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Some Fossils from the Dundas Series, Dundas

By

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PLATE I

(Read 13th November, 1944)

The Dundas Series consisting of black and grey slates, sandstones, grits, conglomerates, ashes, and tuffs has been assigned a Cambro-Ordovician age. The discovery of fossil dendroids associated with fragments of trilobites—the latter, unfortunately, too imperfect for specific identification—enables the age of part of this series to be established with some degree of certainty. The age indicated by the fossils is greater than that determined by previous workers on the evidence supplied by fossils stated to be graptolites. Doubt has been cast on the determination of these fossils as graptolites by one of us (D.E.T.), so that the discovery of other fossils in these rocks is important, particularly as they establish the age of the rocks.

GEOLOGY

The fossils were found on the Razorback spur about half a mile east of the deserted township of Dundas, which is six miles east of Zeehan. The geology of this area has been described in official publications by L. K. Ward (1909), A. McIntosh Reid (1925), and in an unpublished report by D. E. Thomas and Q. J. Henderson (1943).

In brief, the Razorback is a spur running south-south-east from Lewis Hill, which is on the eastern flank of Mount Razorback. This spur runs between the Gander Creek on the east and an unnamed tributary on the west, both of which flow into the Dundas Rivulet.

The oldest rocks of the area form the Dundas Series, which is intruded by a large body of ultra-basic rock. The general distribution and relationship of these various rocks is shown in the plan and sections. The structural trend is in a meridional direction, and in the area mapped the ultra-basic rocks outcrop on the eastern side of the sedimentary rocks. Although the ultra-basic rocks are intrusive into the sedimentary rocks, the normal relationship is masked by faulting in this locality. The fault at the junction of the rocks, for the sake of reference, is called the Razorback Fault, but several others are exposed in the various mine openings. The dip of this fault varies considerably, in some places being vertical, in others dipping as low as 50° E. (at No. 1 adit), and in the northern part of the mapped area west from 55°-75°. The fault, as is usually the case, is not a straight line, but has well-marked bends in the central portion, when its course swings from north-west to more northerly.

The alteration that the ultra-basic dyke has undergone is considerable, for, apart from the normal metasomatism generally associated with these rocks, included in the general term serpentinization, there has been extensive development of talc and silicification associated with the introduction of tin-bearing solutions.

The sulphides mainly pyrrhotite with some pyrite and arsenopyrite were precipitated simultaneously with the bulk of the quartz. With progressive crystallization and falling temperatures, the solutions became less siliceous and in the later stages carbonate minerals were deposited.

The fossils are found in the black slates on the western side of the fault, and were first gathered in the dump of No. 1 adit, and then later in the black slates further south. In the dump from No. 1 adit there are thin, sandy beds in which fragmentary remains of trilobites were found. Unfortunately, these are too fragmentary for specific identification, but detailed search in this belt may yet yield determinable forms.

The Dundas Series

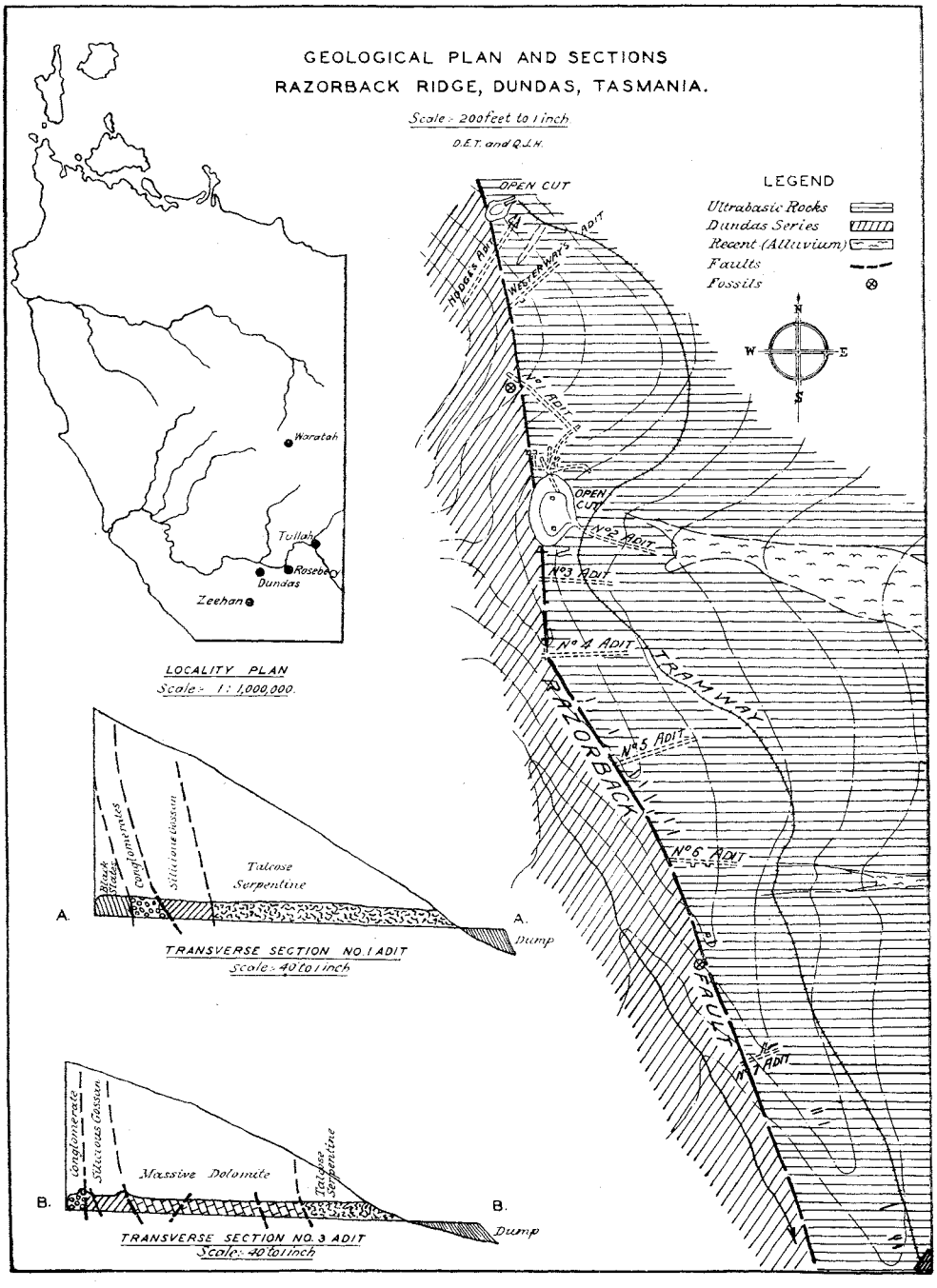
L. K. Ward (1909) used the term Dundas Slates to designate the sedimentary rocks of the Dundas area. 'The greater part of the North Dundas tin field consists of slate, together with the coarser grained sediments—sandstones, grits, and conglomerates. The whole are to be considered as one series, and to them the term "Dundas Slates" has been applied, since the typical rock type is a slate.'

Later authors have used the term 'Dundas Slates' or 'Dundas Series' indiscriminately. In accordance with modern usage, the rock group should be referred to as the Dundas Series. As the Razorback area is included in Ward's original plan of the North Dundas Tin Field, the fossils we are describing were found in the type area and thus fix the age of part of what is undoubtedly the Dundas Series.

Age of the Dundas Series

Faunas similar to that at Dundas have been found in other parts of the world. Of interest are those reported from various horizons below the Tremadocian, i.e., in undoubted Cambrian rocks. *Dendrograptus hallianus* (Prout) is found in the Potsdam sandstone and is an Upper Cambrian form. From the Tempealeau formation of Minnesota and Winsconsin, Ruedemann (1933) has described a fauna which contains *Dictyonema*, *Dendrograptus*, and *Callograptus* which is associated with a Dikellocephallus fauna, and he describes other Upper Cambrian forms from Tennessee, Vermont, and Quebec. Older than these is (?) *Dendrograptus meso-cambricus* from the Paradoxides Shales from Krekling, Norway, which was described by Opik (1933). Of greater interest are those found in Victoria and described by Chapman (1919), Chapman and Skeats (1919), and Chapman and Thomas (1936). The Tasmanian species are identical with the Victorian and no doubt detailed collecting will add to the number of species that are common to both States. In Victoria, the fauna is associated with two trilobite bands which have been called the Dinesus and the Amphoton bands. These two bands have been included by Whitehouse (1936, pp. 73-74) in his Kootenia Stage, the lowest in the Middle Cambrian. As the Tasmanian forms are identical with the Victorian, there is strong evidence that the rocks are of the same age, i.e., low in the Middle Cambrian.

The table below shows the broad correlation of the Tasmanian horizons with those established in other parts of the world. It should be noted that there has been disagreement between workers as to what should be considered the top of the Cambrian. One of the outstanding geological controversies of the last century was between Murchison and Sedgwick as to the limits of the Silurian of the former and the Cambrian of the latter. Lapworth, in 1879, proposed the term Ordovician as a compromise between their views. While the base of the Arenig, as proposed by Lapworth, has been acceptable to workers on shelly fossils, it has


GEOLOGICAL PLAN AND SECTIONS
RAZORBACK RIDGE, DUNDAS, TASMANIA.
Scale:- 200 feet to 1 inch
D.E.T. and Q.J.H.
LEGEND
Ultrabasic Rocks
Dundas Series
Recent (Alluvium)
Faults
Fossils
OPEN CUT
HOLDEN'S ADIT
WESTERN ADIT
No 1 ADIT
OPEN CUT
No 2 ADIT
No 3 ADIT
No 4 ADIT
TRAMWAY
RAZORBACK
No 5 ADIT
No 6 ADIT
FAULT
No 7 ADIT
Waratah
Tullah
Rosebery
Dundas
Zeehan
LOCALITY PLAN
Scale:- 1 : 1,000,000.
Black Slates
Coal Laminites
Siliceous Gossan
Talcose Serpentine
Dump
TRANSVERSE SECTION NO. 1 ADIT
Scale:- 40 to 1 inch
Conglomerate
Siliceous Gossan
Massive Dolomite
Talcose Serpentine
Dump
TRANSVERSE SECTION NO. 3 ADIT
Scale:- 40 to 1 inch

COMPARATIVE TABLE OF CAMBRIAN STRATA

	Britain	America	North East Australia		Victoria	Tasmania
(Now included in Ordovician)	Tremadoc or Shumardia Series	Ozarkian	(After F. W. Whitehouse) (Faunal Stages) Asaphellus		Lower Ordovician Lancefieldian	Junee Series and Caroline Creek Beds
			Ellesmereoceras	Ninmaroo Limestones		(Unconformity)
Upper	Lingula Flags or Olenus Series	Croixian	Elathriella Rhodonaspis Glyptagnostus Eugonocare	Pituri Sandstones	Goldie Series	
				Georgina Limestones		Dundas
Middle	Paradoxides Series	Acadian	Anomocare Papyriaspis Phoidagnostus Agnostus Seminula Dinesus Eurostina Amphoton	Templeton Series	Linesus Hydroid Beds	Dendroids and Hydroids Series
Lower	Ollenellus Series	Waucobian	Redlichia Protolenus Archaeocyathus		Heathcote Igneous Complex	

not proved so to those dealing with graptolites, and a number of workers preferred to transfer the uppermost part of the Cambrian (the Tremadocian) into the Ordovician. Mention should also be made of Ulrich's attempt (1911) to recognize two other periods—the Ozarkian and the Canadian between the Cambrian and the Ordovician. The Ozarkian, however, is almost synonymous with the Tremadocian and the Canadian is part of the Lower Ordovician. In the table of correlation the base of the Ordovician is taken as the horizon marked by the incoming of the graptoloid, *Dictyonema flabelliforme*, so that the Tremadocian is included in the Lower Ordovician.

The horizon of the Junee Series and of the Caroline Creek Sandstone is that determined by Kobayashi (1940 *a*, 1940 *b*). As one of the writers (D.E.T.) has found Ordovician fossils in the soft sandstone overlying the conglomerates at Adamsfield, the unconformity beneath the Basal Conglomerate of that district, is taken to be that between the Dundas Series and the Junee Series. This corroborates the views expressed by the late Dr. A. N. Lewis (1940).

Palaeontology

The detailed morphology of the Graptolithina is still a matter of considerable doubt, although during the last decade or so our knowledge of the palaeozoology has advanced considerably. Our lack of knowledge is due to the fact that the forms are extinct, and because their soft parts have left little or no impression upon the chitinous periderm, even when the latter has been preserved. Even with the graptolites, opinion regarding their classification has undergone remarkable changes, which need not be elaborated here, but all these forms are generally included in the Coelenterata. The graptolites themselves are separated from the Dendroids by the presence of a sicula, while the Dendroids have generally a definite stem and a disc of attachment and are characterized externally by their much branched plant-like habit of growth. The stipes of the Dendroids are polymorphic and give rise to a regular succession of budding individuals, bithecae, and hydrothecae. The budding individual, which does not open to the exterior, is a tubular cavity within the stipe and gives rise to the hydrothecae, bithecea, and budding individual of the next generation.

A few dendroids are known in which the rhabdosome originates from a typical sicula with a nema, e.g., *Dictyonema flabelliforme*. As some forms of graptolites, e.g., *Clonograptus* and *Bryograptus*, have a complex thecal structure, it is difficult to indicate the point at which the dividing line between the groups should be placed.

A further complication to the classifications of these fossils was the description by Chapman (1919) of fossil Hydroids. This was based on the external resemblance of the fossils to hydroids of the Campanularid type. Chapman and Thomas (1936) advanced this idea still further when they included *Acanthograptus* with *Cactograptus* in the family Idiidae of living Calyptoblastean Hydroids. The Dendrograptidae were also included in the Calyptoblastea, while *Archaeocryptolaria* and *Archaeolafoea* and several new genera were included in the family Campanulariidae.

Bulman (1937) points out that the detailed morphology of the forms as far as is known is not like that of the living Calyptoblastea and that the genera *Archaeocryptolaria* and *Archaeolafoeia* show a similarity to *Acanthograptus* in the type of development, general habit, and in the possession of tubular and sometimes adnate thecae which confer a 'ropey' appearance to the main axis.

Kozlowski (1938) has published a preliminary paper on a remarkable graptolite fauna in siliceous rocks of Upper Tremadocian age from Wysoczki in Poland,

in which the fossils are in a most perfect state of preservation, the chitinous substance having undergone surprisingly little change. He recognizes two classes, Graptolithina and Pterobranchia. Until detailed descriptions of his new genera are available, we are unable to compare our forms with his, and so adopt the conservative view of considering the fossils from Dundas as belonging to the order Dendroidea.

Genus **Archaeocryptolaria** Chapman, 1919

Archaeocryptolaria skeatsi Chapman

(Plate I, Fig. 1)

A. skeatsi Chapman, 1919, p. 392, pl. XIX, fig. 3, pl. XX, fig. 7.
A. skeatsi Chapman and Skeats, 1919, p. 550, pl. XV, fig. 1.
A. skeatsi Chapman and Thomas, 1936, p. 199, pl. XIV, fig. 3.

Axis slightly curved, 9 mms. long. Hydrothecae about eleven on stipe, suddenly bent outwards at large angles to the main stipe, which is 1/3 mm. wide: maximum length 1 mm.; cylindrical, and only slightly tapering at junction with stem.

Observations. In the figured specimen the hydrothecae are apparently developed only on one side of the main stipe, but a close examination shows that some are bent across the main axis. The general similarity to the Victorian forms is striking. The figured specimen is the only one found sufficiently well preserved for specific identification and is, on Specimen No. 8A, associated with *Mastigograptus* and cf. *Acanthograptus*.

Genus **Mastigograptus** Ruedemann, 1908

Mastigograptus sp.

Hydrocaulus filiform: bifurcating: angle of bifurcation just less than 20°. Total length is 15 mms., of branches 10 mms.

Observations. The form is too slender for illustration, but fragments are common on several slabs. The described form is on Specimen 8B.

Genus **Archaeolafoea** Chapman, 1919

Archaeolafoea serialis Chapman and Thomas

(Plate I, Fig. 3a)

A. serialis Chapman and Thomas, 1936, *Proc. Roy. Soc. Vic.*, p. 201, pl. XIV, figs 9-11, pl. XV, figs 12, 12*a*, and 12*b*.

Hydrosome 30 mms. long, consisting of a slightly flexed axis without branches, the thecae are long, elongately cylindrical, nearly 3 mms. in length spaced somewhat irregularly and give the appearance of arising all round the axis.

Observations. This form is probably the most common in our collections and is indistinguishable from the Victorian forms. The description is of Specimen No. 12.

Genus **Cactograptus** Ruedemann

Cactograptus flexispinosus Chapman and Thomas

(Plate I, Fig. 2)

Cactograptus flexispinosus Chapman and Thomas, *Proc. Roy. Soc.*, 1936, p. 207, pl. XVII, figs 29-33.

Hydrocaulus long, 38 mms., in width of central axis 2 mms., width across the thecae 4 mms. Hydrothecae alternate. Adnate and set at a more acute angle than in *C. crassus*, about 7-8 in 10 mms., bluntly triangular in outline mucronate with flaring apertural margins. The broad middle portion of the hydrocaulus is composed of numerous thecal tubes, as is indicated by the numerous thecal walls.

Material. Specimen No. 5 and counterpart.

Genus **Protohalecium** Chapman and Thomas, 1936

Protohalecium hallianum Chapman and Thomas

(Plate I, Fig. 4)

Protohalecium hallianum Chapman and Thomas, 1936, *Proc. Roy. Soc. Vic.*, p. 204, pl. XVI, fig. 22.

Hydrocaulus short, 15 mms. in length, branching alternately at the angle of the main branch. A grouping of three or four elongate (?) hydrothecae is shown at the terminals of two of the secondary branches, length 2 mms.

Material. Specimen No. 7.

Genus **Sphenoecium** Chapman and Thomas, 1936

Sphenoecium filicoides (Chapman)

(Plate I, Fig. 5)

Sphenothallus filicoides Chapman, 1917, *Rec. Geol. Surv. Vic.*, vol. IV, p. 92, pl. IV, fig. 1.
Sphenoecium filicoides Chapman and Thomas, *Proc. Roy. Soc. Vic.*, 1936, p. 205, pl. XVI, fig. 1.

The length of the available fragment is 4 mms. long, but the specimen is compressed and not well preserved. The thecae 5 mms. in length, elongate, cylindrical in shape and in some cases the aperature is seen as with a cylindrical boundary. The general form of a flaccid stipe and the characteristic thecae are similar to the Victorian forms.

Material. Specimen No. 13 and counterpart.

Sphenoecium sp.

(Plate I, Fig. 3c)

On Specimen No. 13 there is a form which in general shape and characters can be referred to this genus. It differs from *S. filicoides* by being less robust and the thecae are only 1·5 mms. long. Further material is needed before this form can be described in detail.

Genus **Protistograptus** McLearn, 1915

(Plate I, Fig. 3b)

McLearn erected this genus for a simple dendroid that possesses only simple straight or arched cones. The cone is considered as homologous with the sicula of all graptolites. One of these simple forms is present on Specimen No. 12, but there is the possibility that it represents an isolated theca of forms similar to the Sphenoecium sp. mentioned above.

REFERENCES

BULMAN, M. B., 1937.—The Structure of Acanthograptus suecicus and the affinities of Acanthograptus. *Geo. Foren. For handl.* Bd. 59 H.2.

CHAPMAN, F., 1919.—Hydroid remains of Lower Palaeozoic age from Monegetta near Lancefield. *Proc. Roy. Soc. Vic.*, vol. 131, pp. 383-393.

———————, and SKEATS, E. W., 1919.—On the Discovery of Fossil Hydroid Remains, etc. *Geol. Mag.*, p. 550, pl. XV.

———————, and THOMAS, D. E., 1936.—Cambrian Hydroida of the Heathcote and Monegetta Districts. *Proc. Roy. Soc. Vic.*, vol. 48, pp. 193-212.

KOBAYASHI, T., 1940*a*.—Lower Ordovician Fossils from Junee, Tasmania, *Pap. Roy. Soc. Tas.*, 1939, pp. 61-66.

———————, 1940*b*.—Lower Orodovician Fossils from Caroline Creek, etc. *Ibid.* pp. 67-76.

KOZLOWSKI, R., 1938.—Les Graptolithes du Tremadoce la Pologne et les portee theoretique. *Annales Musée Zoolog. Poloniei*, pp. 183-195.

LEWIS, A. N., 1940.—Geology of the Tyenna Valley. *Pap. Roy. Soc. Tas.*, 1939, pp. 33-59.

MCLEARN, F. H., 1915.—The Lower Ordovician at St. John, New Brunswick, and the new Genus Protistograptus. *Am. Journ. Sc.*, (4) 40, pp. 49-59.

OPIK, A., 1933.—Uber einen Kambrischen Graptolithen aus Norwegan. *Norsk. Geol. Tiddskr*, 13, pp. 113-115.

REID, A. MCINTOSH, 1925.—The Dundas Mineral Field. *Bull. No. 6, Geol. Surv. Tas.*

RUEDEMANN, R., 1933.—The Cambrian of the Upper Mississippi Valley. Pt. III. *Graptoloidea Bull. Publ. Mus. City Milwaukee.*

ULRICH, E. O., 1911.—Revision of the Palaeozoic Systems. *Bull. Geol. Soc. Am.*, vol. 22, pp. 281 and 680.

WARD, L. K., 1909.—The Tin Field of North Dundas. *Bull. No. 36, Geol. Surv. Tas.*

WHITEHOUSE, F. W., 1936.—The Cambrian Faunas of North Eastern Australia. Pts. 1 and 2. *Mem. Queens. Mus.*, vol. XI, pt. I, pp. 59-112.

EXPLANATION OF PLATE I

FIG. 1.—*Archaeocryptolaria skeatsi* CHAPMAN. Spec. No. 8A.

FIG. 2.—*Cactograptus flexispinosus* CHAPMAN and THOMAS. Spec. No. 5.

FIG. 3.—*(a) Archaeolafoea serialis* CHAPMAN and THOMAS.

(b) ?Protistograptus sp.

(c) Sphenoecium sp.
Spec. No. 12.

FIG. 4.—*Protohalecium hallianum* CHAPMAN and THOMAS. Spec. No. 7.

FIG. 5.—*Sphenoecium filicoides* (CHAPMAN). Spec. No. 13.

(All figures are X2)

All figured specimens are in the Geological Survey Collections, Mines Department, Hobart.

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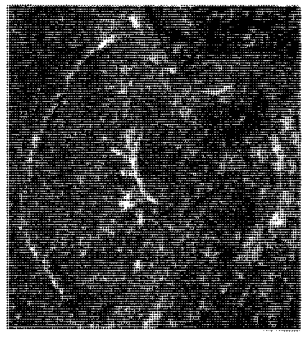

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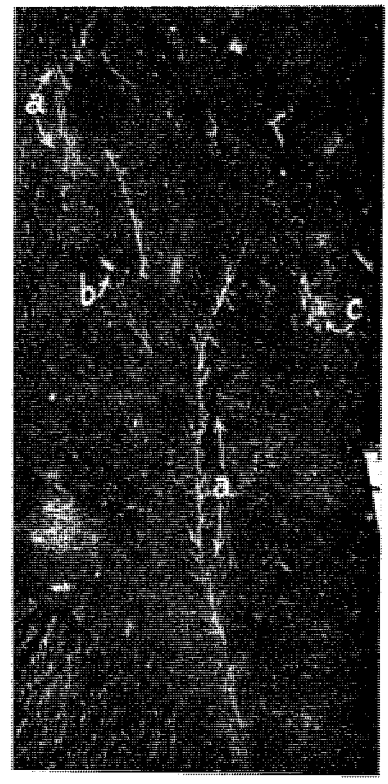

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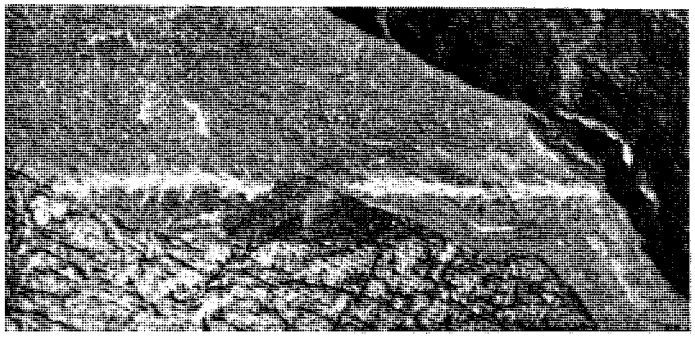

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