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GRAPTOLITE LOCALITIES OF THE SNOWY MOUNTAINS, NEW SOUTH WALES

By H. O. FLETCHER.

(Graptolite Identifications by Mrs. K. Sherrard, M.Sc.)

(4 Maps.)

The initiation of the Snowy Mountains Hydro-Electric Authority gave a decided impetus to geological research over an area of some 6,000 square miles in southern New South Wales.

Following the Authority's request in 1949 for geologic investigation, officers of the Geological Survey of New South Wales have mapped more than 3,000 square miles of this country by detailed reconnaissance standard on a scale of 1 inch = 1 mile. During the course of these surveys an intensive search was made for fossil remains.

The information embodied in this report was gained during several visits to the Snowy Mountains with Survey parties in the author's capacity as Honorary Palaeontologist to the Geological Survey of New South Wales. A good deal of the information is included in the Snowy Mountains Reports (unpublished) of the Department of Mines. I am indebted to Mrs. Kathleen Sherrard for the graptolite identifications.

Previously the geology of the Snowy Mountains area was not very well known except for a broad generalization. The age of the meta-sediments, which comprise a large section of the region, was matter of considerable doubt.

The first graptolite remains to be recorded from the actual Snowy Mountains area are those mentioned by David (1908, p. 659), from Barney's Range, near Berridale. The genus *Leptograptus* was recognized among the specimens.

Laserson (1909, p. 118) recorded graptolites from a black slate at Wambrook Creek, which crosses the Adaminaby Road, eleven miles from Cooma. Specimens were collected from some distance up the creek on the southern side of the road. Laserson's locality was again mentioned by Browne (1914, p. 191), and the following list of graptolites, supplied by Laserson, was published: *Diplograptus foliaceus* (very abundant), *Climacograptus bicornis*, *C. hastata* (very abundant), *Dicellograptus elegans*, *D. caduceus*, *D. affinis*, ? *Pleurograptus*.

Öpik (1952, p. 1), recognized at Wambrook Creek, *Pleurograptus linearis*, the zone species of the lower zone of the Bolindian, and also *Dicranograptus nicholsoni* indicating the top of the lower zone of the Eastonian ("zone with *Climacograptus wilsoni*?"). In between, as Öpik points out, "is the complete Upper Eastonian zone with *Dicranograptus clingani* = *D. hians*."

Poorly preserved graptolites and apparently only recognizable as such have been recorded from black shales exposed at McCarty's Crossing, near the junction of Bridle Creek and the Murrumbidgee River. The locality is about four miles to the north-north-east of the Wambrook Creek locality.

A further locality is mentioned by Browne (1914, p. 192), at Geygedzerick Hill, 2½ miles north-east of Berridale. The slates at this locality although greatly altered contain an abundance of well preserved graptolites, said to include *Diplograptus*, *Didymograptus* and *Tetragraptus*.

Graptolites of Upper Ordovician age were also recorded by Mulholland (1937, p. 124) from black slates at Sheep Station Creek, near Beloka Station, and in Beloka Creek (Portion 73, Parish Wilson, County Wallace).

Other known graptolite localities do not fall within the area of the Snowy Mountains and are not mentioned. These would include those recorded by Carne (1897, p. 153) and found during a survey of the border country between New South Wales and Victoria, and the locality recently discovered by Keble between Jingellic and Tumbarumba.

During the past three years a number of graptolite localities have been visited by members of the Geological Survey of New South Wales and the Australian Museum. These localities fall broadly into several geographic groups as follows:—

- (1) The Wambrook Occurrence, 10 miles west of Cooma.
- (2) The Caddigat Occurrence, 20 miles north-west of Cooma.
- (3) The Tumut Pond Occurrence, about 12 miles south-west of Kiandra.
- (4) The Eastbourne Occurrence, on the Eucumbene River, 10-15 miles south of Adaminaby.
- (5) The Geehi Occurrence, on the upper reaches of the Geehi River, a major tributary of the Murray River.

Apart from these defined groups several isolated occurrences are found, the most notable being one near Wullwe Trigonometrical Station, five miles east-north-east of Dalgety. Another on the Snowy River is found five miles west of Dalgety.

The wide geographic distribution of these graptolite localities suggests that all the metamorphic rocks between Cooma and Khancoban are of Upper Ordovician age.

THE WAMBROOK OCCURRENCE. (Sketch Map 1.)

Locality 1.—Portion 42, Parish of Lake, County Wallace, approximately 1 mile next south of bridge on Monaro Highway over Wambrook Creek.

The graptolites occur on top of a ridge in a greyish altered slate with a distinct bedding cleavage. Mineral solutions have partly obscured and stained the graptolite remains a reddish-brown colour.

The following species are represented: *Dicranograptus ramosus*, *Diplograptus* sp., *Climacograptus caudatus*, *Diplograptus* cf. *apiculatus*, *Diplograptus apiculatus*, ? *Climacograptus minimus*, *Dicellograptus* sp.

Specimens F.43890—F.43935, Australian Museum Collection.

Geological Age.—Upper Ordovician. Zone of *Dicranograptus clingani* (upper horizon of Eastonian of Victoria.)

Locality 2.—Portion 111, Parish Coolringdon, County Beresford. One mile west-north-west of Coolringdon Trig. Station and 1 mile south of the Monaro Highway.

The graptolites at this locality occur in a light grey to white slate (strongly leached) in a creek near the middle of the eastern boundary of the portion. Specimens stained by iron oxide.

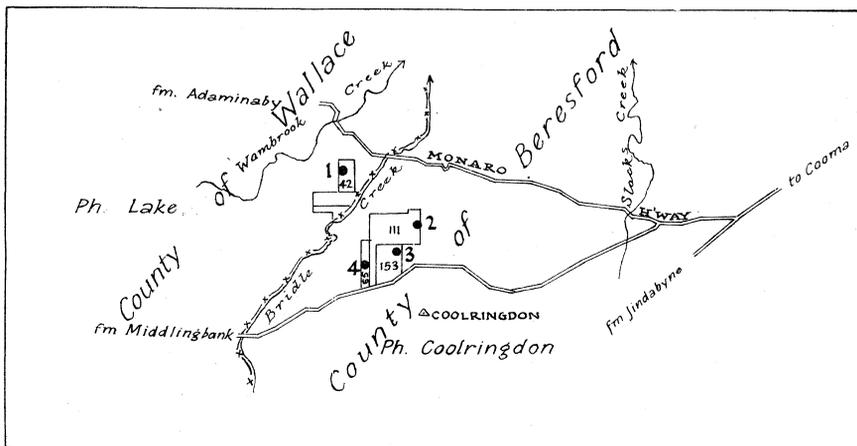
The following species have been recognized: *Cryptograptus tricornis*, *Diplograptus apiculatus*, *Climacograptus caudatus*, *Climacograptus tubuliferus*, *Diplograptus* sp., ? *Leptograptus flaccidus* var. *macer*.

Specimens F.43826—F.43844, F.43878—F.43887, F.43939—F.43943, Australian Museum Collection.

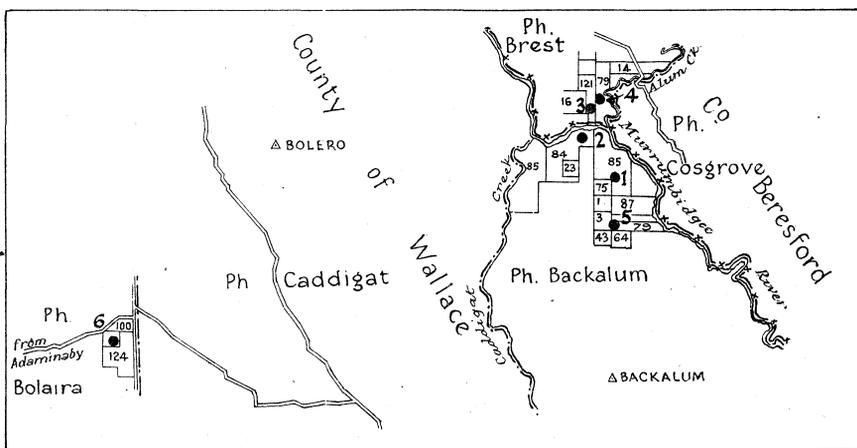
Geological Age.—Upper Ordovician. Zone of *Dicranograptus clingani* (upper horizon of Eastonian of Victoria).

Locality 3.—Portion 153, Parish of Coolringdon, County Beresford.

The graptolites from this locality are not well preserved. They occur in a dark-grey altered slate and are stained red by mineral solutions.



Sketch Map 1
WAMBROOK



Sketch Map 2
CADDIGAT

The following species are represented: ? *Climacograptus* sp.; ? *Diplograptus* sp.

Specimens F.43936—F.43938, Australian Museum Collection.

Geological Age.—Not determined.

Locality 4.—Portion 65, Parish Coolringdon, County Beresford. One mile north-west of Coolringdon Trig. Station, north of Middlebank Road and about in the centre of the portion.

The graptolites occur in a highly altered chialstolite-bearing black slate. The specimens are not well preserved and are deeply stained with iron oxide.

The following species are represented: *Dicellograptus* cf. *morrissi*, *Diplograptus apiculatus*. Many indeterminate specimens.

Specimens F.43759—F.43773, F.43819—F.43825, F.43950—F.43952.

Geological Age.—Upper Ordovician. Zone of *Dicranograptus clingani* (upper horizon of Eastonian of Victoria.)

THE CADDIGAT OCCURRENCE. (See Sketch Map 2.)

Locality 1.—Centre of C.P.L. 85, Parish Backalum, County Wallace, about 3½ miles north of Backalum Trig. Station.

The following species are represented: *Dicellograptus caduceus*, *Diplograptus* sp., *Dicellograptus morrissi*, *Dicellograptus* cf. *elegans*.

Specimens F.44307—F.44310, Australian Museum Collection.

Geological Age.—Upper Ordovician. Zone of *Dicranograptus clingani* (upper horizon of Eastonian of Victoria.)

Locality 2.—North-east corner of Portion 84, Parish Backalum, County Wallace, about 3½ miles north of Backalum Trigonometrical Station.

The following species are represented: *Climacograptus* sp., *Climacograptus caudatus*, *Dicranograptus ramosus*, *Diplograptus calcaratus*, *Climacograptus bicornis*, *Diplograptus* sp., *Climacograptus minimus*.

Specimens F.44284—F.44296, Australian Museum Collection.

Geological Age.—Upper Ordovician. Zone of *Dicranograptus clingani* (upper horizon of Eastonian of Victoria.)

Locality 3.—Portion 121, Parish Brest, County Beresford. Graptolites are found in the south-central part of the portion.

The following species were recorded: *Climacograptus caudatus*, *Climacograptus* or *Diplograptus*.

Specimens F.44302—F.44306, Australian Museum Collection.

Geological Age.—Upper Ordovician. Zone not certain.

Locality 4.—Portion 79, Parish Brest, County Beresford. Graptolites are found on the crest of a ridge near a fence and the locality is a few chains north-north-east from locality 3.

The following graptolites are represented: *Diplograptus* sp., cf. *Climacograptus caudatus*.

Geological Age.—Upper Ordovician. Zone uncertain.

Locality 5.—Portion 64, Parish Backalum, County Wallace. Graptolites are found in the north-west corner of the portion and the locality is about 2¼ miles north of the Backalum Trigonometrical Station.

The following species is represented: *Diplograptus* sp.

Specimen F.44297, Australian Museum Collection.

Geological Age.—Upper Ordovician. Zone uncertain.

Localities 1–5 are close to the Murrumbidgee River and about 13 to 14 miles east of the township of Adaminaby.

Locality 6.—Portion 87, Parish Bolaira, County Wallace. Graptolites are found in a small quarry one-quarter of a mile south of Dry Plain Road, about 4½ miles east of Adaminaby.

The following species are represented: *Diplograptus* sp., *Diplograptus calcaratus* var. *vulgatus*.

Specimens F.44298—F.44301, Australian Museum Collection.

The graptolites from this locality are not well preserved and many were indeterminate. Mrs. Sherrard remarks: "The slate from this locality has been subjected to contact metamorphism and there is a considerable development of chiastolite. The graptolites are preserved as a very tenuous film of iron sulphide. However, these long, wide diplograptid-like forms are characteristic of the Upper Ordovician, zones 11 and 12".

THE TUMUT POND OCCURRENCE.

Several visits were made to the Tumut Pond area by members of the Geological Survey of New South Wales during their work in the region but the search for graptolites or other fossil remains was unsuccessful.

Dr. Öpik (1952, p. 2) of the Bureau of Mineral Resources, Canberra, has reported the occurrence of rare ostracods, fragments of small brachiopods and several graptolites from the black shale east of Tumut Pond. The graptolites recorded are *Orthograptus* near to *O. quadrimucronatus*, fragments of a *Cryptograptus*, a *Climacograptus*, most probably *C. scharenbergi*, and *Dicellograptus divaricatus* cf. var. *salopiensis*. These graptolites, as pointed out by Dr. Öpik, indicate the Gisbornian, Lower Upper Ordovician.

Recently Mrs. K. Sherrard visited the Tumut Pond area and secured a collection of graptolites. The results of her investigations are yet to be published.

THE EASTBOURNE OCCURRENCE. (See Sketch Map 3.)

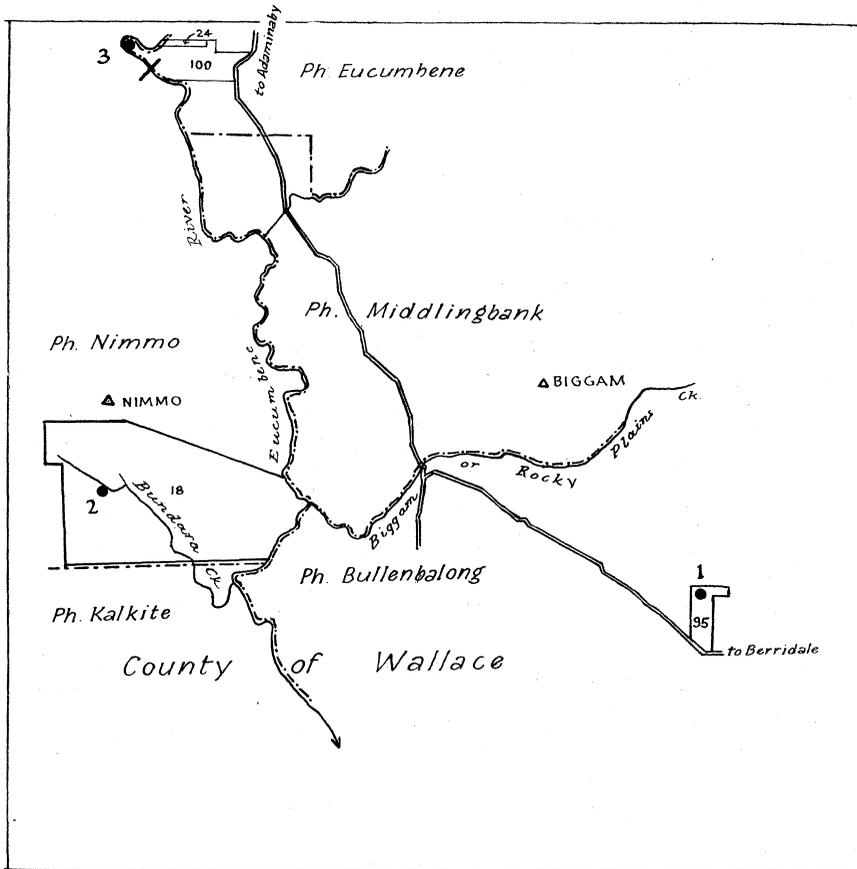
Locality 1.—Portion 95, Parish Bullenbalong, County Wallace, 8 miles north-west of Berridale on the Rocky Plain Road. The graptolites are found on top of a small wooded hill to the north of the road. They occur in an unaltered black slate with the impressions white in colour.

The following species are represented: *Diplograptus* sp., *Climacograptus tridentatus*, *Climacograptus bicornis*, *Dicranograptus nicholsoni*.

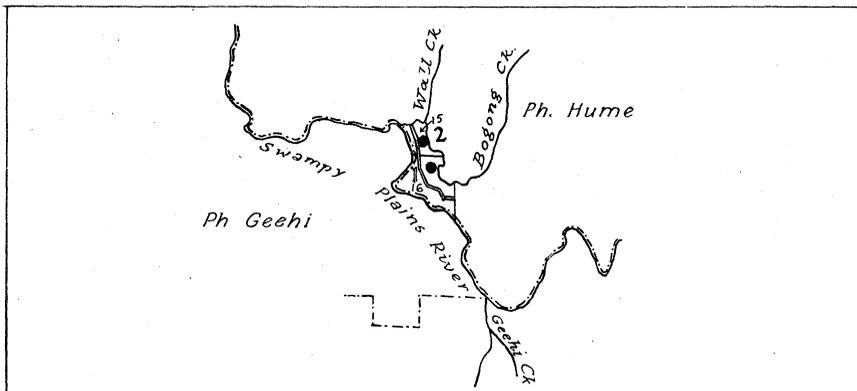
Specimens F.43743—F.43758, F.43774—F.43819, Australian Museum Collection.

Geological Age.—Upper Ordovician. (Zone of *Dicranograptus wilsoni*), lower horizon of Eastonian in Victoria.

Locality 2.—Portion 18, Parish of Nimmo, County Wallace. Near the headwaters of Bundara Creek, an east-flowing tributary of the Eucumbene River.



Sketch Map 3.
EASTBOURNE



Sketch Map 4
GEEHI

The graptolites from this locality were found in a very small isolated patch in an extensive outcrop of very altered slate. The outcrop is close to the contact with granite. None of the specimens could be identified but Mrs. Sherrard has no doubt regarding their Upper Ordovician age.

The graptolite material collected from this locality has been registered in the Australian Museum Collection, numbers F.43845—F.43878.

Locality 3.—Portion 100, Parish Eucumbene, County Wallace. The graptolites are found $\frac{1}{2}$ mile upstream from the Eagle Hawk Adaminaby Dam Site.

The following graptolites are represented: ? *Glossograptus hincksii*, form of *Diplograptus calcaratus* but species uncertain, ? *Climacograptus* sp. possibly *C. minimus*, ? *Lasiograptus* type, *Diplograptus* sp.

Mrs. Sherrard reports that "though all the graptolites from this locality are poorly preserved and all fragmentary, and the rock metamorphosed, the fact that fragments seen on twenty or more specimens are of Diplograptids, fairly large and wide and occasionally showing traces of a wide virgular tube, seems evidence enough to point to one of three zones of the Upper Ordovician, either Zones 10, 11 or 12, somewhere above, below or at the base of the Eastonian of Victoria. These are the zones characterized by large Diplograptids".

Further graptolites from the Adaminaby Dam Site appearing as indistinct impressions on a chistolite slate are as follows: *Climacograptus caudatus* or *Cl. tubuliferus*, *Dicellograptus* cf. *pumilis*, *Climacograptus* sp., *Diplograptus* sp., *Climacograptus caudatus*, *Dicellograptus* may be *D. elegans*; indeterminate remains.

Specimens F.45229—F.45235, Australian Museum Collection.

Geological Age.—High Upper Ordovician.

THE GEEHI OCCURRENCE. (See Sketch Map No. 4.)

An extensive series of sedimentary rocks on the western flanks of the Snowy Mountains and in the areas drained by the Geehi and Murray Rivers was closely examined for fossil remains during a visit to the area in November, 1951, by the author, with Messrs. L. R. Hall and D. Wynn of the Geological Survey of New South Wales. Graptolites were found for the first time at two localities.

The sediments extend over a large area of country and consist mainly of highly altered and silicified slates with occasional interbedded quartzites. The slates on occasions pass into schists and phyllites.

The areas visited included Swampy Plain Creek where the highly silicified and sheared slates and quartzites appear to be totally devoid of any fossil remains.

The Snowy Mountains Hydro-Electric Authority has recently had constructed a road from Khancoban to Tom Groggin on the Murray River. Road cuttings have exposed the sediments to a considerable extent but a careful search resulted in graptolites being found only on two occasions. Granite is traversed from Khancoban almost to the Geehi Walls where just before the steep descent a contact is found between it and the sediments. These sediments, which then continue almost to the mouth of the Geehi Creek, are dominantly slates and phyllites with minor developments of interbedded quartzites and schists. The slates are frequently perfectly laminated.

An occurrence of graptolites was found near the side of the road on a ridge between Bogong Creek and the Geehi River. The slates are strongly leached at this locality and fairly rich in graptolites although they are restricted to a comparatively narrow zone. The white-coloured graptolite-bearing slates have a north-south strike and are dipping vertically. Graptolite remains are for the most part well preserved and are revealed as pale mauve coloured impressions.

Locality 1.—Portion 16, Parish Hume, County Selwyn. The following species are represented: *Dicellograptus elegans*, *Dicellograptus* cf. *morrisi*, *Climacograptus* sp., *Diplograptus calcaratus* var. *basilicus*, *Dicellograptus* sp., *Dicellograptus* cf. *pumilis*, *Diplograptus* sp., ? *Dicellograptus* cf. *forchammeri*; indeterminate remains.

Specimens F.44508—F.44555, Australian Museum Collection.

Locality 2.—Portion 15, Parish Hume, County Selwyn.

This locality is about one quarter of a mile below (N.N.W. of) the above occurrence. The graptolites are exposed in a road cutting of the new road, at the time in the process of being completed, and occur in a leached slate which is almost certainly on the same horizon as the slates from the first locality.

The following species are represented: *Dicellograptus morrisi*, *Dicellograptus* cf. *forchammeri*, *Diplograptus calcaratus* var. *basilicus*, *Diplograptus* cf. *quadrimumcronatus*.

Specimens F.44556—F.44571, Australian Museum Collection.

Geological Age.—In the opinion of Mrs. Sherrard the graptolites from Locality 2 are almost certainly from the zone of *Pleurograptus linearis*, that is Zone 14 of the British Succession, and the equivalent of the Bolindian of Victoria, Upper Ordovician. The graptolite evidence from Locality 1, indicates a possibility of the same horizon. Field-work also suggests that both the graptolite horizons belong to the same zone.

The occurrence of graptolites in the sediments west of the main range of Kosciusko is of importance as they are the first to be recorded from that area in New South Wales. It is also the first time that Upper Ordovician sediments of Bolindian age have been recognized in New South Wales. Upper Ordovician graptolites have been recorded from the Corryong district, Victoria, in rocks lithologically similar to the Geehi sediments.

ISOLATED LOCALITIES.

A locality on the right bank of the Snowy River. Northern part of Portion 113, Parish Beloka, County Wallace.

The following species are represented: *Dicellograptus* cf. *pumilis*, *Diplograptus* possibly *D. calcaratus* var. *vulgatus*, ? *Glossograptus hincksi*, *Climacograptus*, *Diplograptus* possibly *D. quadrimumcronatus*, *Dicellograptus* cf. *elegans*, *Diplograptus* sp., *Dicellograptus pumilis*, *Diplograptus calcaratus* var.

Specimens F.44479—F.44487, Australian Museum Collection.

Geological Age.—Upper Ordovician. Zone of *Dicranograptus clingani* (upper horizon of Eastonian of Victoria).

As mentioned earlier, Upper Ordovician graptolites have been collected from Sheep Station Creek and Beloka Creek; both these localities are only a few miles south of Portion 113.

A locality half a mile south of Wullwey Trig. Station, northern part of Portion 28, Parish Bobundara, County Wallace. The slate in which the graptolites occur is highly metamorphosed with well developed chialtolite.

The following species are represented: *Climacograptus* sp. (*C. caudatus* or *C. wilsoni*), *Dicellograptus* (fragment of large species), *Diplograptus* sp.

Specimens F.44488—F.44507, Australian Museum Collection.

Geological Age.—Upper Ordovician. Zone of *Dicranograptus clingani* (upper horizon of Eastonian of Victoria).

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