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THE ULTRABASIC ROCKS of the
GORDON CONCESSION
S.W. Tasmania

58-254

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Gordon Concession, S.W. Tas
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THE ULTRABASIC ROCKS OF THE GORDON CONCESSION, S.W. TASMANIA

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PART I

Preface

It must be emphasised at the beginning that this report is only an interpretation. It rests upon very little field work, and none by the writer, who has however worked with similar rocks in Quebec, Canada.

It is an attempt to summarise our present knowledge of the ultrabasic rocks of S.W. Tasmania which has been gathered from the photographs and geophysical surveys carried out by Adastra Hunting Geophysics Pty. Ltd. and field work carried out in this area in the past.

Report on the Serpentinites in the Gordon Concession

1. Introduction

Along the contact between the Precambrian and Dundas Group, which strikes NE from Hibb's Lagoon to Gravelly Beach (SW shore of Macquarie Harbour), a series of intrusive ultrabasic rocks (loosely referred to as serpentinites) is believed to be exposed. This report is to set out what is known of these ultrabasics at the present time; to develop an interpretation of their local and regional structure; and in light of the airborne geophysical results, to indicate those areas which appear most favourable for mineralisation. As relevant field work is extremely scanty, the criteria for the 'facts' presented, and the premises for theories developed, will be explained.

2. The Nature of the Ultrabasics+

It is widely recognised that ultrabasic intrusions are a common

+A glossary of petrological terms is included in the Appendix to this report.

feature in the late stages of the formation of geosynclines, and especially of Palaeozoic geosynclines. They have been frequently reported from the axis, or geanticlinal regions of geosynclinal troughs. The following sketch (plate P80) which is modified after Elliston (1953) shows the broad structural setting of the rocks under discussion.

In contrast to Elliston (1953), Banks (1956) considers that the serpentinite bodies bear no clear relationship to the major tectonic framework of Tasmania.

He considers that these "Basic and ultrabasic rocks range in composition from quartz-mica gabbros to dunites, but mainly pyroxenites, are common in Tasmania. Many of these have been extremely serpentinised."

He adds that "There are either two separate and unrelated intrusions of ultrabasic rocks in Tasmania, one of upper Cambrian, the other middle Devonian age, or, an intrusion during the upper Cambrian as slightly transgressive sills and dykes of ultrabasic material, some of which was re-introduced during the middle Devonian into faults or unconformities between Eldon and older rocks."

He contends that "Pyroxenite, with minor amounts of other ultrabasic types were intruded during the upper Cambrian as transgressive sheets in the Cambrian group or as dykes in the Precambrian, and carried osmiridium which is associated with the bronzitite or peridotite members of the suite. These were serpentinised before the deposition of the Junee Group."

3. Known Occurrences of Ultrabasic Rocks in the Vicinity of the Modder Area

Taylor (1955), in his discussion of asbestos in Tasmania, mentions two occurrences of serpentinites which we believe to be directly related to the Modder ultrabasics. These are:

A. Spero River Area;

B. Asbestos Point.

The Modder 'series' may be regarded as a major occurrence of ultrabasics, which is broad terms forms a continuous belt; the north and south extremities of which have, for many years, been recognised at Asbestos Point, and at Spero.

A. Spero River Area

(a) Composition

The composition of the Spero River ultrabasics may be summarised as:

(i) Gabbros;

(ii) Saussurite - gabbro;

(iii) Bronzitite;

(iv) Serpentinite - present in relatively small amounts.

B. Asbestos Point

The composition of the Asbestos Point rocks is briefly:

(i) Pyroxenite and related types;

(ii) Gabbros and norites;

(iii) Serpentinites.

In this report, four belts of ultrabasic rocks are proposed:

1. Modder;
2. Spero;
3. Birch;
4. Settlement.

The distribution and extent of these belts is shown on plate P25p.

One of the premises upon which this report is based, is that the composition of these ultrabasics is broadly identical with that of the rocks at Spero River area, and Asbestos Point, described above. An important piece of evidence supporting this is that the magnitude of the magnetic results corresponds with those of known Tasmanian ultrabasics (see Hancock's report).

Confirming evidence comes from previous fieldwork (report G25), where in the creeks draining N into Gravelly Beach many grains of disseminated chromite (magnetically susceptible) were found, together with osmiridium and gold. The osmiridium confirms the presence of serpentinites.

In summary, it is proposed that the four belts, Modder, Spero, Birch and Settlement are composed of:

1. Pyroxenites;
2. Gabbros;
3. Serpentinites.

4. Criteria used for Identifying the Ultrabasic Rocks

A. Airborne magnetic results

B. Photogeological interpretation

The identification of the Birch Belt rests upon magnetics, as the whole area is covered by Tertiary sediments.

For the other belts, the procedure used by the writer was first to carry out a detailed photogeological interpretation on 30 chain photographs, and on this foundation, to interpret the 10 chain photographs with more detail and precision. This photogeological work was carried out over areas producing the appropriate magnetic anomalies. The aims were twofold; to discover the local structure, and to attempt to outline any outcrops of ultrabasic rocks.

The attempt to outline the ultrabasics proceeded at first by trial and error, until a technique was developed, which was both consistent and reasonable. Reid, writing in 1921 of the Bald Hill area, observed that "the line of contact of slates and serpentinites is marked by the luxuriant growth of the vegetation on the sediments compared with the almost barren appearance of the serpentinites. Land where serpentinite occurs is unsuitable for agriculture, or any other purpose, because the soils resulting from decomposition of these rocks lack the alkalis necessary for plant growth. Bald Hill is almost completely devoid of vegetation, only button grass and allied plants finding sustenance thereon."

To have selected every area covered by poor or low vegetation in the vicinity of the characteristic magnetic anomaly would obviously have been an impossible task: for what would constitute poor timber? An arbitrary delineation would hardly have been rational. In addition, the results of such a selection would have presented great difficulties in making a structural interpretation which was considered necessary. Hence a certain type of vegetation was deemed characteristic. It is predominantly button grass with stunted scrub, which presents a smooth, even texture especially on the 30 chain photographs.

Summarily, the ultrabasics have been identified by magnetics which served to direct attention to particular areas. Concomitance of a characteristic timber pattern with an assumed structural setting are the photogeological criteria.

5. The Structural Setting of the Four Belts Under Discussion

In this report it has been taken that the Dundas Group is unconformably placed on the Precambrian; the plane of the unconformity dipping at approximately 45° east. Major faulting has taken place along this plane which has been folded so that major folds in the Dundas Group reflect similar structures in the basement, and hence in the unconformity. It is along this unconformity and major faults that the ultrabasic rocks have been intruded.

Each belt will now be considered in turn.

A. The Modder Belt

(a) The magnetics suggest that this is a discontinuous belt, which probably consists of nine or ten separate intrusions, which may or may not have a tenuous connection at depth.

(b) The evidence from magnetics of the whole belt points to these serpentinite bodies having steep dips, which from photogeological outcrops would in general be to the east. With respect to the individual outcrops (except for the distribution of magnetic lows), there is no definite direction of dip clearly indicated by magnetics, which would suggest that the dip is vertical.+ However, the following is put forward as possible evidence for an easterly dip. The magnetic low to the west may be due to the contrast between the highly susceptible ultrabasics, and very unsusceptible Precambrian metaquartzites; while the low to the east may be the effect of the 'other pole' of the east dipping ultrabasic sheet.

(c) Magnetics point to these ultrabasics as being sheet like bodies with a vertical pitch.

B. The Settlement Belt

(a) The magnetics show two anomalies. The larger one to the south is situated on the axis of a major anticline. This anticlinal axis would coincide with the axis of the Hibbs anticlinorium, proposed in Geological Report number G72. On this basis, the crest of the anticline would bring the unconformity near to the surface (?outcrop). The unconformity is a control for the ultrabasics, hence this outcrop of ultrabasics is to be expected.

+ Note. There is a very strong magnetic evidence for the series as a whole dipping east.

(b) Magnetics indicate a general NE dip, with a northerly plunge. This accords well with the attitude of the major fold.

(c) The magnetic anomaly 14/1 to the north is an exceptional feature in many respects.

(i) The structural setting is a highly complex area of folding and faulting.

(ii) Absence of characteristic vegetation suggests ultrabasics do not outcrop here.

(iii) The very broad contours, together with lower magnitude, suggest it may be an ultrabasic intrusion which does not reach the surface.

That it is due to another cause apart from ultrabasic rocks cannot be excluded, especially in regard to its complicated structural position.

C. The Birch Belt

This extends from the mouth of Birch's Inlet south to the junction of a major NE fault, with the Lyell Shear just west of Moore's Valley.

The evidence for this belt is based entirely on magnetics. It accords well with the regional structure which briefly is as follows:

The Birch belt marks the main anticlinal axis in the folded unconformity which brings this unconformity near the surface. An alternative view is that the ultrabasics have made use of a major fault to intrude the Cambrian sediments. This fault would be the west boundary fault of 'Birch Rift Valley'. Further to this, it is obvious that it could well be a combination of the two factors, both serving to facilitate the intrusion. The age of this fault seems to the writer to present some problems, but none of an insuperable nature. ?

D. The Spero Belt

(a) This trends NNW from the Spero River to Hibb's Lagoon, where it 'joins' the Modder Belt.

The magnetics suggest that there are two main intrusions:

(i) The main outcrop on the mouth of the Spero River;

(ii) The photo-outcrop about half way from Spero to Hibb's Lagoon.

(b) These two intrusions may have a tenuous connection with each other and with the Modder Belt. Magnetics definitely suggest that other smaller intrusions exist at depth.

(c) The ultrabasics have been intruded into the Cambrian along a NNW fault.

(d) Magnetics indicate a steep easterly dip which accords with photogeological interpretation.

(e) It is of considerable interest that the two outcrops occur where an E-W trending fault intersects the main NNW fault. The presence of the largest intrusion of ultrabasics in all four of the belts, always coincides with the intersection of two major faults of different directions (not always the same two directions).

The absence of any large ultrabasic intrusion (magnetics suggest only very small bodies present) along the major E-W fault that 'connects' the Modder to the Spero Belt seems to the writer to indicate an exception. This structural exception might prove interesting, and would seem to warrant being kept in mind for preliminary geophysical investigation after we have learnt something more of the field association of the ultrabasic intrusions.

To conclude this general outline, the following extract from Taylor (1955) seems particularly apt:

"It has been suggested by the previous investigators that there is a strong possibility that the serpentinite extends as a continuous belt from the Spero River to Asbestos Point on Macquarie Harbour. This supposition is not supported by the present writer for the following reasons:

(1) There is a marked difference in the type of serpentinite occurring in the two areas;

(2) The differential cover of vegetation in the Spero area shows quite clearly that the serpentinite cuts out a few chains north of the river.

(3) It is shown in the sections dealing with the Asbestos Point occurrence that the serpentinite there definitely disappears a little over half a mile south of the coast;

(4) It is unusual for large masses of ultrabasic rocks to appear at the surface. The distance between the two occurrences is about 25 miles and were the serpentinite to appear continuously over this distance the exposure would be unique.

The above statements do not preclude the possibility that patches of serpentinite may appear along the Spero-Asbestos Point line."

It is both interesting and ironic to observe how literally this is correct; yet scarcely more than a mile to the west of this Spero-Asbestos Point line, there exists a belt of 'serpentinites' continuous for about 12 miles.

Part II

Preface

This section of the report is a fairly detailed consideration of each of the outcrops of ultrabasic rocks.

The important elements will be found summarised in the sections headed "Economic geology and structural setting".

Description of Outcrops of Ultrabasics and the Relationship of Airborne E.M. Response

1. Modder Belt

(a) Detailed Description of the Outcrops

Outcrop 1

Twenty chains wide at Gravelly Beach and extends south for twenty chains.

This intrusion into Cambrian has come up a major fault which passes through the east limb, (and parallel to the axis of) a northward plunging syncline

The airborne E.M. shows one peak of ratio 0.7 just east of the magnetic high peak, which may be associated with the intrusion, although it is five chains east of what I interpret as the boundary of the intrusion.

Outcrop 2

Seventy chains south of 1. A small outcrop thirty chains long and five chains wide, in the floor of a valley.

It occurs at the junction of two major faults which define the Precambrian/Cambrian boundary. Another N-S fault (intra-Cambrian) to the east, possibly serves to delimit the intrusion at depth (magnetic).

The airborne E.M. has produced a peak of 1.17 which is slightly to the east of the magnetic high peak on the gradient. This E.M. response may be associated with the intra-Cambrian fault; or ~~from~~ with the upper (east) face of the eastward dipping intrusion.

I think the intrusions giving rise to outcrops 1 and 2 are small discrete bodies. As it might be found that those areas where the ultrabasics pinch out are of importance, this should be noted. The airborne E.M. shows little or no response from these areas of pinching except where faults have been active in effecting it.

Outcrop 3

Half a mile south of 2. It is one mile long - ten chains wide. It has a very similar structural setting to 2, being intruded along the same boundary fault along the unconformity. Like 2, it forms the floor of the valley.

Airborne E.M. has produced three peaks 0.42, 0.72, 0.53, which are all slightly west of the magnetic high axis. These are possibly associated with the upper face of the western intrusion, which dips east in contact with Cambrian sediments.

Outcrop 4

Thirty chains east of 3; a small apophysis of the ultrabasic is associated with three E.M. peaks.

(a) 0.64, ten chains east of the eastward dipping contact (depth response?);

(b) 0.58 as above (depth response?);

(c) 0.59 on contact which is probably faulted.

All these peaks are very near the magnetic high axis.

Outcrop 5

Situated between 3 and 4 but to the south, en echelon. It is seventy chains long, and widens southwards where it 'joins' a major outcrop (7).

It is structurally part of 3 from which it is separated by a wedge of Cambrian sediments.

Two E.M. peaks of ratio 0.67 and 0.8 are associated with the contact of the intrusion. Another to the east of 0.43 coincides with photo boundary.

Outcrop 6

Situated half a mile east of Outcrop 4. It is 1.25 miles long and half a mile wide.

It is separated from 3, 4 and 5 by a major NNE fault. This same fault passes eight chains west of the known exposure of ultrabasics at Asbestos Point. This may mean there is a structural (and ?compositional) affinity with the Asbestos Point intrusion. The magnetics are of much lower magnitude for 6 (approximately 2000γ).

Another difference is that there is relatively poor correlation between the delineation of the intrusion by photogeological interpretation, and by magnetics. This could mean that the composition of the intrusion (6) is different from that of the main Modder Belt: one aspect of this composition being the quantity, and distribution, of magnetite and chromite. Alternatively it could be due to a displacement in magnetics, which might well result from the juxtaposition of several high magnetic bodies.

Airborne E.M. has produced a peak of 0.25 near the boundary of the intrusion. This could be emanating from the contact (at depth) which dips east.

A major fault (mentioned above) which passes just west of Asbestos Point coincides with three E.M. peaks. One of 0.57 is found where the magnetics pinch out (reflecting the pinching out of the intrusive). Further SSW on the next flight line, one of 0.89 at the north end of this extension of the intrusion (6) as suggested by the magnetics. Here there is a marked local magnetic disturbance suggesting a NW fault, which would meet the major fault about sixty feet from the E.M. peak.

Following the major fault SSW it passes through a sharp local disturbance in magnetics; on the next flight line it coincides with an E.M. peak of 0.67. All of these E.M. peaks coincide with magnetic high gradients; and all are associated with faulted ultrabasic/Cambrian boundaries.

There are several other E.M. peaks in this area, most of which coincide with photo-linears (which are probably faults). Two in particular are interesting. They occur about thirty and forty chains respectively north of the northern limit of Outcrop 4. They are of 0.65 and 0.69 and both are situated in areas of sharp magnetic disturbance which probably occur where the intrusion pinches out against faults (or is cut by later faults).

This looks a particularly interesting area to the writer.

<u>Outcrop 7</u>

This is a large outcrop 1.5 miles long and thirty chains wide. To the north it branches into two (Outcrops 4 and 5).

The western (easterly dipping?) boundary has three E.M. peaks: 0.43, 1.67 and 0.45 which is also on a fault. The eastern boundary has only one E.M. peak of 0.23.

Outcrop 8

Twenty chains west of 5. It occurs in the floor of a valley. It is delineated on the west by the major boundary fault.

South of the outcrop, two peaks of 1.0, 0.86 may be associated with the intrusion at depth, or as magnetics indicate with a fault.

Outcrop 9

This is the southern continuation of 7. It forms the largest area of ultrabasic rock in the Gordon concession. It is two and a quarter miles long and half a mile wide.

It occurs on the nose of a major NNW plunging anticline in the Cambrian. It appears to be delineated to the west by the unconformity, and not by the major fault which here is about ten chains west of the unconformity. The structure in this area is complicated; the most important factors will be noted.

1. The major Precambrian/Cambrian fault leaves the unconformity in this region, and its action is taken over by another fault twenty chains to the east. This en echelon movement occurs on the southern limb of the anticline mentioned above.

2. A large NW regional fault intersects the NNE boundary fault in the middle of the outcrop. This fault is in the east limb of the anticline mentioned above.

South of the intersection of the two major faults the ultrabasic gives rise in the east to a prominent hill. I believe this hill may be formed of pyroxenite. An aerial reconnaissance of this area by the writer showed this hill to fit a description by Taylor of pyroxenites. Taylor writes "In the field the pyroxenite because of its superior hardness forms prominent rugged outcrops projecting twenty feet or more above the surrounding serpentinite. These outcrops are much weathered, and the rock assumes a dark rusty-brown colour. The general aspect is that of a number of huge boulders piled one atop the other. From quarrying it is seen that the pyroxenite does not extend to great depths. Often the best asbestos fibre is found in the serpentinite adjacent to, or beneath pyroxenite outcrops."

If this hill is indeed pyroxenite, it would be a large body, and the low ground to the west may well be the softer much less resistant serpentinite. It follows from Taylor's remarks that this area would recommend itself for careful investigation for asbestos. The foot of the hill which presents a marked change in slope might be a good place to look for the contact.

It may be significant that there is very little E.M. response from this outcrop although it is so large.

At the southern end of this outcrop there are three E.M. peaks, 0.59, 0.45, 0.31, all of them associated with the contact of the intrusion in the Cambrian sediments.

There is one peak of 0.33 which occurs toward the middle of the southern part of the outcrop with no apparent correlative feature..

Outcrop 10

Seventy chains south of 9. It occurs in the valley with the characteristic structural setting, that is with the plane of unconformity and the NNE fault. The structure is much simpler now that we are away from the nose of the anticline and concomitant cross faulting. Here the ultrabasic seems to have its foot wall on the unconformity and to have its hanging wall along the fault (which is now east of the unconformity). Fault, unconformity and intrusive dip east.

E.M. shows two peaks: one on the contact of the Cambrian with the intrusive, and the other on the associated major fault. Ratios are 0.53 and 0.47.

The outcrop divided by a 'wedge' of Cambrian is one mile long and ten chains wide.

Outcrop 11

One and a quarter miles south of 10. It is one and quarter miles long and ten chains wide.

It is delineated on the west by the unconformity. It is possibly limited (not in a strict sense) to the east by the NNE fault. As with (10), the unconformity, fault and intrusion all dip east.

The airborne E.M. has produced a well defined, discrete anomaly with a peak on every flight line except one. The low frequency 'background' is very high, (the exception for the Modder Belt) up to 2.1° phase shift. The average ratio is about 0.7.

These features, especially the high 'background', suggest the response is coming from a non-metallic conductor. There is a noticeable double curve in the E.M. axis which pays no heed to the magnetic axis, nor the topography; however, it follows quite closely the curves in the outcrop of the unconformity. Hence the following suggestions are made as to the cause of the E.M. response:

1. A water table associated with the unconformity;
2. Talcose alteration of serpentinite with a large development of serpentine, which serves to hold water and have a high conductivity (c.f. clays).

This is not meant to be an exclusive interpretation, but is put forward as a possible explanation.

(b) <u>Economic Geology and Structural Setting</u>

1. The possibilities of asbestos being developed where the nose of the Cambrian anticline intersects the largest ultrabasic intrusion has already been mentioned (Outcrop 9).

2. The most complicated, and most interesting, E.M. response has come from that area in the Modder Belt which shows greatest structural complexity.

The structure of the intrusion in the area north of the anticlinal nose, and the NNW fault which cuts off the anticline, is so different, that it may be due to these intrusions being in a very different structural setting - namely a syncline. It is significant that the Spero Belt which is intruded into a syncline is compounded of discrete bodies as is the north part of the Modder Belt.

That this area immediately north of the anticline was one of great stress and movement is demonstrated by a series of tight folds in the Cambrian east of this.

3. What is the nature of the conductors producing the E.M. anomalies in this area of several juxtaposed ultrabasic intrusions? If these conductors are metallic, the following are suggested as possible:

(a) Magnetite and chromite veins and <u>schlieren</u> which would probably be parallel to the contact near the contacts.
(b) Magnetite and chromite smears along faults and shears and possibly at the contacts.

(c) Sulphides -

(i) Innate association of the Ultrabasics. Some nickeliferous sulphides are highly magnetic, and could give rise to local magnetic disturbances as well as producing an E.M. response.

It might be advisable to use an IN/OUT phase E.M. unit to check magnetic conductors, e.g. Ronka or Turam.

(ii) Hydrothermal emplacement.

(d) The presence of osmiridium may indirectly give rise to E.M. anomalies. The osmiridium may occur in schlieren; "the matrix consisting of steatite, limonite and clay, is contained between two well defined walls". - Taylor (1955). Such clay filled bands could produce good conductors.

2. Settlement Belt

(a) Detailed Description of the Outcrops

Outcrop 1

One and a half chains east of Hibb's Lagoon.

This is a very large feature which necks in the centre producing two main portions each about one and a quarter miles long and half a mile wide, with their long axes NW.

Each part is closely associated with a magnetic high, the necking in the magnetics reflecting that in the outcrop.

A. Southern part

Magnetics suggest SW dip. Two E.M. peaks of 0.13, 0.14 may be related to the contact of the intrusion with the Cambrian. It is possible that this contact in places is the Precambrian/Cambrian unconformity, but as no Precambrian has been identified from the photographs it seems unlikely. The intrusion in this part of the outcrop may be related to a NW fault (manifested as a photo linear).

B. Northern part

Magnetics suggest a NE dip, which as the magnetic high is displaced NE of the outcrop may be not as steep as that on the SW of the axis of the Hibb's anticlinorium.

A major NNW fault passes through the east end of this outcrop. The intrusion is probably related to this fault more closely than is apparent from the outcrop.

The only E.M. response on this northern part not suspect with respect to drainage are peaks of 0.28, 0.43. The former occurs within the intrusion in the vicinity of a probable fault, while the other is within the Cambrian, it is possibly related either to the fault or the intrusion contact at depth.

There is no outcrop corresponding to the magnetic high anomaly which is possibly the north end of the Settlement Belt of intrusives. The shape of the magnetics lead one to believe this may be an ultrabasic intrusive plug which has not reached the surface. The magnetic high peak falls on the intersection of two faults; one of which is a major E-W fault. This area is one of very compressed folds with considerable faulting. The magnetic anomaly is situated in a faulted hiatus between five southward plunging synclines.

E.M. response has been low over the magnetic anomaly. However, a peak of 0.4 occurs towards the magnetic high peak, possibly associated with a fault, or with the intrusive at depth.

There are three E.M. peaks of 0.45, 0.25, 0.36, over the syncline, which is due south of the magnetic anomaly. Photo-interpretation suggests these may be picking up a conductor in one bed, or at the contact between the same two beds.

(b) Summary

In summary, I think that too little is known of this belt to make any further interpretation of the composition; nothing can be said beyond noting that both E.M. and magnetic response show sufficiently different features from the Modder Belt to suggest a different composition. Whether this difference is in the composition of the intrusive rock as a whole, or in the nature and distribution of the more magnetically susceptible constituents must remain uncertain, until field investigations have been carried out.

3. Birch Belt

This belt is completely covered by Tertiary sediments. The presence of these intrusives has served a very useful purpose in enabling a more detailed interpretation of the western boundary of the Birch Rift Valley.

A single fault with a downthrow to the east is incompatible with the concept of ultrabasic intrusion along the fault.

Therefore the following generalisation is proposed; there must be at least two major N-S trending faults in the region of these intrusions forming the west boundary of the rift. The eastern one of these two faults must be downthrown to the east and very probably dips to the east. The fault to the west may have an upthrow to the east and a vertical or steeply westward dip (see Plate P81).

4. Spero Belt

(a) Detailed description of Outcrops

All are intra-Cambrian intrusions. One and a half miles SE of Hibb's Lagoon. It is over a mile long and twenty chains wide, elongated N-S.

It occurs on the east side of a major N-S fault, just south of its junction with an ENE oblique slip sinistral fault, which has displaced the axis of the syncline (to which the intrusion is related) about thirty chains in a horizontal direction. This syncline shows considerable refolding, and shearing in the vicinity of the intrusion.

Magnetics suggest an eastward dip of the intrusion. The magnetic 'pinch' in the centre of the intrusion corresponds with the position of a probable fault in the intrusion.

Magnetics indicate that the intrusion probably continues at depth as a thin sill-like body to the north. It appears that there may be another discrete intrusion at depth about thirty chains south of the outcrop.

Over the intrusion, the E.M. response has a high 'background' on the low frequency - up to 2.7° phase shift. This high background suggests that the conductor is not metallic. This type of E.M. response is very similar to that of Outcrop 11 of the Modder Belt.

East of the northern part of the outcrop E.M. peaks of 0.68 and 0.69 occur in a region of shearing and right folding, here again the background is high, 1.8° phase shift. The magnetics are locally disturbed here.

Although the low frequency phase shift is high, this highly disturbed area adjacent to the ultrabasic intrusion the writer considers particularly worthy of investigation.

Outcrop 2

This is the well known exposure at the mouth of the Spero River, which is one and a quarter miles south of the southern end of Outcrop 1.

The intrusion is situated between two N-S faults at the intersection with a probable E-W fault in the mouth of the Spero.

Magnetics suggest the intrusion dips SE. It is interesting to note that this belt probably continues SSW striking out to sea, as do the two N-S faults which 'enclose' the outcrop.

The E.M. response shows a large phase shift in the low frequency of 1.8°. The interpretation of the E.M. in this region is difficult due to the proximity of the sea water (see Hancock).

(b) Economic Geology and Structural Considerations

1. Asbestos: Taylor considered it unlikely that any commercial deposit of asbestos would be found in the Spero River intrusion (Outcrop 2). However, if Outcrop 1 is a pyroxenite body, it is possible that reasonably good grades of asbestos will be found in the associated serpentine.

2. Osmiridium: In 1955, Taylor wrote of the ultrabasic intrusion at the Spero River. "The similarity of the whole serpentinite mass to the known osmiridium-bearing serpentine east of the Wilson River is most striking. In many ways the description of the Spero intrusion fits the Wilson River serpentinite. At Riley's Knob at the southern end of the latter field, considered to be the source of the osmiridium in the creeks, exactly the same type of vertical banding of the ultrabasic occurs. During the present investigation, it was not possible to find time to search for osmiridium, but, in the writer's opinion, there is strong presumptive evidence that it may occur at the Spero River. It is considered that prospecting for osmiridium would be worth while in this area."

If the composition of the intrusive forming Outcrop 1 is comparable to that of the Spero River, Taylor's remarks mean that a large area of source rocks crops out.

3. With regard to magnetite, chromite and sulphides, the remarks on the Modder Belt apply here equally.

4. The Spero Belt may be regarded as a number of related discrete intrusions. The same may be said of the north part of the Modder Belt. It may be significant that both have been intruded into a syncline; and that the intrusions are elongated in the direction of the fold axis.

5. As a point of detail, in the Spero Belt, the two outcrops pinch out in that region where the fold axial plane has apparently been replaced by a major N-S fault.

6. On the basis of very similar E.M. response, the writer suggests that if any mineral of economic interest is found in Outcrop 1 of the Spero Belt, it may also appear at the southern end of the Modder Belt.

Part III

Conclusion on the Mineral Prospects of these Rocks

Economically important minerals associated with ultrabasic intrusions

The following minerals have been reported from various localities throughout the world associated with ultrabasic intrusions: it is highly probable that they will all occur in some quantity associated with the ultrabasic intrusions of the Gordon Concession.

1. Asbestos
2. Magnetite
3. Chromite
4. Ilmenite
5. The Platinoids
6. Gold
7. Sulphides

1. Asbestos results from alteration of the intrusive rocks by aqueous agencies; and often it would seem its development followed soon after the intrusion.

It has been worked at Argent Hill, Tasmania.

2. Magnetite is common as segregations in ultrabasic rocks.

3. Chromite is large masses mainly represents purely magmatic separations in peridotite magmas. Deposits in serpentine are often admixed with magnetite. Sampson (Lindgren 1933) has shown that in South Africa chromite occurs in pyroxenite, and rocks rich in bronzite, rather than in peridotite.

Deposits of chromite in the serpentine areas of Quebec, Canada, have been worked by concentration.

Chromite deposits associated with serpentine have been mined in S. Rhodesia, New Caledonia, California.

4. Ilmenite (Titanium Iron Ore), with magnetite, is contained in almost all gabbros and ultrabasic rocks. The ilmenite-magnetite ores form irregular masses or streaks in the central part of gabbro or norite intrusion.

In this connection, it might be worth while considering the possibilities of Vanadium, which is concentrated in the evolution of ultrabasic deposits (Vogt)(Lindgren, 1933); Clarke (Lindgren 1933) has shown that many proxenes can carry "notable" amounts of vanadium.

5. Platinoids, which comprise the following elements: platinum, osmium, iridium, palladium, ruthenium and rhodium, mainly occur as magmatic products in basic rocks, particularly peridotite. Osmium and iridium are well known as products of ultrabasics in Tasmania (e.g. Adamsfield). Platinum has not been reported from these deposits. As on a world wide basis, platinum usually predominates among the group, the writer suggests that the possibilities of platinum should not be overlooked.

6. Gold: Reid in his report on Osmiridium in Tasmania states "No feature stands out more prominently in connection with these deposits than the constant association of gold with osmiridium."

7. Sulphides of nickel and copper may occur in two ways:

(a) Magmatic segregation. It has been shown that nickel sulphide, chalcopyrite and pyrrhotite have separated from the magma giving rise to peridotite and gabbro.

Reid commented on Heazlewoodite - "This is a distinct variety of nickel ore occurring in the Heazlewood district. The mineral occurs in narrow bands up to 3 inches wide in serpentine rocks, samples have shown a nickel content up to 38%."

At Five Mile Copper/Nickel Prospect near Zeehan, the copper-nickel orebodies also carry platinum and palladium. These orebodies are probably of magmatic origin.

There is thus the possibility that the absence of platinum and palladium from the Tasmanian osmiridium deposits may be explained by their being concentrated from the magma in a different chemical environment, perhaps with the sulphides.

(b) Hydrothermal emplacements possibly associated with the serpentinisation.

(c) Tin may occur; as the association of cassiterite with sulphide minerals characterises a number of tin ores in a well defined metallogenic province in NW Tasmania including Mount Bischoff and Renison Bell.

8. Finally, to end this report on a high note of optimism, it is recalled that diamonds occur in some varieties of ultrabasic rocks, and they have been reported from Tasmanian ultrabasics.

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GEOLOGIST

APPENDIX

An explanation of petrological terms.

Serpentinite — A rock composed predominantly of the serpentine group of minerals. It is an altered rock; being derived by the action of hot aqueous agents upon basic and ultrabasic rocks.

Basic Rocks — The term is used as a group name for rocks with very little or no quartz. The various varieties are defined in terms of the proportion of their two main constituents, namely pyroxenes and calcium rich felspars.

Ultrabasic Rocks — These contain no quartz and have a greater proportion of the iron-magnesium rich minerals (olivine and pyroxene) than felspars. This term includes the rarer monomineralic rocks like dunite.

Gabbro — A basic rock.

Norite — A basic rock.

Saussurite-Gabbro — An altered gabbro.

Peridotite — An ultrabasic rock.

Pyroxenite — An ultrabasic rock composed mainly of pyroxenes.

Dunite — An ultrabasic rock composed predominantly of olivine.

Bronzitite — A variety of pyroxenite.

Serpentine — A mineral group name, whose members are invariably found in ultrabasic rocks in varying proportions.

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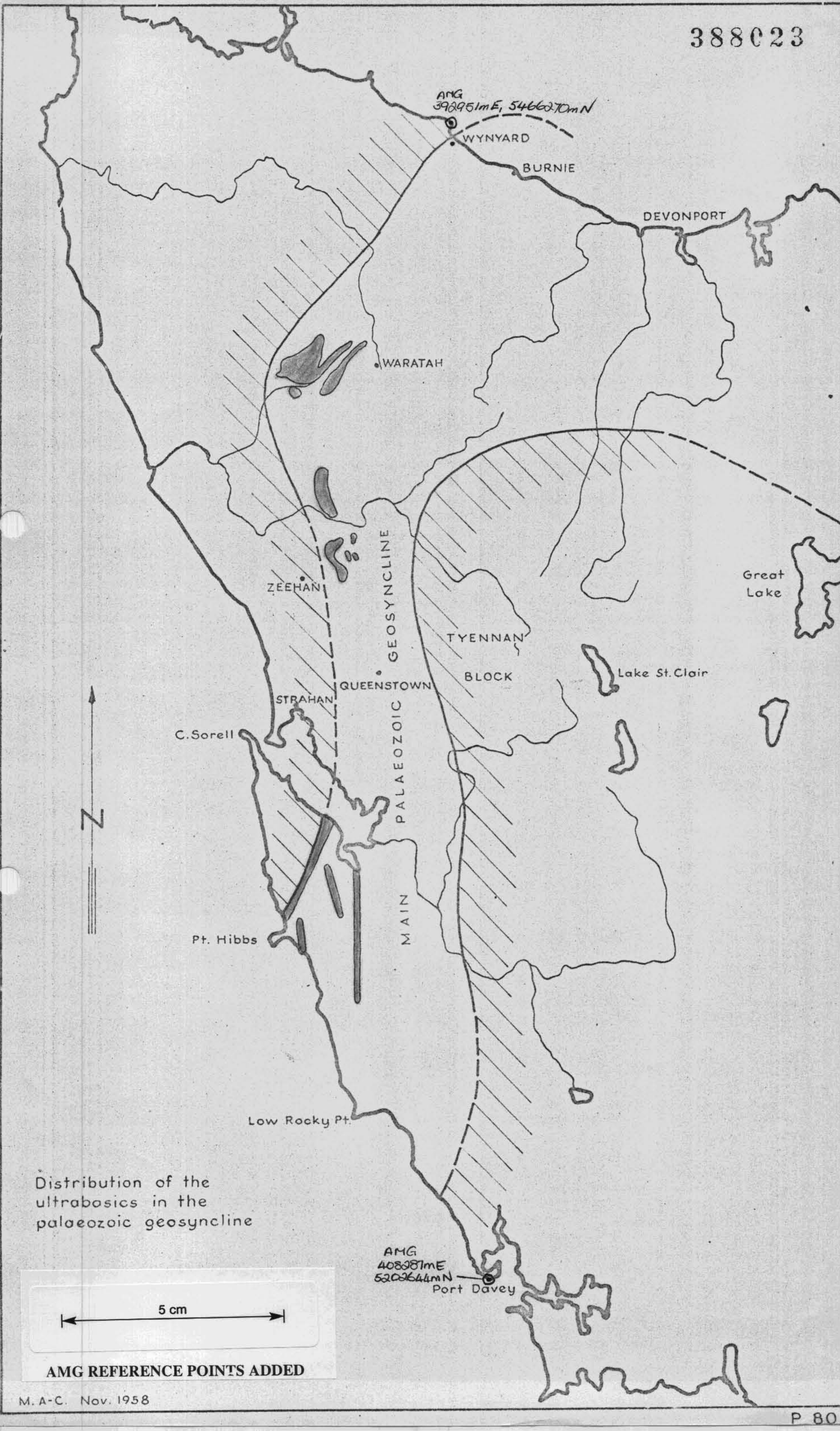

Distribution of the ultrabasics in the palaeozoic geosyncline

M. A-C. Nov. 1958