COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES GEOLOGY AND GEOPHYSICS

RECORDS:

1965/148

PETROGRAPHIC NOTES ON PERMIAN FORMATIONS IN THE MUNDIBBERA 1:250,000 SHEET AREA, QUEENSLAND.

---

by

L.J. BASTIAN

PETROGRAPHIC NOTES ON PERMIAN FORMATIONS IN THE MUNDUBBERA 1:250,000 SHEET AREA, QUEENSLAND

by

L.V. Bastian

Records 1965/148

CONTENTS

	Page
SUMMARY	1
INTRODUCTION	1
BUFFEL FORMATION	3
OXTRACK FORMATION	3
BARFIELD FORMATION	3
FLAT TOP FORMATION	7
GYRANDA FORMATION	8
CONCLUSION	9
REFERENCES	9

APPENDIX A. List of specimen field numbers and registered rock numbers

APPENDIX B. List of abbreviations used in Tables.

PETROGRAPHIC TABLES

FIGURES

Figure 1: Location of Specimens.

Figure 2: Specimen No. T1. Chert in Buffel Formation, showing abundant sponge spicules.

Figure 3: Specimen No. T23. Oxtrack Formation, showing fossil debris in cherty groundmass.

Figure 4: Approximate stratigraphic positions of specimens from Barfield Formation.

Figure 5: Specimen No. T51. Crystal-lithic tuff in Barfield Formation.

Figure 6: Specimen No. T130H. Flat Top Formation; vitric-crystal tuff.

Figure 7: Specimen No. T35B. Gyranda Formation; coarse-grained tuff.

PETROGRAPHIC NOTES ON PERMIAN FORMATIONS IN THE MUNDUBBERA 1:250,000 SHEET AREA, QUEENSLAND.

by

L. V. Bastian

Records 1965/148

SUMMARY

Twenty seven thin sections, from the Permian Buffel, Oxtrack, Barfield, Flat Top, and Gyranda Formations, are described.

The Buffel and Oxtrack Formations are similar, and both contain calcareous marine fossils and sedimentary chert rich in sponge spicules. The Barfield Formation mudstones are cherty and intercalated with arenites composed of reworked volcanic materials; there are primary tuffs towards the top of this unit. Lithologies of the Flat Top Formation, described in the field as hard mudstones, are mostly vitric tuffs with minor crystal admixtures. Specimens from the Gyranda Formation, described in the field as calcareous lithic sandstone, are vitric and vitric-lithic tuffs. The upper part of the Gyranda contains a volcanic conglomerate and several tuff beds.

Tuffs and reworked volcanics are the dominant rock types in these units. Distinctive petrographic features of each unit, which may be useful for correlation, are discussed.

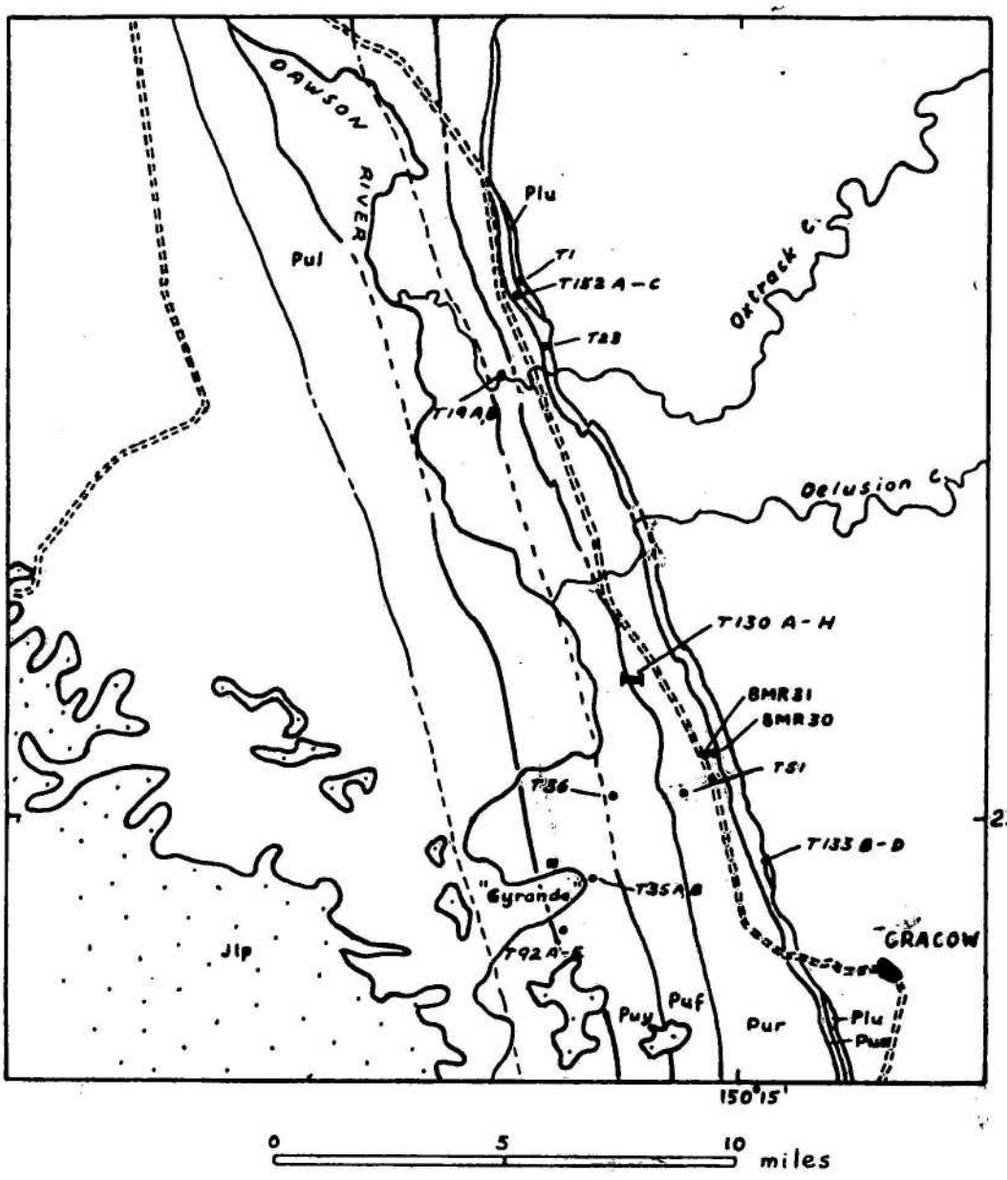
INTRODUCTION

This report contains descriptions of thin sections cut from 27 specimens collected in the Cracow area from five Permian units, namely the Buffel, Oxtrack, Barfield, Flat Top and Gyranda Formations. These specimens were collected in 1963 by Dr. A. Fehr and myself at a number of localities near the Dawson River west and north-west of Cracow in the Mundubbera 1:250,000 Sheet area.

Specimen localities are shown in fig. 1, and their stratigraphic relationships are discussed under the respective formation headings; the stratigraphic position of each specimen is approximate. Section measuring was not possible because of poor outcrops. The stratigraphy has been adopted from the Taroom-Mundubbera geological report (Jensen, Gregory and Forbes, 1964).

The presentation follows the format used for recent petrographic reports, in which the essential data for each thin section are tabulated (Table 1), while comments and special observations are contained in the body of the report. The lithological nomenclature proposed by Pettijohn (1957) is generally followed, but the term "volcanic sandstone" as applied by Williams, Turner and Gilbert (1955) has been used for subgreywackes rich in volcanic detritus. In the case of tuffs in which a compound adjective is required, e.g. vitric-crystal, the major component is the first word, in accord with Pettijohn's nomenclature.

LOCATION OF SPECIMENS



To accompany Record 1965/148

G56/A5/7

Figure 1: Location of Specimens

Key to units:

Precipice Sandstone	J1p
Baralaba Coal Measures	Pu1
Gyranda Formation	Puy
Flat Top Formation	Puf
Barfield Formation	Pur
Oxtrack Formation	Puo
Buffel Formation	Plu

(Other units not plotted)
Specimens prefixed "T" . Shallow drill holes prefixed "BMR".

BUFFEL FORMATION

Specimens T1 and T133B were collected from this unit. T1, from the south end of Mount Ox about 2 miles north of Oxtrack Creek, is a sedimentary chert containing many sponge spicules (Fig.2), and scattered radiolaria, in a subisotropic groundmass which may have originated largely from breakdown of radiolaria. These features indicate silica-rich ocean waters. T133B, from about 3½ miles north-west of Cracow, is a subgreywacke almost completely replaced by dolomite and laumontite; original grain outlines are difficult to recognize in many parts of the thin section. The replacement was probably due to hydrothermal effects from nearby contemporaneous vulcanism.

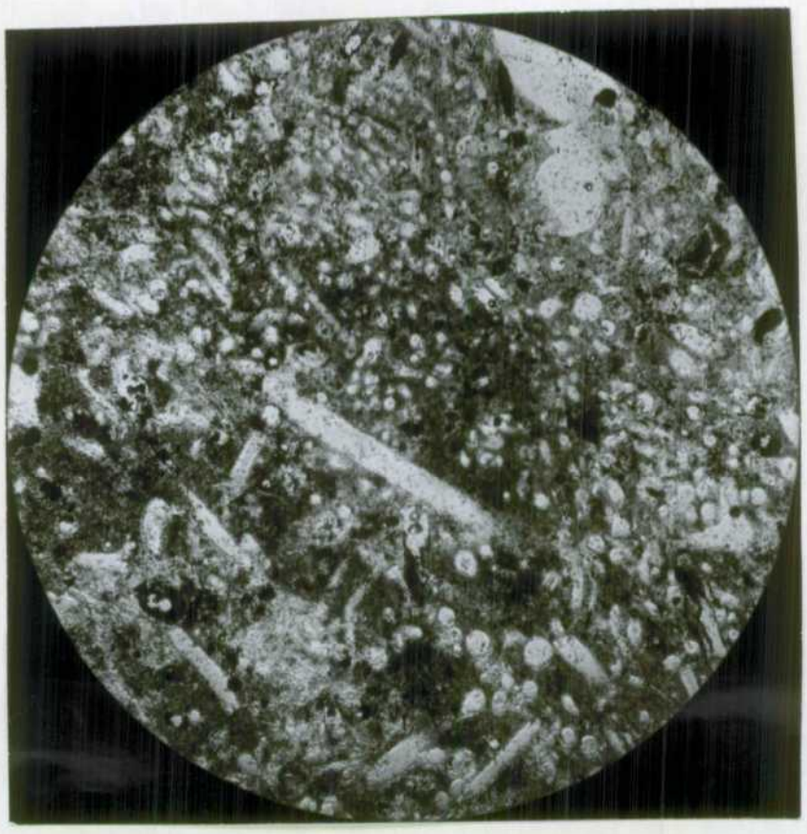
OXTRACK FORMATION. Specimens T133C, T133D, T23 and T152A were collected from this unit. T133C and T133D were collected from the same hill as T133B, about 3½ miles north-west of Cracow. T23 came from a small quarry about ½ mile north of Oxtrack Creek, just east of the Cracow-Theodore Road. T152A came from very close to T1 at the south end of Mount Ox, and slightly higher stratigraphically.

T152A, a chert containing abundant sponge spicules is similar to T1 of the Buffel Formation. Shelly fossils of several types are abundant in most specimens, up to 75% in T133C. The matrix of all specimens, which is commonly almost isotropic, appears to be composed of mixtures of chert (possibly opaline material from macerated spicules and radiolaria) and collophane. Chalcedony spheres appear in the groundmass of T23; some of these are clearly replaced fossil fragments such as crinoid stems (Fig.3), but others have no relic structures and could be of inorganic origin. Similar bodies have commonly been noted in the Permian units, e.g. in U.K.A. Cabawin No.1 (Bastian 1965, p.13). In the field it appeared that T133D which was collected from a hilltop, may have suffered silicification near the level of the exhumed Triassic surface noted by Jensen et al (1964, p.47); however, in thin section it is obvious that the fossil content of T133D is lower than in T133C. Thus the abundant siliceous groundmass in T133D was of primary origin.

BARFIELD FORMATION. This unit is represented by specimens T152B, T152C, T51 and T130 A-G.

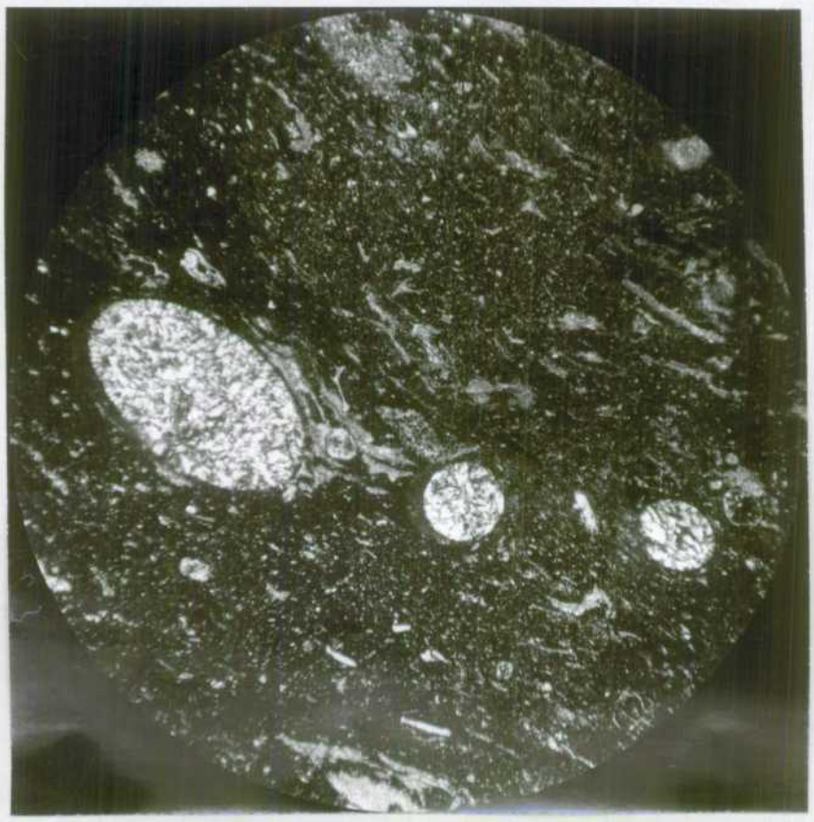
T152B and T152C, collected just south of Mount Ox, are from very close to the base of the unit, and T51, collected about 3 miles east-north-east of Gyranda Homestead, is from near the top of the unit. Specimens T130A to G, collected about 4½ miles north-north-east of Gyranda Homestead, came from the upper third of the unit. The approximate stratigraphic positions of these specimens are shown below.

The lithology of these specimens ranges widely. T152B and C, are fairly typical of large parts of the unit. T152B was collected from a calcareous concretion, and 90% of it is microcrystalline calcite which has apparently replaced detrital clays, probably at an early diagenetic stage. T152C is a cherty claystone, probably equivalent to the lithology T152B would have shown before replacement. Much of the clay-sized material is siliceous, and the rock in hand-specimen is quite tough. Evidently the waters in which these sediments were deposited, were saturated with silica in solution. BMR Nos. 28, 30, and 31, studied by Arman (1965) show similar features, indicating that the lower half of the Barfield Formation is very cherty.



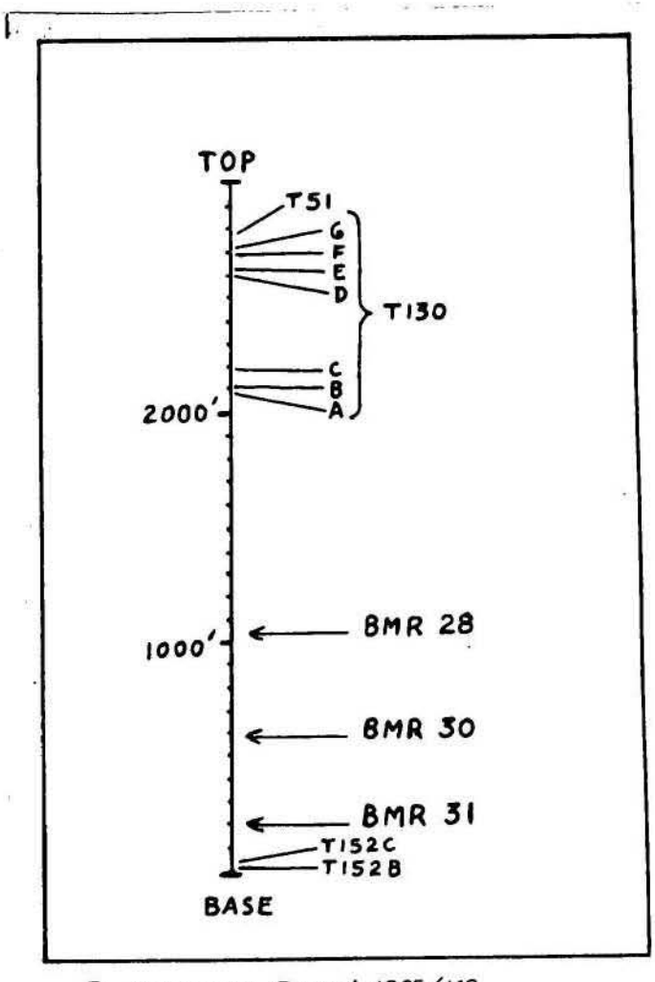
Field 2.75 mm mag. x 40, ordinary light.
Figure 2: Specimen No.T1. Chert in Buffel Formation, showing abundant sponge spicules.

BMR Neg. F/4562



Field 3.4 mm. mag. x 32 crossed nicols.
Figure 3: Specimen No.T23. Oxtrack Formation, showing fossil debris in cherty groundmass, and crinoid columnals replaced by chalcedony.

BMR Neg. F/4553.



To accompany Record 1965/148

G56/A5/8

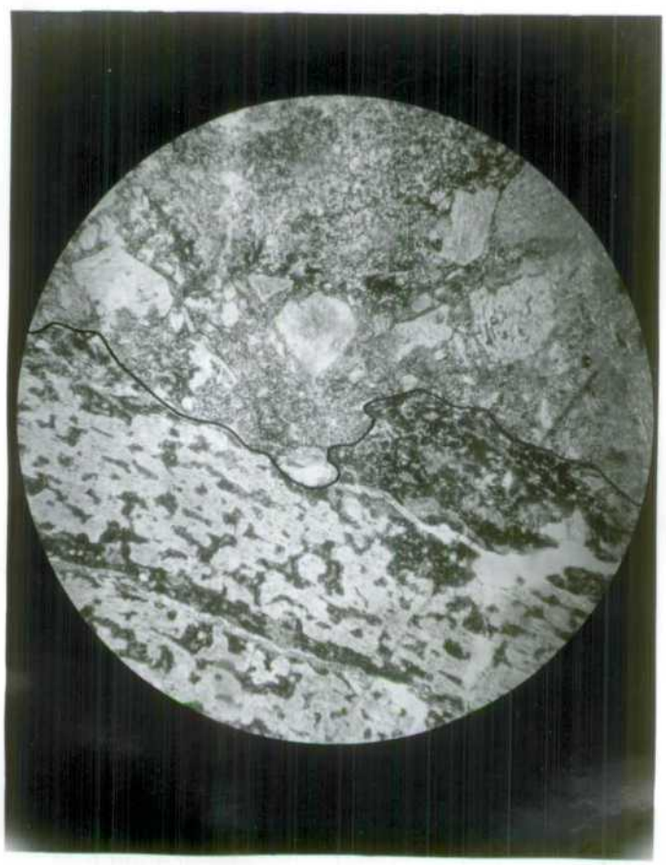
Figure 4:
Approximate stratigraphic positions of specimens from Barfield Formation.

T130A, a limestone, has ill-defined grains of calcite in a microcrystalline calcite matrix. Both grains and matrix have been slightly recrystallized; the matrix contains fine impurities and has a darker tone than the grains. Small calcite veinlets cut across these grains, which suggests the grains are probably primary constituents of the rock. T130B is a volcanic breccia or agglomerate; the thin section does not show the large-scale features of the rock. Fractures and cavities in this rock are filled with botryoidal calcite.

T130C, a calcareous siltstone, is typical of much of the upper part of the unit. The presence of spicules indicates that the sediment was deposited in silica-rich waters. T130D, E and F represent a succession of volcanic sandstones which increase in grain-size and become more poorly sorted upwards. The volcanic source of these rocks was nearby. Shard-like glass grains in T130F may represent primary tuff material. Although there are no such shards in T130G, the poor sorting and the lack of orientation of grains point strongly to a tuffaceous origin; rounding of some grains suggests slight reworking, but this feature could have been caused by melting. The rock has been called a lapilli tuff. Both labradorite and albite occur in these specimens.

T51, a crystal-lithic tuff from about the same horizon as T130G, contains many fragments of a pumiceous lava, the bulk of which is made up of a greenish- or yellowish-brown phyllosilicate; probably a chlorite. Associated with this lava are many albite crystals with sieve-textured resolution; holes in these crystals are filled with the same phyllosilicate (Fig.5). Some lithic fragments

in this specimen have irregular shapes strongly suggestive of a lack of re-working; this is supported also by a virtual absence of dimensional orientation of grains and their lack of sorting. Apatite is common in the vesicular rock fragments of this specimen.



Field 3.5 mm mag. x 25 ordinary light.
Figure 5: Specimen No.T51. Crystal-lithic tuff in Barfield Formation, showing albite crystal with sieve-textured resolution, and still attached to it a portion of the lava from which the pyroclast was derived.

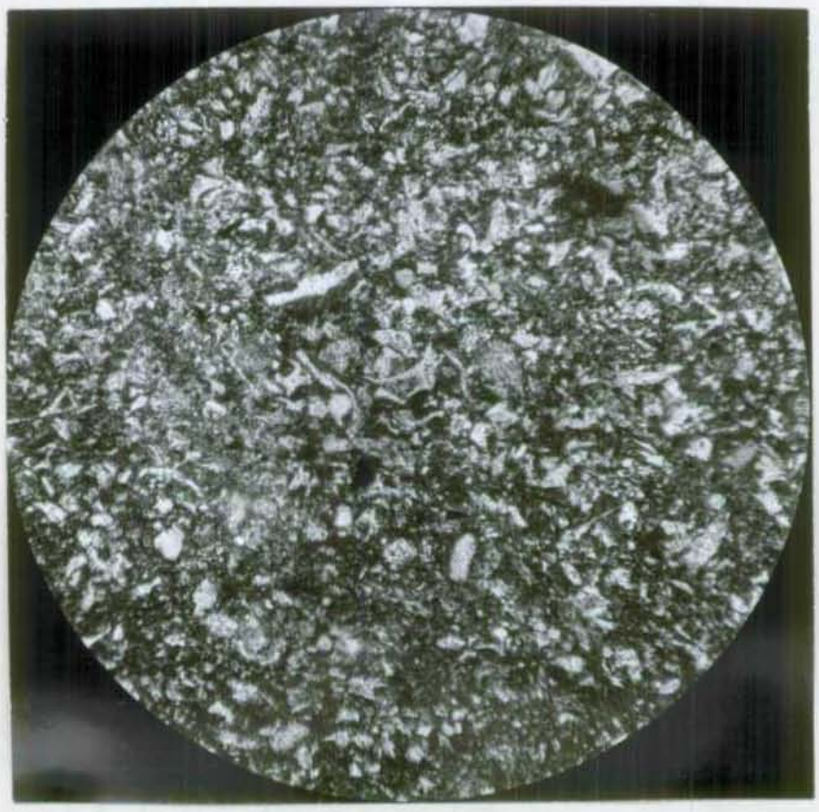
BMR Neg. G/8022A.

FLAT TOP FORMATION. This unit is represented by specimens T130H, T19A, T19B and T36. Specimen T130H, collected in the same creek as specimens T130A to G, came from the base of the unit. T19A and B, collected from Oxtrack Creek about 2½ miles south-south-west of Mount Ox, probably came from close to the base. T36, collected about 3 miles east-north-east of Gyranda Homestead, came from about the middle of the unit.

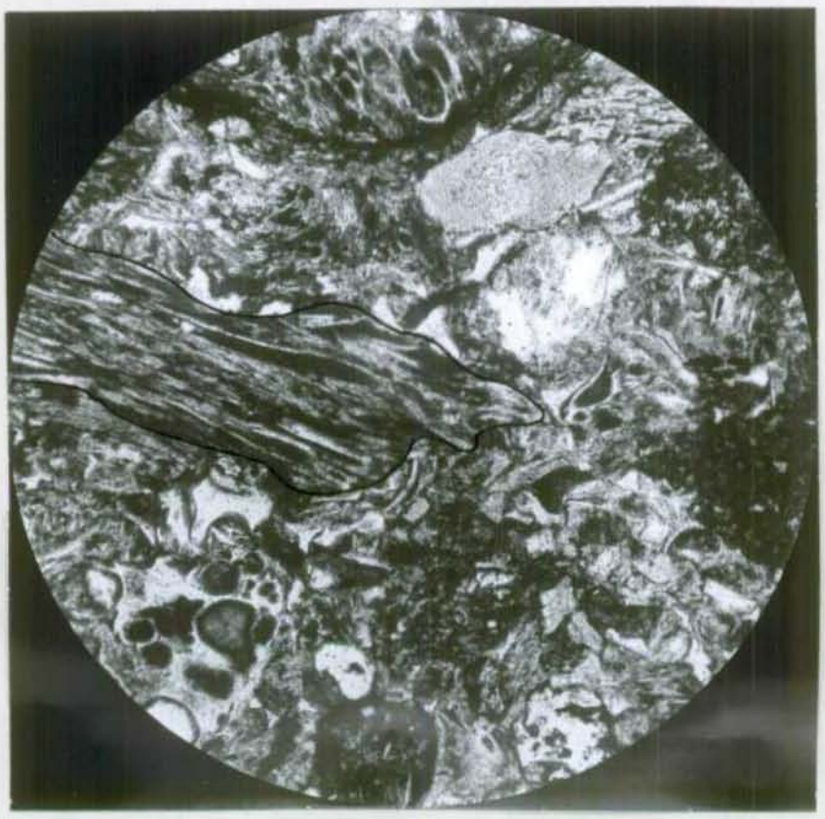
In hand-specimen these rocks are very tough, and commonly show strongly contorted bedding due to slumping when the sediment was still soft.

They are all primary tuffs or tuffaceous sediments. T19A and B are siliceous vitric tuffs of very fine and fine grainsize, containing a minor crystal admixture; T130H has more crystals but otherwise is very similar (Fig.6). The shards are rather difficult to recognize because of their small size and a similar R.I. to the devitrified siliceous glass "dust" which comprises the matrix of these rocks (R.I. $<$ balsam); however where replaced by calcite or outlined by iron oxides the shards are obvious. The plagioclase is albite.

T36 is mainly devitrified glass dust; shards could not be identified. The presence of a few radiolaria indicates marine deposition, at least for part of this unit.



Field 1.8 mm, mag x 62, ordinary light.
Figure 6: Specimen No. T130H. Flat Top Formation; vitric-crystal tuff in which glass shards and crystals were disintegrated to a uniformly fine size.
BMR Neg. G/8016.



Field 2.2 mm, mag x 50, ordinary light.
Figure 7: Specimen No. T35B. Coarse-grained tuff, showing on left a fragment of pumice; also pieces of froth, smaller shards and crystals.

BMR Neg G/8020.

GYRANDA FORMATION. This unit is represented by specimens T35A, T35B and T92A-E.

Specimens T35A and T35B were collected from beside the pumping station on the Dawson River, about 1 mile south-east of Gyranda Homestead. They are from roughly 500' above the base. The unit in this area was estimated at about 1,600' thick by Jensen et al., (1964, p.29). Specimens T92A to E were collected about 1¼ miles south of the pumping station, from near the top of the unit; they were taken from loose surface blocks on a hillside.

T35A and T35B, in contrast to the specimens from the Flat Top Formation, have large and very well defined shards. T35B has abundant fragments of pumice (Fig.7) and older tuffs, indicating proximity to volcanic eruptions. The plagioclase is andesine. Small woody fragments are abundant, and concentrated into bands and laminae; the lithology is quite distinctive and differs markedly from that of the Flat Top Formation.

T92A is a conglomerate composed of reworked volcanics, probably derived from theCamboon Andesite or Auburn Complex to the east. The predominant rock types in this conglomerate are acid volcanic flow rocks with devitrified glassy groundmasses - probably rhyolites. Feldspathic volcanic flow rocks, such as dacite or rhyodacite, are also very common (one grain of andesite is present in the thin section). Jensen et al. (op.cit. p.12) show that andesite and dacite are the most prevalent rock types in the Camboon Andesite, while rhyolitic flows

are minor; this does not preclude derivation of the conglomerate from that unit, as the parts of the Camboon Andesite then exposed could have had different proportions of the rock types to those now seen - especially a greater proportion of rhyolitic extrusives. Clasts of devitrified glass, lacking flow textures, are somewhat less common in this conglomerate than the various flow rocks.

T92B is a pebble of volcanic sandstone from the conglomerate, and the remainder of the specimens from this locality are tuffs. T92D appears to be more basic than other tuffs in these units. The plagioclase in T92D is labradorite, and euhedral biotite crystals are abundant. This latter feature has been commonly noted in tuffs intercalated in the Upper Permian coals (e.g. in Cabawin No.1 and Cabawin East No.1), and may prove to be a useful diagnostic character of this part of the Bowen Basin sequence.

CONCLUSION

For the purposes of correlation there are many petrographic features by which to identify these units. The hard mudstones of the Flat Top Formation have been shown to be vitric tuffs with some distinctive characteristics. Other differences such as the composition of plagioclase, the presence and size of shards, ratio of crystal and lithic components in the tuffs, are useful in identification.

The environment of deposition of these units was predominantly marine, with silica-rich waters which probably derived their silica from fine volcanic dust blown in, or from submarine vulcanism. Vulcanism prevailed throughout the period and the supply of terrigenous material seems to have been low; the bulk of the sediment was derived from volcanics.

REFERENCES

ARMAN, M., 1965 : Petrographic notes on Bowen Basin shallow holes drilled in 1963. Bur.Min.Resour.Aust. Rec. in prep.

BASTIAN, L.V., 1965 : Petrological report on the basement to Lower Jurassic sections of some subsidized wells in the Surat Basin. Bur.Min.Resour.Aust. Rec. 1965/120 (unpubl.).

JENSEN, A.R., GREGORY, C.M., AND FORBES, V.R., 1964 : The geology of the Taroom 1:250,000 Sheet area and of the western part of the Mundubbera 1:250,000 Sheet area, Queensland. Ibid, 1964/61 (unpubl.).

PETTIJOHN, F.J., 1957 : SEDIMENTARY ROCKS. Harper, New York.

WILLIAMS, H., TURNER, F.J., AND GILBERT, C.M., 1955 : PETROGRAPHY. Freeman, San Francisco.

APPENDIX A.

LIST OF SPECIMEN FIELD NUMBERS AND REGISTERED ROCK NUMBERS.

Formation	Field Number	Registered rock Number
Buffel Fm.	T1	R16308
	T133B	R16309
Oxtrack Fm.	T133C	R16312
	T133D	R16313
	T23	R16311
	T152A	R16310
Barfield Fm.	T152B	R16314
	T152C	R16315
	T51	R16323
	T130A	R16316
	T130B	R16317
	T130C	R16318
	T130D	R16319
	T130E	R16320
	T130F	R16321
	T130G	R16322
Flat Top Fm.	T130H	R16326
	T19A	R16324
	T19B	R16325
	T36	R16327
Gyranda Fm.	T35A	R16328
	T35B	R16329
	T92A	R16330
	T92B	R16331
	T92C	R16332
	T92D	R16333
	T92E	R16334

APPENDIX B.

LIST OF ABBREVIATIONS USED IN TABLES

ab.	above
abt	about
andes.	andesine
ang.	angular
biot.	biotite
blk	black
brn	brown
c	common
c.	carbonaceous
calc	calcareous
chalc.	chalcedony
crs.	coarse
devit	devitrified
Fe ox	iron oxide
frags	fragments
grn	green
hyd	hydrated
incl.	including
labrad	labradorite
loc.	locality
lt	light
max	maximum
microXl	microcrystalline
mod	moderate
phyllo.	phyllosilicate
pyrox	pyroxene
r	rare
r.	rather
rd	rounded
repl	replacement
reXd	recrystallized
rks	rocks
sltst	siltstone
subang	subangular
subrd	subrounded
u	uncommon
volc	volcanic
Xl	crystal
Xline	crystalline
yel	yellow

PETROGRAPHIC TABLES

Specimen Number and name	TEXTURE: sorting	grain-size (mm)	roundness	sphericity / orientation	PERCENTAGE ESTIMATES: fossils	quartz	micas	shards	plagioclase	rock fragments	primary precipitate	matrix	cement	alteration	ACCESSORIES: tourmaline	zircon	apatite	epidote	hornblende	glauconite
BUFFEL FORMATION																				
T1 Spicular chert		spicules - .02 - .1mm diam.		mod.	50 (spicules, few radiolaria)			plus (10% brnish clays and opaque matter)				40 (opaline detritus)				r				
T133B zeolitized dolomitic subgreywacke	good	max. .35 mode. .2	ang.-subang.	low	few (mostly replaced	<1			10 (20% andesite 10% other volcs)	30			(20% laumontite) (40% dolomite	60		r				u
OXTRACK FORMATION																				
T133C coquina					75 (crinoids, corals, bryozoa)	<1						<25 (20% isotropic, (5% clays)	?collophane,)	Feox.						
T133D fossiliferous, cherty claystone					40 (crinoids, corals, shelly fossils)						5 (chalcedony)	55 (debris from fossils, incl. ?collophane)								
T23 fossiliferous, cherty, claystone					40						5 (chalc. spheres)	55 (collophane, chert, c.matter)		Feox.						
T152A spicular chert		spicules - .02 - .1mm diam.			35 (spicules,) (?radiolaria)	r		plus (greenish phyllosilicates) (in cavities)				>60 (opaline) (detritus,) (& illite)								
BARFIELD FORMATION																				
T152B silty micrite		calcite <5μ	ang. silt.		u minor blk. matter	5%						>90 micro-X1. calcite								
T152C cherty claystone		max. .1	ang.			15% & chert						85 (illite, ?cherty matter, & C. matter)								
T51 spilitic crystal-lithic tuff	un-sorted	max. (hand-spec.) 7mm.	ang. (-subrd)	low weak					35 (albite, sieve-texture)	30 (flow-rocks,? spilitic volc. glasses).	20 &		15 (<10% grn.-brn.phyllo., 5% calcite).						c	u (mostly repl.by calcite)

Spec. No. Name.	TEXTURE: sorting	TEXTURE: grain-size (mm)	TEXTURE: roundness	TEXTURE: sphericity / orientation	PERCENTAGE ESTIMATES: fossils	quartz	micas	shards	plagioclase	rock fragments	primary precipitate	matrix	cement	alteration	ACCESSORIES: tourmaline	zircon	apatite	epidote	hornblende	glauconite
T130A calcarenite (?) or pelmicrite					(plus- 1% C. matter u. pale brn. ? mica)						<100 (abt. 30% rd. grains. ? (.1-.2 mm diam.) of calcite & about 70% micro Xl. calcite)									
T130B soda-rhyolite, brecciated		phenocrysts >3mm.			phenocrysts of albite, quartz, pyroxenes and ?K-feldspar, strongly replaced by calcite and chlorite; groundmass micro-Xl., with microlites and vesicles; fractures filled with botrycidal calcite.															
T130C fossiliferous, calcareous siltstone	fairly good	max. .08 mode .03	ang. (-subrd.) (glass)		10 (spicules & calc. fossil debris)		u	15		10 (?devit. glass)	(plus minor c. frags)	5 (illite)	(calcite .1-.2mm strong replacement)	60						
T130D volcanic sandstone	mod.	max. .75 mode .30	ang-subang (-subrd.)	mod nil					30 (labrad. & albite)	55 (andesite & glassy flow rocks)		<10 (micas, glass)		<10 (calcite)						
T130E calcareous, volcanic sandstone	fairly good	max. .4 mode <.2	ang.- (subang.)	low nil	u. (crinoid)		r		25 (labrad., ? andes.)	20 (andesite, vesicular, minor tuff, sltst.)				>50 (calcite, & <5% Feox.)						
T130F calcareous, volcanic sandst. (?tuffaceous)	rather poor	max. .9 crs. mode .8 fine mode .3	ang.- (subang.)	fairly low weak				<5	>30 (labrad.)	<20 (15% andesite, <5% glassy flow rocks)				45 (calcite)		(plus 2% altered ?pyrox.)				
T130G lapilli tuff (?reworked)	poor	max. 7 crs. mode 2 fine mode .4	ang.- (subang)	mod. weak			5 (grn.) (?chlorite)		20	40 (25% Xline flow rocks 15% glassy " ")				35 (calcite)		u				
FLAT TOP FORMATION																				
T130H vitric - crystal tuff	mod.	max. .1 mode .03	ang.	low mod.			r	25	20 (albite)	25 (<5% flow rocks 20% glass frags.)		25		5	r	r (plus- 1% c. matter, along stylolites and in patches)				
T19A vitric tuff	mod.	max. .4 crs. mode .15 main mode .05	ang.- (subang.)	mod. mod.				>5	<10 (?albite)	<10 (as ab.)	(vitric, with fine reXd. shards)	>40	(20% calcite 15% hyd.Feox)	35						

Spec. No. Name	TEXTURE: sorting	grain-size (mm)	roundness	sphericity / orientation	PERCENTAGE ESTIMATES: fossils	quartz	micas	shards	plagioclase	rock fragments	primary precipitate	matrix	cement	alteration	ACCESSORIES: tourmaline	zircon	apatite	epidote	hornblende	glauconite
T19B vitric tuff	mod.	max. .25 crs. mode.12 main mode<.05	ang. (-subang)	mod. / mod.		<1		5	10	15 (Xline & glassy flow rocks)		45 (as ab)	(10% 15% hyd.Feox)	25 calcite			u			
T36 silty, tuffaceous claystone		max. .05	ang.		r (radiolaria)	↑ 10 ↑				r	(60% & 30% isotropic)	90 chert patches, ? rexd. shards,								
GYRANDA FORMATION																				
T35A vitric tuff	rather poor	max. .3 crs. mode .15 main mode .08	ang. (-subang)	low / strong		<1	r	35	<10 (andesine)	10 (volcs.)		25 (light brown glass)		>20 (chlorite in bubbles, streaks)	r (plus- woody frags.)					
T35B lithic-vitric tuff	very poor	max. 1.5 crs. mode .6 fine mode .1	ang. & subrd. (? by melting.)	fairly low		1	1	25	10 (zoned, An40)	>50 (pumice, tuffs)		<10			r					
T92A volcanic conglomerate	poor	max. 5 mode 2 max. (hand-spec) 2cm.	(subang) -subrd. (-rd)						u	>80 (<20 devit. glass 40 glassy flow rks. 25 Xline " ") e.g. dacite		(chert, chalcedony and yel.-brn. phyllo.)		15						
T92B pebble from above loc. - volcanic sandstone.	poor	max. 3 mode 1	(subang) -subrd. (-rd)	mod. / slight		<1			5	75 (andesite, rhyolite, vitric and vitric -Xl tuff)				20 (calcite)						
T92C vitric tuff	good	max. .06				↑ <10 ↑		50				40 (cherty)								
T92D vitric-crystal tuff	very poor	max. 1.5		v. low / strong		<5 (biotite Xls.)		>10	>20 (labradorite An67)			>50 (light brown glass)		<5						
T92E vitric tuff	fairly good	max. .1				5 "grn. biot."		25	2	<10		60 (devit. glass, pale brown)								