Tasmania Department Of Resources and Energy

Division of Mines and Mineral Resources — Report 1990/06

Limestone resources of the Maydena–Florentine Valley area

by C. R. Calver

Abstract

This reconnaissance study represents an initial search for a quarryable limestone reserve in southern Tasmania of >92–95% $CaCO_3$ and of the order of 10^6 tonnes in size. In the Maydena area, the Cashions Creek and Benjamin Limestones (Ordovician, Gordon Group) are possible hosts to such a reserve. The dip of bedding in this area means that a stratigraphic interval of adequate grade must be of the order of 50 m thick to provide a quarryable section with minimal overburden. Reconnaissance grab-sampling indicates that the Cashions Creek Limestone, ca. 150 m thick, may be largely or wholly of adequate grade. Several prospective intervals up to 60 m thick are indicated in the 1300 m thick Benjamin Limestone, but grades are more variable, reflecting lithologic heterogeneity, and generally lower. Both formations appear less prospective in the Florentine Valley because of variable and generally lower grades. Environmental criteria suggest a focussing of further work at Risbys Basin, 2 km SW of Maydena.

INTRODUCTION

This report outlines the results of a short investigation into the limestone resources of the Maydena–Florentine Valley area. The aim of the study is to locate possible alternative limestone sources to Newlands Quarry, operated by Benders Spreading Services Pty Ltd at Lune River. Size and grade of the required resource are dictated largely by the needs of Benders' main customer, the Pasminco-EZ zinc plant at Risdon, which consumes ca. 50 000 tonnes of limestone per annum of grade >92% $CaCO_3$, currently supplied from Newlands Quarry. A reserve of the order of one million tonnes of similar or better grade is therefore required. An added constraint is that for economic reasons overburden must be minimal.

The Ordovician Gordon Group limestone in the Maydena–Florentine Valley area is the only readily accessible limestone occurrence in southern Tasmania where a resource of adequate size and grade is likely to be found, outside the contentious Ida Bay–Lune River area. Permian limestones are widespread in southeastern Tasmania but typically have grades that are clearly too low to be considered here.

The limestone sequence in the Maydena–Florentine Valley area is thick (ca. 2000 m) and areally extensive (ca. 150 km^2). Information on limestone quality previous to this study was scanty and indicated that overall, the sequence is marginal with respect to the required grade. Therefore the main thrust of this investigation was mapping of limestone occurrences in the Maydena area not previously covered by the 1:50 000 series geological maps, followed by sampling of measured sections aiming to delineate more attractive intervals within the sequence. Sampling was concentrated in the Maydena area, which enjoys a slight transport advantage over the Florentine Valley, and where greater relief allows the probability of better quarry sites. Major element analyses of 111 samples were carried out by the Department's laboratory in Launceston.

Dr C. P. Rao, of the University of Tasmania, kindly provided analyses of a further 131 samples from the Florentine Valley, from which $CaCO_3$ contents were calculated.

Overall, grades in the Maydena–Florentine area appear generally somewhat lower than at Newlands Quarry. An added disadvantage is that since bedding nearly everywhere dips moderately to steeply, a prospective interval must be relatively thick (>ca. 50 m) if overburden is not to become prohibitive. However the data from the Maydena area indicate the possibility of intervals of adequate grade and thickness in the Cashions Creek Limestone and in the lower part of the Benjamin Limestone. Further sampling, particularly of the Cashions Creek Limestone, is required. Fully-cored diamond drilling of these formations would be necessary to fully establish the extent of any prospective intervals.

Further work should probably be focussed on the Risbys Basin area 2 km SW of Maydena, where quarrying would not affect important karst systems and would have less visual impact than alternative sites NW of Maydena.

PREVIOUS WORK

The only previous work specifically devoted to the economic aspects of the limestone of the area in question was by Hughes and Everard (1953), who mapped the geology of the Maydena area and presented the results of eleven analyses. The lower cherty part of the limestone sequence (now known as the Karmberg Limestone) was reported to be of poor quality, with analyses averaging about 76% $CaCO_3$. Higher parts of the sequence (Cashions Creek and Benjamin Formations) were reported to be variable but in general considerably more attractive, averaging 91% $CaCO_3$ and 1% MgO (in close agreement with new data presented below). Hughes and Everard indicated potential quarry sites northwest of the Junee Cave reserve and at Risbys Basin. Shortly afterwards a quarry was opened at the former site by Australian Newsprint Mills, the limestone mainly being used in the bleaching process at the Boyer paper mill.

The bulletin by Hughes (1957), a state-wide compilation of limestone resources, reproduces most of Hughes and Everard (1953) and cites other reconnaissance work on the Florentine area (Dickenson, 1943; Jennings, 1955). Hughes (1957) reported the Junee Quarry to be producing 2,500 tons of limestone per annum at an average grade of 95% $CaCO_3$. This quarry is now only worked intermittently for road gravel.

Systematic regional mapping has established the stratigraphy and distribution of the limestone in the Florentine Valley (Corbett and Banks, 1974; Brown *et al.*, 1982), and several mappable units were differentiated within the limestone sequence. A considerable volume of detailed work has been carried out on the stratigraphy and sedimentology of the limestone (Weldon, 1974; Whyte, 1974; Calver, 1977; Page, 1978; Calver, 1990; Rao, in press) but these studies provide no analytical information relevant to economic potential.

LOCATION AND ACCESS

Maydena is situated in the Tyenna River valley in central-south Tasmania, 93 km by road from Hobart (*cf.* Lune River, 103 km from Hobart). A railway also serves the Tyenna Valley, terminating at the ANM depot 3 km west of Maydena. The Florentine Valley lies a further 20 km to the northwest, seperated from the Tyenna Valley by a highland divide. Practically all of the limestone country in the Maydena–Florentine area lies within the forestry concession granted to Australian Newsprint Mills, and an extensive network of unsealed roads constructed and maintained by ANM provides ready access to most parts of the area.

STRATIGRAPHY

Limestone of the Gordon Group ('Gordon Limestone' of earlier and vernacular usage) comprises a conformable sequence almost 2000 m thick in the Florentine Valley. The limestone is conformably underlain and overlain by siliciclastic rocks (Florentine Valley Formation and Arndell Sandstone, respectively). Three formations have been defined (Karmberg, Cashions Creek and Benjamin Limestones: Corbett and Banks, 1974) and these are also readily differentiated in the Maydena area (Whyte, 1974; fig. 1).

Karmberg Limestone

This, the oldest carbonate formation, is approximately 450 m thick, and consists of argillaceous lime mudstone with calcareous siltstone near the base and chert near the top. Typically the rock carries a stylolitic fabric of anastomosing argillaceous, dolomitic seams. Nodules and layers of chert may comprise a few percent to 50% of the rock volume in the upper part of the formation (Wherretts Chert Member of Corbett and Banks, 1974).

Cashions Creek Limestone

This is a distinctive unit consisting of about 150 m of thick-bedded, oncolitic, fine-grained calcarenite. Oncolites are usually ca. 10 mm in diameter in the Maydena area but attain 40 mm in some Florentine Valley localities (Weldon, 1974). The oncolites are supported by a matrix of fine-grained, slightly dolomitic grainstone. Silicification of fossils and some oncolites is commonly seen in the Florentine Valley, while the basal part of the formation locally contains chert nodules in the Maydena area. In this latter area part of the unit consists of oncolite-free calcarenite.

The Cashions Creek Limestone appears to be more resistant to erosion than the enclosing sequence, and consequently is relatively well exposed. In the Florentine Valley the formation typically forms low hills rising 10–20 m above the valley floor.

Benjamin Limestone

This formation, about 1300 m thick, consists of a variety of different limestone types interbedded on a scale of metres to tens of metres. In the Florentine Valley, Corbett and Banks (1974) divided the formation into two subequal units, the Lower and Upper Limestone Members, which are separated by a thin (15 m) siltstone unit, the Lords Siltstone Member. Because of poor outcrop, the Lords Siltstone has been located in only a handful of places and this lithostratigraphic subdivision of the Benjamin Limestone is not generally applicable.

The Benjamin Limestone is a heterogeneous sequence of different limestone types. The lithofacies scheme of Calver (1990) is used here to characterise and subdivide the measured sections (Table 1). These lithofacies recur throughout the sequence, but broad variations in relative abundance are evident in the Florentine Valley (Calver, 1990), and the Maydena sections (figs. 2–4) are qualitatively very similar.

The lowest 150 m of the Benjamin Limestone consists almost entirely of lithofacies 5 (poorly fossiliferous micrite). The interval 150–500 m above the base is dominated by lithofacies 5, 6, 2 and 1, typically in a cyclic succession (Calver, 1977, 1990). At approximately 300 m above the base in the Florentine Valley there is a unit up to 20 m thick of coralline limestone (lithofacies 10), which probably correlates with a similar unit in the Maydena area named the Sunshine Spur Coralline Member by Whyte (1974) (see fig. 3). In the top 50–100 m of the Lower Limestone Member, and in the whole of the Upper Limestone Member, the intertidal lithofacies (lithofacies 1, 2, 4, 5, 6), previously abundant, become relatively rare and subtidal facies (especially 7, 8, 10) are far more abundant (Table 1).

Most of Tasmania's high grade industrial limestone reserves are within equivalents of the Benjamin Limestone. Summons (1981) found that birdseye limestone (lithofacies 1) gave the best analytical results in terms of $CaCO_3$ content at Ida Bay, while Banks (1989) also mentions coralline biomicrite (*cf.* lithofacies 8, 10) as showing high grades.

STRUCTURE

A series of open folds, with wavelengths of several kilometres, comprise the Florentine Synclinorium in which the Gordon Group occurs. The folds are horizontal or plunge gently north. Dips in the limestone are moderate (30–60°) or somewhat steeper in the western part of the valley. A major fault, the Misery Fault, delimits the eastern margin of the synclinorium, bringing Parmeener Supergroup (Permo-Carboniferous) rocks against Ordovician limestone (Corbett and Banks, 1974; Brown *et al.*, 1982).

The Maydena area (fig. 1) is separated from the Florentine Valley by a highland divide capped by Parmeener Supergroup rocks and Jurassic dolerite. Structure in the limestone sequence is dominated by a southward extension of the Westfield Syncline.

Dips are mostly moderate, and quite gentle (10–25°) in the Cave Hill area. A southward extension of the Misery Fault downthrows a small area of limestone in the floor of the John Bull valley.

A separate area of limestone at Risbys Basin, south of Maydena, is isolated by major faults. Bedrock geology under the flats north of Pine Hill and west of the ANM depot is largely obscured by Quaternary cover, but limestone may underlie part of this area.

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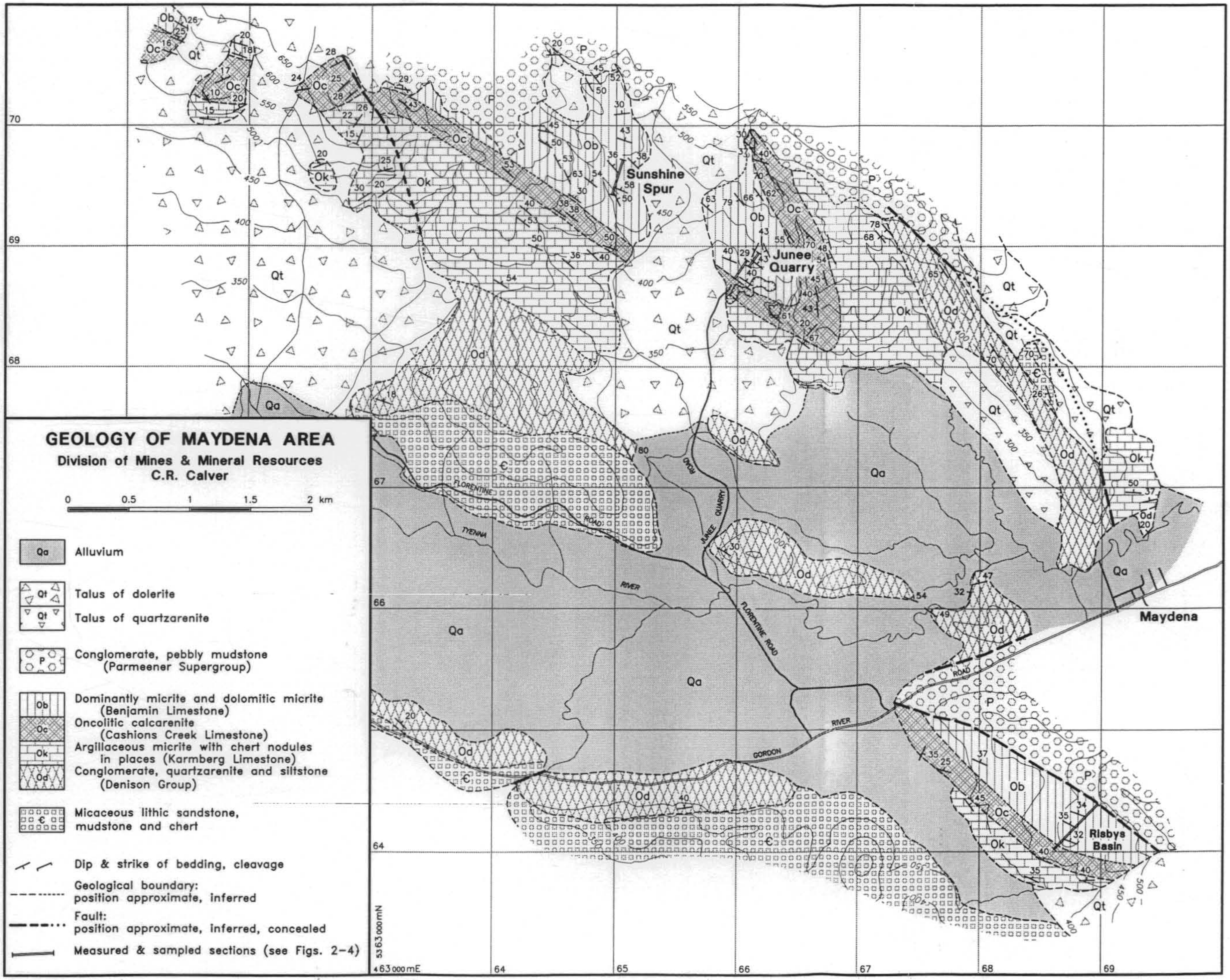

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Figure 1.

Table 1. *Lithofacies of the Benjamin Limestone.*

ENVIRONMENT	LITHOFACIES	FAUNA
UPPER INTERTIDAL	1. Birdseye limestone: pale grey micrite or fine packstone–grainstone; abundant irregular to laminoid coarse spar-filled fenestrae. Rare pseudomorphs after gypsum.	Ostracodes, rare large hormotomids, spar-filled vertical borings.
	2. Algal-laminated limestone: pale to dark grey micrite and pelmicrite; persistent cryptalgal lamination; domed stromatolites, mudcracks, flat-pebble breccias, lenses of skeletal debris common.	Ostracodes, rare gastropods, allochthonous skeletal debris.
LOWER INTERTIDAL	3. Peloidal grainstone: well-sorted, fine- to coarse-grained calcarenite, dominantly massive, rarely cross-bedded.	Allochthonous skeletal debris.
	4. *Tetradium* boundstone: *in situ* dendroid-fasciculate *Tetradium* colonies in micrite, and reworked *Tetradium*-rich wackestone.	*Tetradium*; other taxa rare.
	5. Poorly fossiliferous pale to dark grey dolomitic micrite: thin to medium bedded with dolomite "stringers". Common random to vertical dolomitised burrows. Thin grainstone beds (channel lag ?).	Two or more trace fossil taxa; low diversity molluscan assemblages in grainstone layers.
QUIESCENT SUBTIDAL	6. Horizontally burrowed micrite: similar to 5 but with abundant *Chondrites*-like bedding-parallel burrows.	*Chondrites*-like trace fossil; moderately diverse nuculoid–orthid–gastropod dominated assemblages in grainstones.
	7. Argillaceous micrite: massive, bioturbated, brown-weathering black micrite with bituminous and terrigenous (mud, silt) impurities and pyrite.	Unfossiliferous or with cryptostome-dominated assemblage (L.L.M.); diverse fauna with rolled corals (U.L.M.).
	8. Fossiliferous micrite: dark grey to black, massive or poorly bedded, bioturbated, sparsely to richly fossiliferous micrite; dolomitised burrows in some units.	Very diverse assemblages: brachiopods, molluscs, trilobites, bryozoans, algae corals; some in growth position.
HIGH ENERGY SUBTIDAL	9. Oncolitic limestone: oncolites dispersed in fine grainstone to packstone matrix.	Sparse fragmented fauna.
	10. Bioclastic grainstone: coarse grainstone to packstone largely composed of crinoidal, coralline and algal debris.	Diverse fauna dominated by corals, stromatoporids, and calcareous algae, rarely in growth position.

A fault with a throw of approximately 150 m was mapped in the Chrisps Road area, and is exposed in the wall of a sinkhole at DN628705. Another fault is exposed in the lower section of the Junee Quarry. This structure dips SW, and striations suggest reverse movement. No beds can be correlated across this fault but the sequences on either side are similar (fig. 2), suggesting a maximum throw of a few tens of metres. Slickensided bedding planes in the Junee Quarry are in accord with flexural slip during folding.

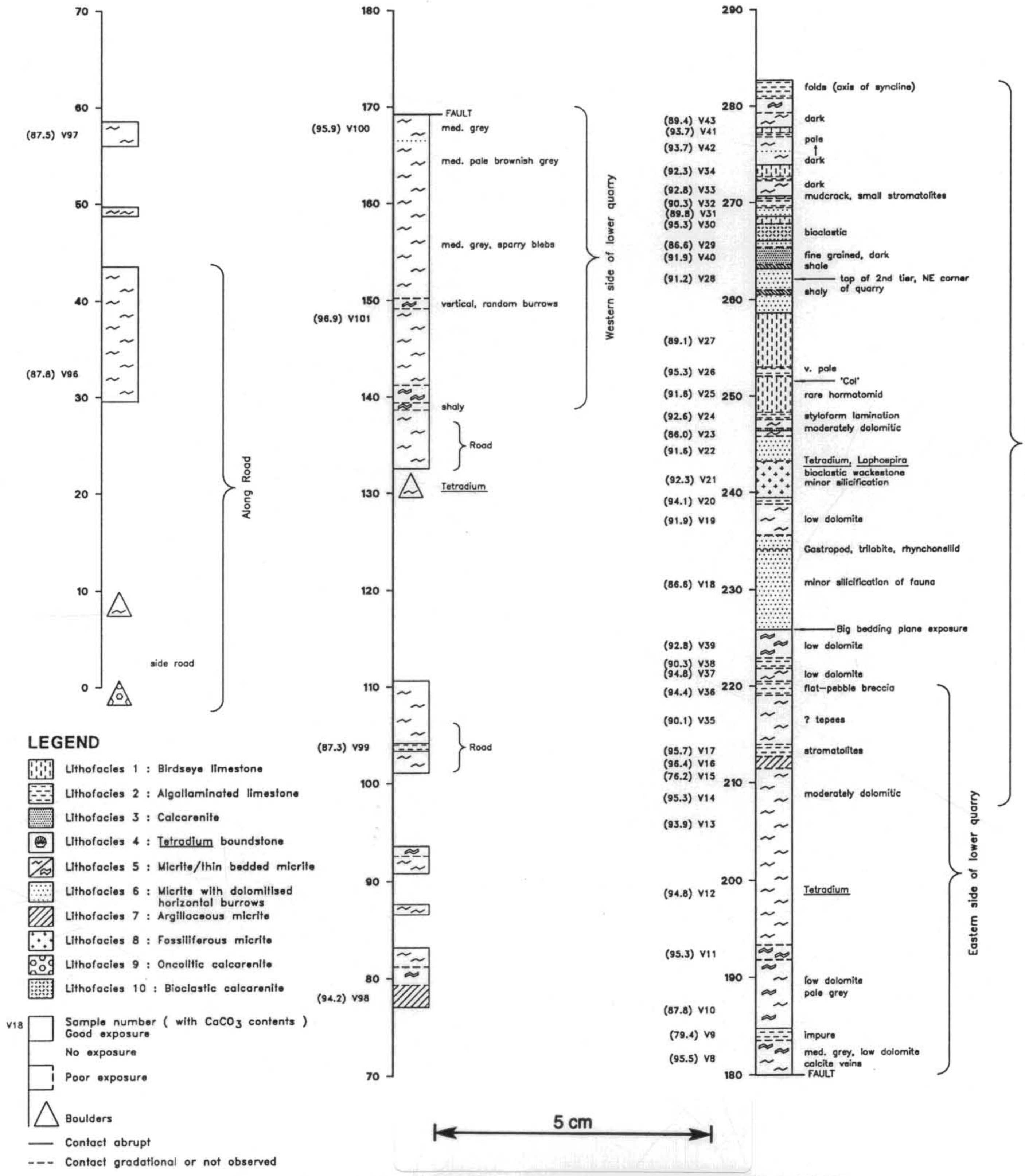
ANALYTICAL RESULTS

Analyses presented in Table 2 are mostly of samples collected from the three measured sections in the Maydena area (figs. 2–4). Some (900018, 900341–354) were collected from selected localities in the Florentine Valley, but most of the following discussion bears upon the Maydena area.

Ninety-three of the samples were analysed for loss on ignition, and CaO, MgO, SiO_2, Fe_2O_3, Al_2O_3 and P_2O_5 by XRF at the Deptartment's Launceston laboratory (900018–900110, Table 2). A further 18 samples were analysed for CaO, MgO and LOI by standard chemical methods (900337–354). Following the advice of the analyst, $CaCO_3$ values for the samples analysed by XRF were calculated from loss on ignition (LOI assumed to be 100% CO_2; MgO all as $MgCO_3$). For the remaining samples, $CaCO_3$ was calculated from CaO.

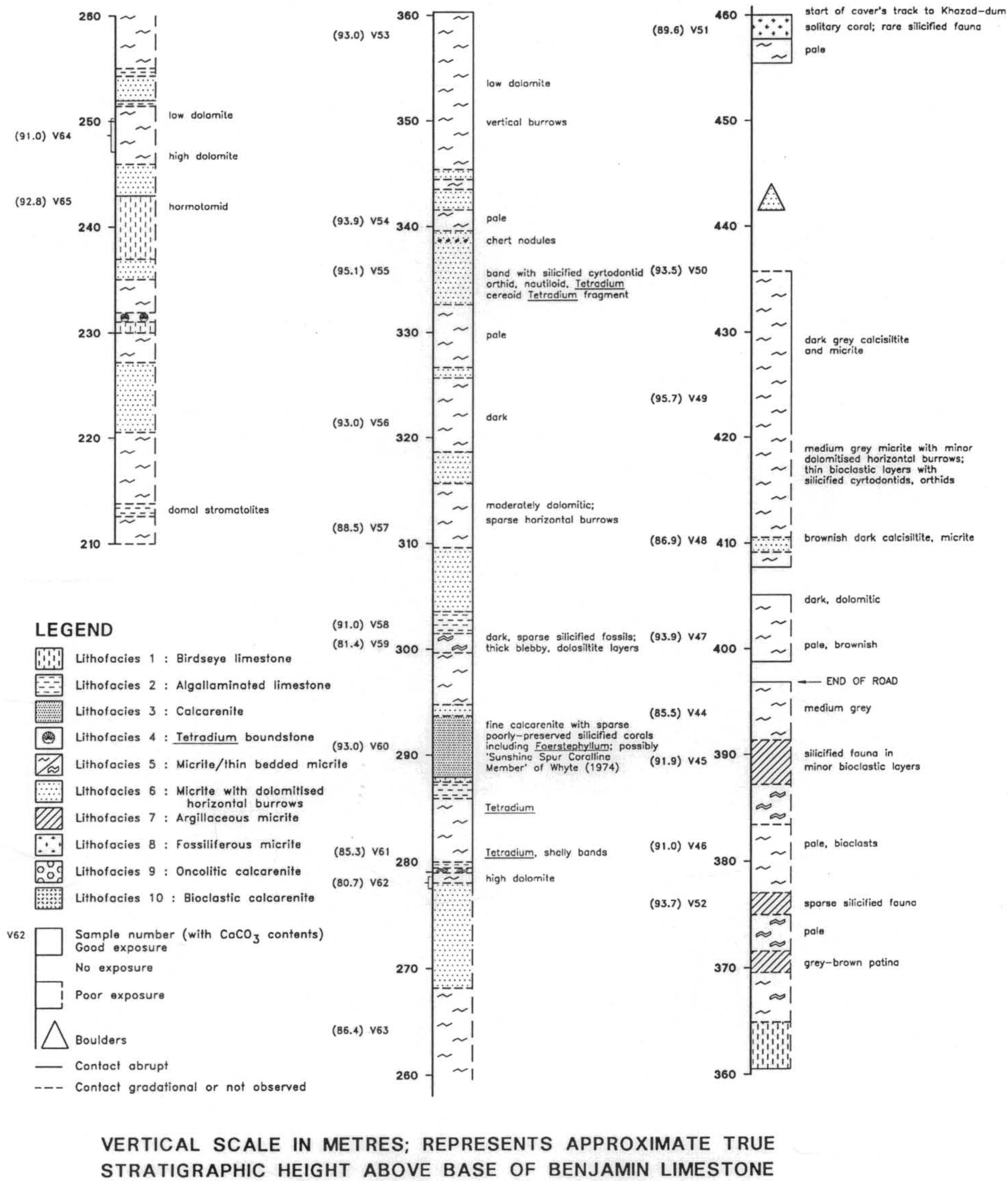
Karmberg Limestone

This formation was largely avoided by the present sampling programme because of the presence of visible impurities in outcrop (chert, dolomite, siltstone, etc.), corroborated by earlier, discouraging results (Hughes and Everard, 1953). Best results come from a small, long-abandoned quarry in John



VERTICAL SCALE IN METRES; REPRESENTS APPROXIMATE TRUE STRATIGRAPHIC HEIGHT ABOVE BASE OF BENJAMIN LIMESTONE

Figure 2. *Section, Junee Quarry area*



VERTICAL SCALE IN METRES; REPRESENTS APPROXIMATE TRUE STRATIGRAPHIC HEIGHT ABOVE BASE OF BENJAMIN LIMESTONE

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Figure 3. *Section, Sunshine Spur area*

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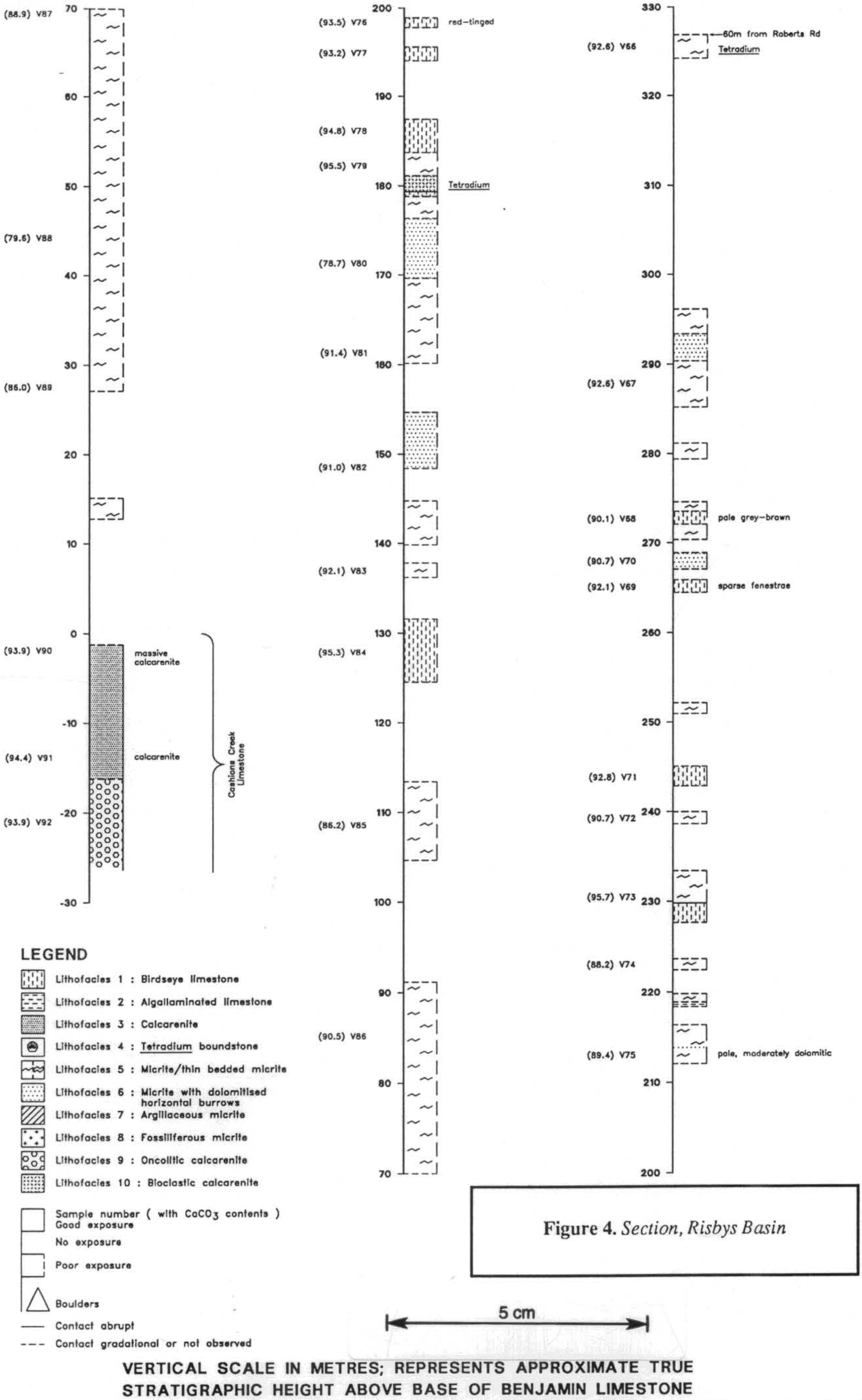

Figure 4. *Section, Risbys Basin*

Bull valley [DN693668], where the limestone lacks chert but has numerous small dolomitic blebs and sparse pyrite nodules. This rock is 91% $CaCO_3$ (900340, Table 2; Hughes and Everard, 1953, p.5).

Cashions Creek Limestone

This formation produced some unexpectedly attractive results from limited sampling on Sunshine Road and at Risbys Basin (900101–106). If one analysis of 87.1% $CaCO_3$ from the base of the unit is excluded, the remaining five samples average 95.2%. Given the apparent lithologic uniformity and thickness (ca. 150 m) of the Cashions Creek Limestone, these values represent the best indication of a quarryable limestone section in the Maydena area. Further sampling needs to be done to test the consistency of these good grades.

Benjamin Limestone

Sampling was concentrated in this formation, as virtually all high-grade industrial limestone in the State (including Newlands Quarry) occurs within equivalents of the Benjamin Limestone. Sections were measured in three relatively well-exposed areas, differentiated according to lithofacies (Table 1), and sampled (figs. 2–4).

Locations of sections are indicated on the geological map (fig. 1). The sections overlap stratigraphically to some extent and cover a total interval from the top of the Cashions Creek Limestone to 460 m above the base of the Benjamin Limestone. Higher levels within the Benjamin Limestone are exposed north of the Sunshine Spur section but lie within the Mt Field National Park.

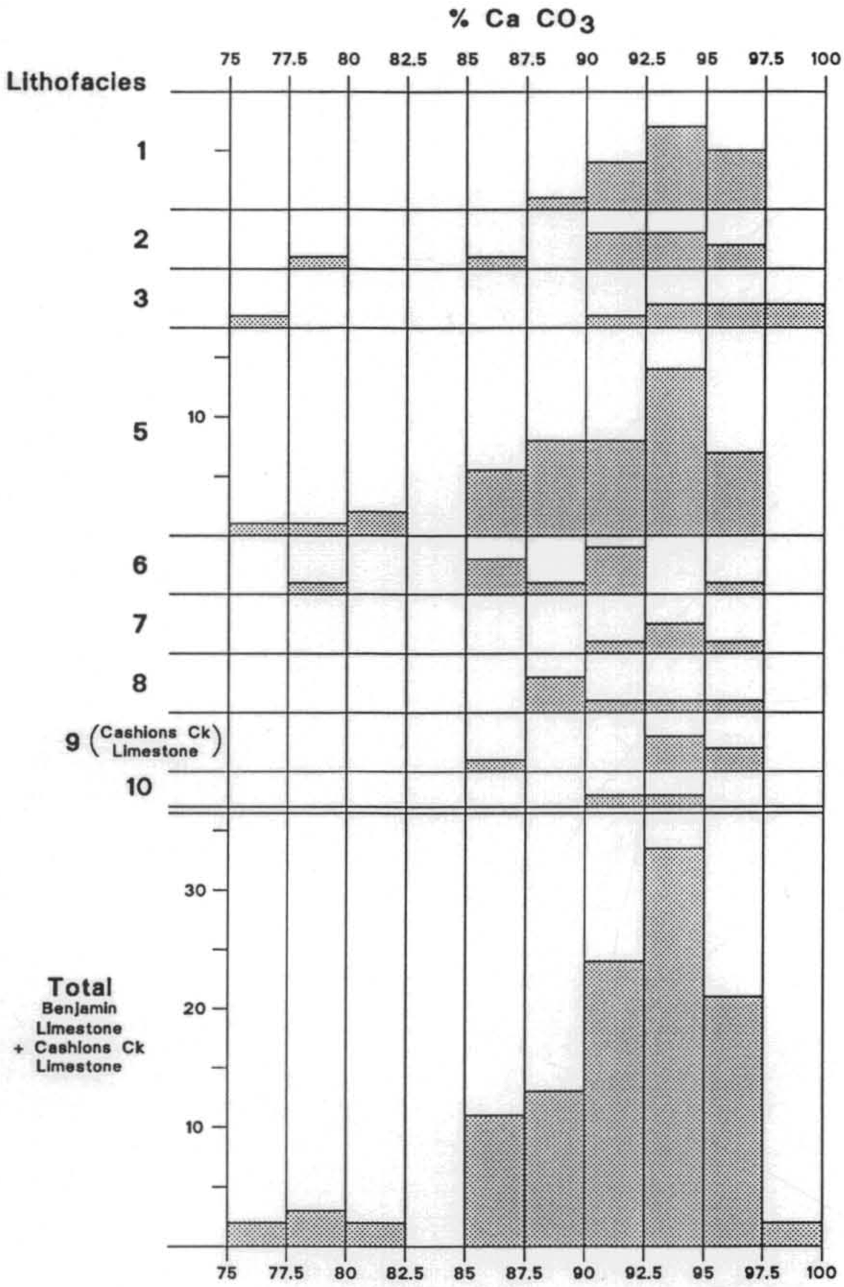

Figure 5. *Frequency histograms of lithofacies with respect to $CaCO_3$ content.*

Previous work by Summons (1981) and Banks (1989) indicates that some limestone types (notably birdseye limestone and coralline biomicrite) are distinctly richer in lime than others, and it was hoped that the analytical results would show consistent differences between lithofacies, enabling some degree of prediction of limestone quality from outcrop. This approach met with only limited success.

Lithofacies are compared by means of frequency histograms for $CaCO_3$ values (fig. 5) and plots of mean MgO and SiO_2 content with standard deviations (figs. 6, 7). Confirming Summons' (1981) observations, birdseye limestones (lithofacies 1) tend to have relatively high grades, with 71% of samples over 92.5% $CaCO_3$. Algal-laminated limestones and calcarenites (lithofacies 2 and 3) also show up well, with only the occasional, visibly impure sample below 90%. Calcarenites include the purest limestones, up to 99.4% $CaCO_3$ (900352). The most volumetrically abundant limestone type (lithofacies 5, 'unfossiliferous' micrites) have a large spread of values, with 45% of them over 92.5% $CaCO_3$. Only lithofacies 6 (micrite with dolomitised horizontal burrows) and 8 (subtidal, fossiliferous micrite) appear to have a tendency for relatively poor grades. In general, however, the overlapping, broad spreads of values show that good grades are not limited to particular limestone types, emphasising the need for a thorough (preferably continuous, i.e. DDH) sampling programme.

Stratigraphic intervals characterised by more than one analysis of consistently high grade occur at several localities. In the lower part of the Junee Quarry, a 20 m thick interval has an average 94.8% $CaCO_3$ based on four analyses (190–210 m, fig. 2). In the Sunshine Spur section, five analyses spread over 60 m average 93.7% (320–380 m, fig. 3). At Risbys Basin, four samples from a 20 m interval average 94.3% (180–200 m, fig. 4). In the Eleven Road area, two separate units of birdseye limestone and calcarenite, each approximately 15 m thick, average 97.7% but this area is flat and low-lying, and bedding dips steeply.

Because of the variability of the sequence these apparently high-grade intervals require confirmation by more intensive sampling or drilling. The present data indicate little more than the possibility of high-grade intervals in the lower Benjamin Limestone. The moderate to steep dip of bedding in these areas

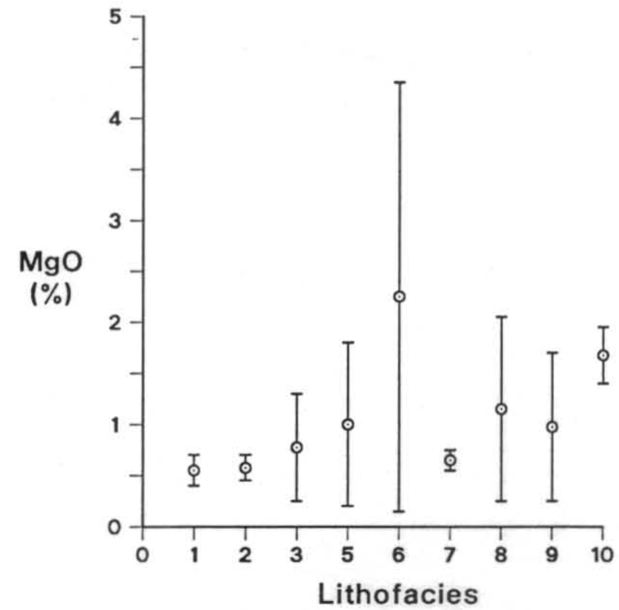

Figure 6. *MgO contents shown as mean and standard deviation.*

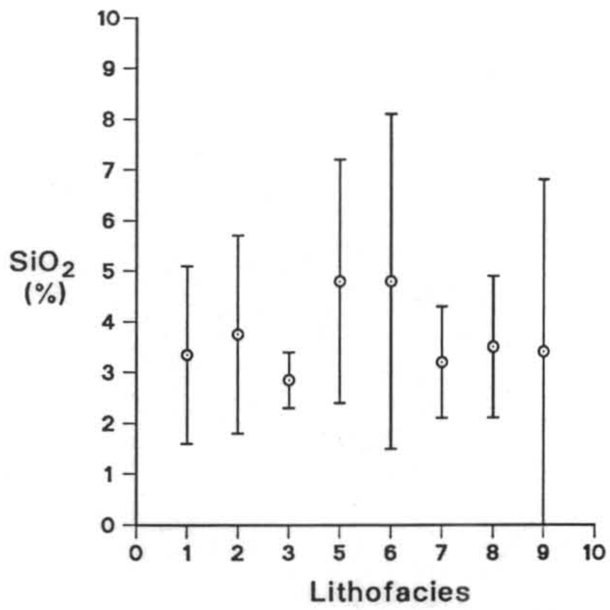

Figure 7. *SiO_2 contents shown as mean and standard deviation.*

means that overburden becomes a problem unless the prospective interval is quite thick (of the order of 50 m).

Average $CaCO_3$ content of the Benjamin Limestone samples is 91.3%, with average MgO at 1.03%, SiO_2 at 4.36%, Fe_2O_3 at 0.42%, and Al_2O_3 at 0.99%. The average of 38 samples (900019–900054, 900337–900338) from Junee Quarry is 91.7%, suggesting the material quarried here is nothing out of the ordinary.

By comparison, the average grade of the total stratigraphic section at Newlands Quarry is approximately 93.4% $CaCO_3$, as calculated from a single fully-cored diamond drillhole (the top 100 m of DLR-2: see Summons, 1981). In the top 10–30 m of this section Summons (1981) was able to define an indicated reserve of 736 000 t at an average grade of 96%.

Samples provided by University of Tasmania, Westfield section, Florentine Valley

A total of 131 samples were collected on a transect through the Cashions Creek Limestone and Benjamin Limestone in the Westfield area in the Florentine Valley [DN595801–DN591779] by Weldon (1974). These were analysed by an AAS technique (Robinson, 1980) under the supervision of Dr C. P. Rao, who made the results available to the writer.

The calculated $CaCO_3$ contents are shown (fig. 8) arrayed according to their stratigraphic position (data on sample localities from Weldon, 1974, p.169–172). The provided values for calcium appeared to be too high and were adjusted downward to bring them into line with insoluble residue and magnesium. An element of uncertainty is therefore present concerning the accuracy of the $CaCO_3$ contents but the data are nonetheless useful for comparative purposes.

The salient feature of the data is their variability. Even allowing that the values may be a couple of percent too low, there is no reasonably thick (of the order of 50 m) interval with consistent values which might be of interest here. Note, however, that there are substantial gaps in the transect due to lack of exposure. The Cashions Creek Limestone shows markedly poorer grades than in the Maydena area, probably due to diagenetic alteration visible in outcrop (dolomitisation; silicification of fossils and of some oncolites).

CONCLUSIONS

Transportation, topographic considerations and analytical results favour the Maydena area ahead of the Florentine Valley. At Maydena the prospective stratigraphic interval may be broadly defined as the Cashions Creek Limestone and the lower 400 m of the Benjamin Limestone. Within this interval, the data suggest that there is only a fair probability of an adequate reserve (of the order of 1 000 000 tonnes) of >92–95% $CaCO_3$ within the Benjamin Limestone, and a somewhat better probability in the Cashions Creek Limestone. The latter formation, although lithologically quite uniform, still needs to be better sampled to confirm the high grades indicated above.

Risbys Basin, 2 km SW of Maydena, may provide a more suitable quarry site than limestone areas NW of Maydena, taking into consideration visual impact, proximity to Mt Field National Park, and the presence of major cave systems NW of Maydena. At Risbys Basin, 1.5 km^2 of Cashions Creek Limestone and Benjamin Limestone crop out, dips are moderate (25–45°), and adequate relief exists for reasonable quarry sites. A fully-cored diamond-drill hole sited just off Roberts Road at DN689643 would allow a more accurate assessment of limestone quality in this area.

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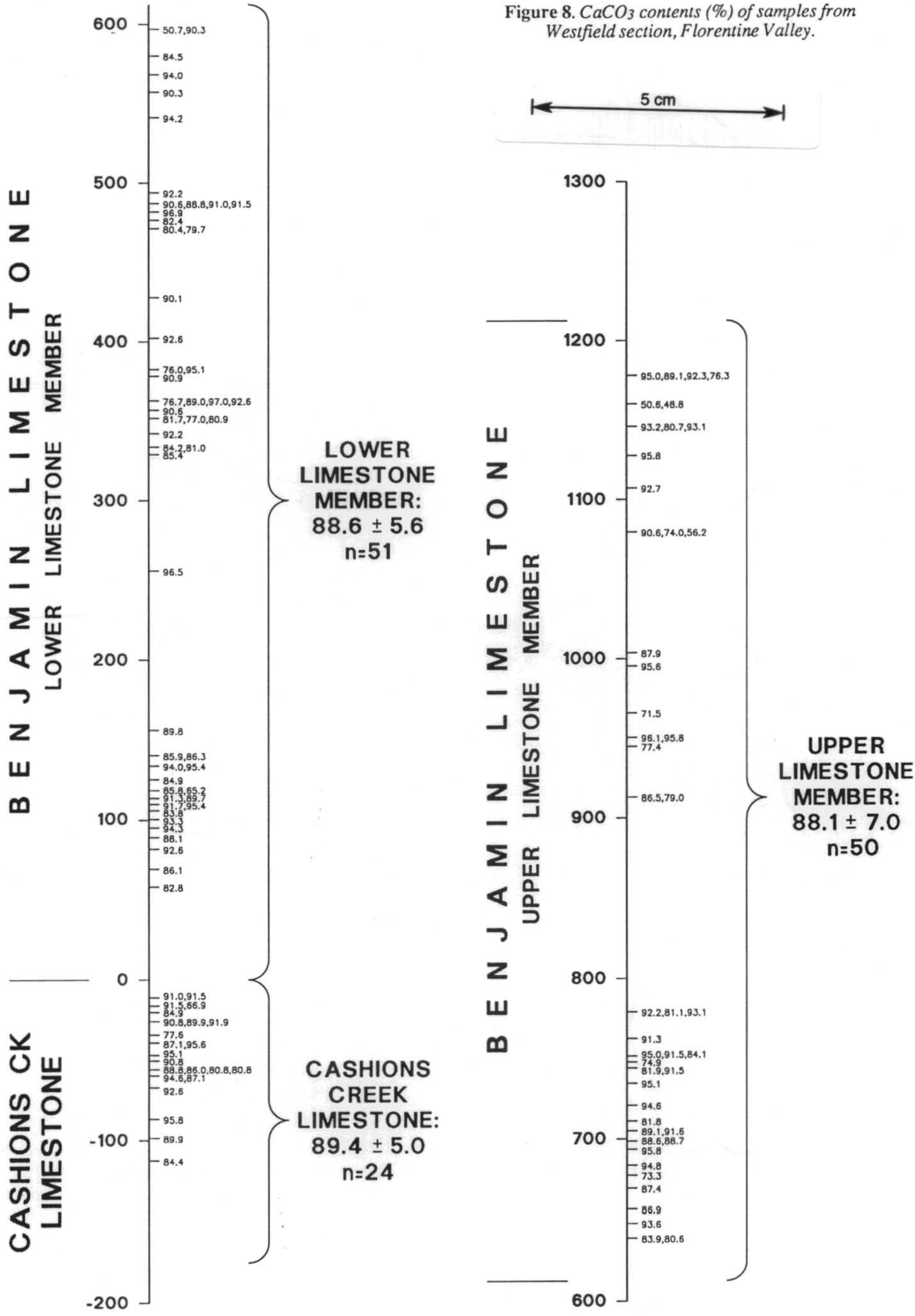

Figure 8. *$CaCO_3$ contents (%) of samples from Westfield section, Florentine Valley.*

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[23 March 1990]

Table 2. *ANALYTICAL RESULTS*

Reg. No.	Field No.	CaO (%)	MgO (%)	SiO_2 (%)	Fe_2O_3 (%)	Al_2O_3 (%)	LOI (%)	CaCO3 (%)	Lithofacies, description	
Eleven Road, Florentine Valley [DN54607795]										
900018	V1	53.9	0.87	1.8	0.36	1.65	42.19	93.7	1	
Junee Quarry Section										
900019	V8	54.0	0.55	2.2	0.23	0.68	42.59	95.5	5	low dol.
900020	V9	45.3	1.50	12.1	1.23	3.14	36.50	79.4	2	impure
900021	V11	54.7	0.47	1.8	0.27	0.48	42.44	95.3	5	thin-bedded
900022	V12	53.7	0.89	2.2	0.26	0.54	42.73	94.8	5	
900023	V13	53.7	0.54	3.0	0.32	0.80	41.88	93.9	5	
900024	V14	54.6	0.08	1.9	0.26	0.53	42.45	95.3	5	mod. dol.
900025	V15	43.2	4.73	10.7	0.55	1.25	38.58	76.2	5	
900026	V16	54.7	0.67	1.5	0.18	0.24	43.10	96.4	7	
900027	V17	55.1	0.42	1.8	0.18	0.36	42.58	95.7	2	stromatolitic
900028	V18	49.4	4.26	2.9	0.34	0.60	42.73	86.6	6	
900029	V19	52.9	0.68	4.7	0.35	0.88	41.16	91.9	5	low dol.
900030	V20	54.3	0.57	3.0	0.24	0.57	41.98	94.1	2	
900031	V21	52.0	0.68	4.5	0.36	1.02	41.37	92.3	8	minor silicification
900032	V22	51.4	0.58	4.6	0.61	1.22	40.96	91.6	6	
900033	V23	49.0	2.47	5.8	0.59	1.46	40.50	86.0	5	mod. dol.
900034	V24	52.7	0.61	3.0	0.53	1.05	41.39	92.6	2	stylolitic
900035	V25	51.4	0.70	4.5	0.47	1.20	41.02	91.6	1	
900036	V26	55.1	0.51	1.5	0.30	0.54	42.49	95.3	2	
900037	V27	50.6	0.67	7.7	0.52	1.46	39.90	89.1	1	
900038	V28	51.7	2.84	0.7	0.26	0.27	42.98	91.2	6	
900039	V29	49.8	4.20	2.5	0.28	0.46	42.69	86.6	6	
900040	V10	50.1	3.05	3.6	0.42	0.86	41.97	87.8	5	
900041	V30	54.7	0.72	1.6	0.40	0.37	42.69	95.3	1	
900042	V31	51.8	1.00	5.2	0.56	1.23	40.54	89.8	6	
900043	V32	51.9	0.64	5.3	0.62	1.28	40.37	90.3	2	
900044	V33	53.5	0.54	4.9	0.38	0.86	41.37	92.8	5	dark
900045	V34	54.0	0.58	4.0	0.32	0.91	41.25	92.3	1	
900046	V35	52.7	0.64	4.1	0.40	0.93	41.13	91.9	5	
900047	V36	55.1	0.41	2.1	0.19	0.35	41.93	94.4	2	intraclastic
900048	V37	55.5	0.37	2.7	0.11	0.15	42.15	94.8	5	low dol.
900049	V38	51.2	0.69	4.3	0.47	1.21	40.49	90.3	2	
900050	V39	53.7	0.64	3.0	0.29	0.74	41.47	92.8	5	low dol.
900051	V40	52.9	1.79	2.4	0.25	0.33	42.32	91.9	3	dark, fine grained
900052	V41	53.7	0.63	2.0	0.23	0.47	41.88	93.7	1	
900053	V42	53.6	0.67	2.3	0.28	0.50	41.94	93.7	5	
900054	V43	51.2	1.02	5.3	0.53	1.39	40.37	89.4	5	dark
Sunshine Spur Section										
900055	V44	49.2	0.95	7.2	0.76	2.06	38.62	85.5	5	
900056	V45	52.8	0.77	4.2	0.49	0.96	41.19	91.9	7	
900057	V46	52.7	0.79	4.1	0.41	1.16	40.87	91.0	5	
900058	V47	53.6	0.52	2.8	0.33	0.60	41.87	93.9	5	pale, brownish
900059	V48	49.7	0.58	9.9	0.40	0.87	38.85	86.9	6	
900060	V49	53.4	0.50	2.9	0.31	0.61	42.65	95.7	5	dark, calcisiltite
900061	V50	54.9	0.72	1.8	0.20	0.34	41.88	93.5	5	dark, calcisiltite
900062	V51	51.3	2.91	2.5	0.30	0.38	42.56	89.6	8	
900063	V52	53.4	0.65	3.6	0.22	0.46	41.88	93.7	7	
900064	V53	53.3	0.57	3.9	0.28	0.62	41.54	93.0	5	low dol., dark
900065	V54	54.2	0.51	3.0	0.26	0.74	41.81	93.9	5	pale
900066	V55	55.0	0.56	2.2	0.23	0.45	42.39	95.1	6	
900067	V56	52.6	0.82	3.4	0.24	0.51	41.81	93.0	5	dark
900068	V57	50.1	1.55	4.8	0.51	1.23	40.57	88.5	5	dolomitic
900069	V58	52.0	0.61	5.2	0.37	0.96	40.64	91.0	2	
900070	V59	46.8	2.65	9.6	0.57	1.36	38.70	81.4	5	silstone layers
900071	V60	53.7	0.93	3.2	0.28	0.54	41.95	93.0	3	
900072	V61	49.2	1.91	7.3	0.65	1.61	39.55	85.3	5	silf. fossils
900073	V62	45.9	1.76	11.6	0.78	2.16	37.39	80.7	6	
900074	V63	49.9	0.74	7.9	0.68	1.71	38.85	86.4	5	

Table 2. *ANALYTICAL RESULTS*

Reg. No.	Field No.	CaO (%)	MgO (%)	SiO_2 (%)	Fe_2O_3 (%)	Al_2O_3 (%)	LOI (%)	CaCO3 (%)	Lithofacies, description	
900075	V64	52.5	1.20	4.3	0.34	0.68	41.33	91.0	5	
900076	V65	53.4	0.51	3.6	0.29	0.76	41.39	92.8	1	
Risbys Basin section										
900077	V66	53.1	0.69	3.9	0.32	0.76	41.41	92.6	5	
900078	V67	53.3	1.34	2.9	0.27	0.47	42.20	92.6	5	
900079	V68	52.0	0.68	5.6	0.47	1.28	40.35	90.1	1	
900080	V69	53.9	0.50	4.3	0.28	0.80	41.02	92.1	1	
900081	V70	53.0	0.61	5.7	0.26	0.86	40.58	90.7	6	
900082	V71	53.1	0.44	4.1	0.20	0.50	41.28	92.8	1	
900083	V72	52.4	0.71	5.2	0.37	0.93	40.70	90.7	5	dark
900084	V73	56.9	0.50	1.7	0.25	0.29	42.59	95.7	1	
900085	V74	50.6	0.83	6.7	0.57	1.55	39.68	88.2	5	
900086	V75	51.4	0.58	5.7	0.54	1.32	39.95	89.4	5	pale, mod. dol
900087	V76	54.6	0.35	2.8	0.33	0.75	41.50	93.5	1	reddish
900088	V77	54.0	0.55	2.6	0.18	0.55	41.59	93.2	1	
900089	V78	55.1	0.32	2.1	0.28	0.43	42.06	94.8	1	
900090	V79	53.6	0.61	2.0	0.23	0.45	42.67	95.5	5	calcisiltite
900091	V80	44.5	6.95	3.8	0.48	1.09	42.18	78.7	6	
900092	V81	51.9	1.47	3.3	0.32	0.77	41.88	91.4	5	
900093	V82	51.0	1.36	3.7	0.40	0.99	41.44	91.0	6	
900094	V83	52.3	0.76	3.3	0.45	1.01	41.33	92.1	5	
900095	V84	53.8	0.54	1.8	0.24	0.73	42.45	95.3	1	
900096	V85	48.6	1.83	6.9	0.56	1.57	39.91	86.2	5	pale
900097	V86	51.5	0.64	5.4	0.70	1.60	40.45	90.5	5	
900098	V87	50.9	0.84	5.8	0.67	1.70	40.00	88.9	5	
900099	V88	44.6	1.00	12.0	1.11	3.64	36.06	79.6	5	
900100	V89	48.8	1.23	6.7	0.78	2.05	39.12	86.0	5	
900101	V90	52.5	1.30	2.9	0.18	0.41	42.69	93.9	9	Cashions Creek Limestone
900102	V91	52.4	1.67	1.8	0.25	0.40	43.31	94.4	9	Cashions Creek Limestone
900103	V92	52.4	1.87	1.2	0.21	0.24	43.38	93.9	9	Cashions Creek Limestone
Sunshine Road [DN645693]										
900104	V93	49.2	0.42	10.4	0.36	0.71	38.77	87.1	9	Cashions Creek Limestone
Sunshine Road [DN646692]										
900105	V94	53.6	0.29	1.9	0.14	0.31	42.67	96.4	9	Cashions Creek Limestone
900106	V95	54.3	0.29	1.0	0.12	0.22	43.08	97.3	9	Cashions Creek Limestone
Junee Quarry section										
900107	V96	49.3	0.75	6.5	0.85	2.13	39.44	87.8	5	
900108	V97	49.0	0.85	7.0	0.75	2.10	39.41	87.5	5	shale bands
900109	V99	48.6	0.79	7.6	0.79	2.18	38.79	86.2	2	silty
900110	V98	52.5	0.63	3.5	0.56	0.83	41.74	93.5	7	
Junee Quarry Section										
900337	V100	53.7	1.02				42.8	95.9	5	
900338	V101	54.0	0.49				42.6	96.4	5	
Near Junee Quarry [DN661687]										
900339	V102	54.1	0.35				42.2	96.6	1	
John Bull Quarry [DN693668]										
900340	V103	51.2	0.93				41.1	91.4	Karmberg Limestone	
Westfield, Florentine Valley [DN591779]										
900341	V104	49.1	0.93				39.0	87.6	8	silty
900342	V105	54.3	0.37				42.7	96.9	3	
900343	V106	51.7	1.86				42.3	92.3	10	
900344	V107	53.9	0.74				42.4	96.2	8	
Westfield, Florentine Valley [DN588785]										
900345	V108	52.8	1.12				42.0	94.2	3	
900346	V109	49.2	0.98				38.8	87.8	8	richly fossiliferous
900347	V110	43.0	0.78				34.8	76.8	3	silty beds
900348	V111	52.4	0.51				41.5	93.5	8	richly fossiliferous

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Table 2. *ANALYTICAL RESULTS*

Reg. No.	Field No.	CaO (%)	MgO (%)	SiO_2 (%)	Fe_2O_3 (%)	Al_2O_3 (%)	LOI (%)	CaCO3 (%)	Lithofacies, description
Westfield, Florentine Valley [DN588785]									
900349	V112	53.0	1.46				42.8	94.6	10
Eleven Road, Florentine Valley [DN544786]									
900350	V113	53.7	0.59				42.6	95.9	1
900351	V114	51.9	0.68				40.9	92.6	5
900352	V115	55.7	0.37				43.4	99.4	3
Eleven Road, Florentine Valley [DN541784]									
900353	V116	54.1	0.32				42.3	96.6	3
Eleven Road, Florentine Valley [DN543785]									
900354	V117	55.3	0.53				43.3	98.7	3

ANALYSTS: R. Roby, M. Frith, Division of Mines and Mineral Resources laboratory, Launceston.