLE	SHEET AREA	GRID REFERENCE
WINTON FORMATION		
6558 2072	AUGATHELLA	3486 8814
2076	AUGATHELLA	3973 8319
MACKUNDA FORMATION		
6558 2016	AUGATHELLA	4020 8330
2031	AUGATHELLA	3966 8679
2032	AUGATHELLA	3755 8715
2065	AUGATHELLA	4065 8812
2066	AUGATHELLA	4013 8716
2014	AUGATHELLA	4175 8346
2071	AUGATHELLA	3857 8867
ALLARU MUDSTONE		
6558 2009	AUGATHELLA	4343 8428
WALLUMBILLA FORMATION COREENA MEMBER		
6558 1932	AUGATHELLA	3850 9561
2004	AUGATHELLA	4558 8368
2006	AUGATHELLA	4424 8385
2021	AUGATHELLA	4564 8479
2030	AUGATHELLA	4127 8656
2038	AUGATHELLA	4568 8286
2041	AUGATHELLA	4545 8366
2044	AUGATHELLA	4412 8399
2057	AUGATHELLA	4490 8680
2058	AUGATHELLA	4460 8890
2077	AUGATHELLA	4750 7858
2082	AUGATHELLA	4894 7812
2091	AUGATHELLA	4723 8073
2115	AUGATHELLA	4718 7987
WALLUMBILLA FORMATION DONCASTER MEMBER		
6558 1851	TAMBO	423 946
2099	ROMA	4135 6895
2117	AUGATHELLA	4959 8000
2130	AUGATHELLA	4472 8921
2151	MITCHELL	537 736
2172	MITCHELL	528 747
TAMBO 3	TAMBO	425 920
MITCHELL 7	MITCHELL	528 748

SAMPLE	SHEET AREA	GRID REFERENCE
HOORAY SANDSTONE		
6558 1850 B.E.F.	TAMBO	4453 9119
1866	MITCHELL	576 754
2132	AUGATHELLA	4706 8882
A.B.C.	AUGATHELLA	4706 8887
2133 A.B.	AUGATHELLA	4683 8789
2134 A.B.C.D.	AUGATHELLA	4668 8789
MITCHELL 4	MITCHELL	569 732
MITCHELL 7	MITCHELL	528 748
BLYTHESDALE FORMATION, MINMI MEMBER		
6558 1942	MITCHELL	6178 7260
1948	MITCHELL	638 736
1951	MITCHELL	650 724
2113 A.B.C.	ROMA	5150 7105
2141	AUGATHELLA	5002 8365
2160 A	MITCHELL	544 728
2164 A	MITCHELL	612 722
MITCHELL 1	MITCHELL	618 724
MITCHELL 4	MITCHELL	569 732
BLYTHESDALE FORMATION (undifferentiated)		
6558 2165	MITCHELL	6119 7224
MITCHELL 1	MITCHELL	618 724
BLYTHESDALE FORMATION, NULLAWURT SANDSTONE MEMBER		
6558 1943	MITCHELL	615 736
1945	MITCHELL	649 730
1961 A	MITCHELL	649 737
2111 B	ROMA	144 714
BLYTHESDALE FORMATION, CLARAVALE SANDSTONE MEMBER		
6558 1868 B	MITCHELL	6118 7357
1882 C	MITCHELL	623 746
BLYTHESDALE FORMATION, KINGULL MEMBER		
6558 2111 A	ROMA	144 714
SOUTHLANDS FORMATION, upper part		
6558 1876 A	MITCHELL	585 757
1882 B	MITCHELL	623 746
1947	MITCHELL	649 735
1953	MITCHELL	666 727
SOUTHLANDS FORMATION, lower part		
6558 1871	MITCHELL	5986 7431
1875 A	MITCHELL	587 758
1877	MITCHELL	587 756
1944	MITCHELL	612 743
1954	MITCHELL	658 733
1957	MITCHELL	6485 7562

SAMPLE	SHEET AREA	GRID REFERENCE
ORALLO FORMATION		
6558 1941 A.B.C.	MITCHELL	6727 7356
1946	MITCHELL	6554 7398
2110	ROMA	370 724
2124 A.B.C.	ROMA	360 725
GUBBERAMUNDA SANDSTONE		
6558 1878	MITCHELL	596 757
1883	EDDYSTONE	6207 7625
1885 B	MITCHELL	611 743
MITCHELL 2	MITCHELL	660 744
WESTBOURNE FORMATION		
6558 1809	TAMBO	4559 9150
1832	TAMBO	4312 9317
1852 C	TAMBO	4123 9577
1864	MITCHELL	563 766
1879 A	MITCHELL	595 763
1884	MITCHELL	610 758
1940	MITCHELL	667 743
1955	MITCHELL	666 746
1959	MITCHELL	651 765
TAMBO 4	TAMBO	434 917
EDDYSTONE 48	EDDYSTONE	6327 7714
EDDYSTONE 50	EDDYSTONE	5202 8173
MITCHELL 2	MITCHELL	660 744
MITCHELL 3	MITCHELL	657 758
MITCHELL 5	MITCHELL	564 760
ADORI SANDSTONE		
6558 1839 C	TAMBO	4360 9411
1849 A.E.F.	TAMBO	4630 9214
1852 A	TAMBO	4123 9577
1853 A	TAMBO	4039 9935
BIRKHEAD FORMATION		
6558 1836	TAMBO	4407 9575
EDDYSTONE 47	EDDYSTONE	6245 8076
MITCHELL 3	MITCHELL	657 758
MITCHELL 6	MITCHELL	561 769
BIRKHEAD FORMATION, SPRINGBOK SANDSTONE MEMBER		
6558 1874	MITCHELL	602 758
1956	MITCHELL	666 746
1958	MITCHELL	656 763
MITCHELL 3	MITCHELL	657 758

SAMPLE	SHEET AREA	GRID REFERENCE
HUTTON SANDSTONE		
6558 1818	TAMBO	4992 9099
1837	TAMBO	4470 9656
1838	TAMBO	4431 9651
1902	JERICHO	4065 0131
1904 A	TAMBO	4119 0090
1918 A	TAMBO	4200 9972
EVERGREEN FORMATION, BOXVALE SANDSTONE MEMBER		
6558 1820 J.H.	TAMBO	4720 9474
1824 D.E.J.	TAMBO	4446 9776
PRECIPICE SANDSTONE		
6558 1820 E	TAMBO	4720 9474
1824 A	TAMBO	4446 9776
1837 A	TAMBO	4474 9661
1916	TAMBO	4189 0014
TAMBO 2	TAMBO	444 977
MOOLAYEMBER FORMATION		
6558 1820 A.C.	TAMBO	4720 9474
1840	TAMBO	4404 9974
1841	TAMBO	4376 9994
1904 B	TAMBO	4119 0090
T 279	TAMBO	4495 0075
T 291	TAMBO	4638 9757
CLEMATIS SANDSTONE		
T 271	TAMBO	4591 0038
T 280	TAMBO	4496 0083
DUNDA SANDSTONE		
6558 1842 B	TAMBO	4592 9868
1843	TAMBO	4650 9924
T 270	TAMBO	4603 0052
REWAN FORMATION		
6558 1845	TAMBO	4785 9811
1846	TAMBO	4793 9813
1848	TAMBO	4783 9848
TERTIARY		
6558 2154	MITCHELL	543 717

APPENDIX II

NOTES ON THE PALYNOLOGY OF BMR SCOUT HOLE

Eddystone 50

by

Elizabeth M. Kemp

At the request of M.C. Galloway palynological preparations from the shallow hole BMR Eddystone 50 were re-examined. These samples, consisting of a core sample from 109 feet, and cuttings from 80-90 feet, 150-160 feet, 200-210 feet and 240-250 feet were examined previously by Dr P.R. Evans, who reported on them briefly in BMR Record 1966/61. No detailed microfloral lists were given at that time. In a verbal communication Evans reported the presence of acritarchs in samples from this hole, and the object of the present re-examination was primarily to determine the horizon at which these occurred, and to observe their abundance.

Evans (1966), on the basis of a preliminary examination, allocated the spore/pollen assemblages from BMR 50 to his palynological unit J6. This unit was considered to include the top part of the Westbourne Formation at that locality. However, in unpublished lists of microfossils compiled by Evans, probably at a later date, he recorded the presence of Cicatricosisporites australiensis in the core sample at 109 feet. The first appearance of this form is considered to mark the lower boundary of unit Kla, so that strictly, the sample could be considered to come from strata of that age. C. australiensis is, however, very rare. Its association in the sample with Murospora florida and Trilobosporites sp. does seem to indicate an horizon very high in J6, if not on the boundary of Kla.

Cuttings from 80'-90' yielded rare acritarchs referable to the genus Micrystridium, suggesting a possibly brackish depositional environment. In the core sample from 109 feet rare specimens of a vaguely defined, probably planktonic form were observed, and referred to the genus Canningia. A single specimen of Horologinella, another algal form, was recovered. These occurrences point to an environment of brackish, possibly near-marine conditions. Unidentifiable specimens of probably dinoflagellate-like bodies were also noted in cuttings from 150-160 feet and 200-210 feet, although these may have derived from caved fragments.

References

EVANS, P.R., 1966 - Palynological studies in the Longreach, Jericho, Galilee, Tambo, Eddystone and Taroom 1:250,000 Sheet areas, Queensland. Bur. Miner. Resour. Aust. Rec. 1966/61 (unpubl.)

THE PETROLOGY OF SOME MESOZOIC SEDIMENTS FROM THE TAMBO AUGATHELLA EDDYSTONE AND MITCHELL 1:250,000 SHEET AREAS — QUEENSLAND.

NOTE: Maturity Index not calculated where sample is calcareous or denominator is zero (i.e. neither feldspar nor rock fragments present in sample

- QUARTZ.
- FELDSPAR.
- ROCK FRAGMENTS.
- ACCESSORIES.
- HEAVY MINERALS.
- MATRIX.
- VOIDS.
- CALCITE.

O PRESENT.
◐ COMMON.
● ABUNDANT.

K K FELDSPAR.
Km MICROCLINE.

Ab ALBITE.
Ol OLIGOCLASE.
An ANDESINE.
La LABRADORITE.

ALL FIGURES REFER TO PERCENTAGES OF TOTAL ROCK.