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Notes on Victoria Trip

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WESFROB MINES LIMITED

NOTES ON VICTORIA TRIP

On February 13, 1964 J. J. McDougall and H. Paulson visited the Department of Mines and Petroleum Resources in Victoria.

The attached material, applicable to Tasu, was released by Dr. A. Sutherland Brown:

1) Unpublished Queen Charlotte geological map. ← Attached to original only

This second edition, post-dating the edition of 1960, includes some reclassifications. It is not much use in this 1:500,000 reduction, but Dr. Brown tells us that we may come and copy the 1:250,000 original if we wish.

2) Stratigraphic section for the Queen Charlottes, which section incorporates the colour legend for the above geological map.

3) Dr. Brown's generalized geological map of Tasu.

This is more or less the same as our generalization, except that it carries a major fault zone marking the approximate northern limits of the main limestone body.

THE FELDSPAR PORPHYRIES

In the area covered by the Wesfrob geological map the post-Kunga, pre-gabbro intrusives are substantially all feldspar porphyries. Dr. Brown discussed the problem of fitting them into the rock chart and of dating them.

LITHOLOGIC DESCRIPTIONS

Although Dr. Brown does not wholly agree with the lithological variations picked out by Wesfrob, he is not yet ready to publish alternatives. The writer, therefore, (from memory) reviews the Wesfrob porphyry classification as it stands. The types granted identity exist among a welter of approximations, departures, hybrids and unfamiliar, one-of-a-kind occurrences. They are listed below according to colour, progressing from white porphyry to diorite porphyry; i.e., from light- to medium-coloured appearance.

White Porphyry - Not personally observed, but assumed by the writer to be the lightest-coloured in the sequence and a very bleached phase of the mottled porphyry described below.

Mottled Porphyry - Usually the host for skarn and magnetite. Vitreous; off-white porphyroblasts with blurred, resorbed margins, commonly ¼" to ½" in diameter on centers averaging ½" or less; ground mass glassy-textured, bleached grey or bleached tan, offering little contrast to the porphyroblasts; altogether, the rock appears fused.

Dr. Brown displayed an uncommon phase having scattered black amphibole lothes about ¼" in length. Current drilling in the No. 5 zone has turned up mottled porphyry that is less fused-looking and contains enough dark crystalline aggregates to suggest true granite-textured diorite. The occurrence is one illustration of the hybrid types that complicate lithologic classification.

The writer is under the impression that zones 1 through 3 held little of this salt-and-pepper diorite - what Dr. Brown calls "honest-to-God diorite." In these zones Wesfrob's diorites are mainly types which approach the andesitic end of the scale.

<u>Grey Porphyry</u> - Vitreous; ground mass medium grey or medium grey-green, aphanitic to fine-grained; lighter-coloured phenocrysts, commonly less than 1/16", occurring in varying amounts from almost absent to such abundance that the rock appears equigranular.

<u>Diorite Porphyry</u> - Resembles the grey porphyry, above, but although tending toward a more greenish, andesitic appearance, the key difference is lustre. In the type specimen the diorite porphyry is stony rather than vitreous; i.e., dull rather than glossy. The difference in lustre, however, is often so nebulous that choosing between grey porphyry and diorite porphyry is a subjective matter.

DATING

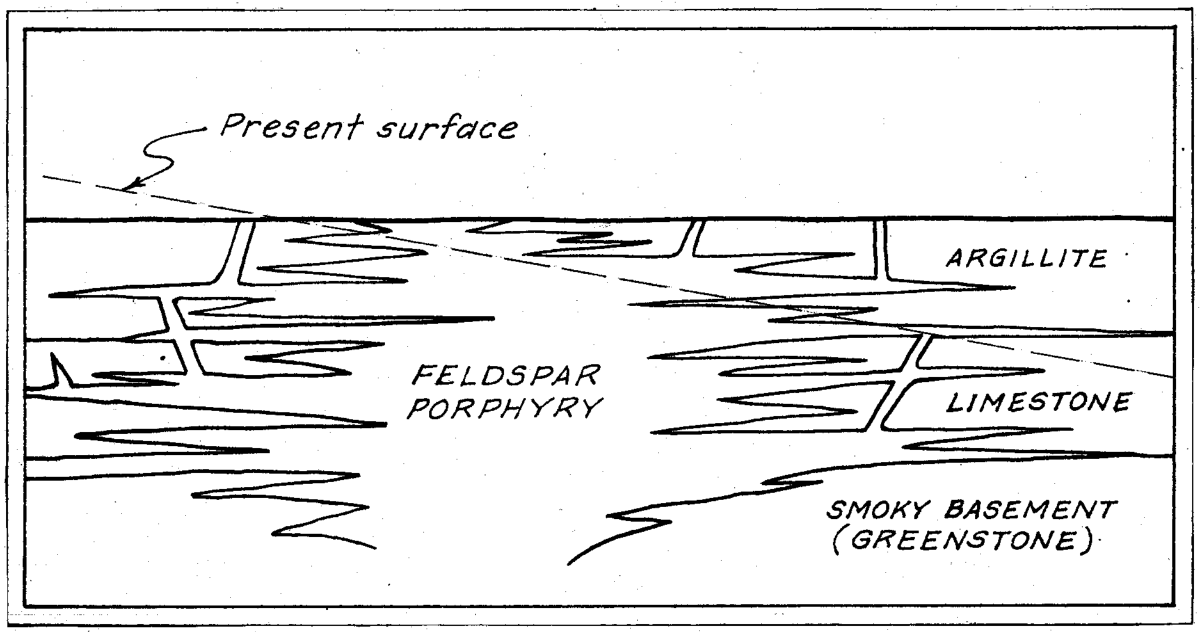
Wesfrob classes the mottled porphyry as pre- and the other porphyries as post-ore. Dr. Brown believes them all, with negligible exceptions, to be pre-ore. His dating has several bases. First, he draws analogy with Jedway and other coastal iron deposits, where the lithology is identical to Tasu's but no mystery because their dyke and sill swarms are not so numerous as to be self obscuring. Second, Tasu at least offered no contradictions, because neither in the core nor in the field did he

Too strongly stated. See Dr. Brown's letter in back personally see porphyry and ore together where one unquestionably cut out the other. Further, late differentiation of iron is known to be a characteristic of the diorite magmas of the B. C. coast.

Thus Dr. Brown sees a single, continuing episode of igneous activity ending with first skarn alteration, then magnetite deposition. J. J. McDougall adds to the post-porphyry idea by noting the preference of skarn and ore for the porphyry rather than the limestone. He theorizes that the limestone furnished CO_2 as a precipitating agent, but, turning plastic and impregnable, could not itself become host. The brittle porphyry, on the other hand, shattered to furnish avenues along which the residual, mineralizing solutions could penetrate.

FORM OF EMPLACEMENT

The sheer numbers of intrusives make for ambiguity. One interpreter of the drill logs may show a dyke grading in composition through several rock types and slicing across ore lenses; his successor sees tiers of sills paralleling the ore lenses. Dr. Brown inclines towards the latter concept; he believes that while dykes are undoubtedly numerous at Tasu, Wesfrob should place more than its present emphasis on sills. He pictures the emplacements as follows:



MISCELLANEOUS

Dr. Brown displayed a hand specimen demonstrating the effects of metasomatism on limestone. It was fine- to medium-grained, saccharoidal, vaguely bedded or banded in dirty grey and dirty greenish grey, the lustre not pearly but so stony as to appear almost earthy. The description is forced, for the specimen was in reality so non-descript that only the presence of Monotis gave it away; where fossils are missing in such a specimen, one would hardly think to check with hydrochloric acid. Some limestone in the Wesfrob core is equally strange - for example, a type so impregnated that it looks andesitic. The point again is the atypical, not to say sham, nature of many Tasu rocks.

Dr. Browns tells us that he expects no further allocation, and so is finished with the Queen Charlotte Islands.

Vancouver, B. C.
February 20, 1964.

H. Paulson,
Geologist.

WHEN REPLYING PLEASE REFER TO

FILE NO.

DEPARTMENT OF MINES AND PETROLEUM RESOURCES

March 5, 1964

Miss Helen Paulson,
Falconbridge Nickel Mines Ltd.,
[illegible] - 1112 West Pender Street,
Vancouver 1, B.C.

Dear Miss Paulson:

I have read your notes on returning to the office today. They admirably summarize my views except that I must have overstated the case in regard to the porphyries. I am sure that the bulk of the porphyries are pre-skarn, pre-ore, and are primarily sills in a flat Christmas-tree type laccolith as you have shown with stem like connection, feeders, etc. This group of porphyries varied widely in original character mainly by abundance of phenocrysts and matrix grain size. Later metamorphism and metasomatism has made it look even more varied including the types covered by your white and mottle porphyries and possibly some that you might classify as grey and diorite porphyry. However there is also no doubt that some of the rocks classified in the latter two categories are post-ore. They can clearly be seen in the field to cut ~~mountain~~ MAGNETITE orebodies and skarn. They are generally as undeformed as the later basalt-diabase-gabbro suite--only rarely show a slight skarning--almost certainly not of the original intense skarn period. The grey porphyry and diorite porphyry are volumetrically unimportant compared to mottle porphyries and [illegible] basalt-diabase-gabbro suite. In tabular summary:

DYKES, SILLS

Type	Characteristics	Relations
A Mottle porphyry	Chiefly sills	Skarned, mineralized
B Diorite		Skarned, mineralized, may or may not be San Cristoval or late phase of same
[illegible]	Related to D? [illegible]	Undeformed, possibly cut by [illegible] faults? possibly [illegible] skarned?

Westfrob geological map as of 13-2-64 shows the mottled porphyry as volumetrically less important.

D	Grey porphyry	1. 40% phenocrysts 2. 10-20% phenocrysts	Dykes	Undeformed, <u>not</u> cut by major faults
E	Basalt suite	1. [illegible] 2. Diabase 3. Basalt	Dykes, various crystallinity according chiefly to width of dyke	"

THE DOMINANT ORIENTATIONS MAY BE MEANINGFUL:

A Chiefly sills, dykes - possibly chiefly N 60° W / steeply E
B Too few to characterize, some N 40° E / steeply
C N 45° W ?
D N 45° W / 65° W
E N - N 15° W / steeply E or W

MULTIPLE DYKES OF VARIOUS PHASES OF BASALT SUITE OR OR E WITH C AND D OCCUR

Regarding the possible metalization: it is clear that the mottle porphyry is host--as important or more important than the limestone. The "smoky" is also a host but possibly a minor one although this is not proven because drilling generally is stopped on entering it (see orebodies ca. E 21000 N 18500). Further the mottle porphyry as dykes does not seem to be as readily replaced as the sills. Clastic or vaguely clastic textures in the mottle porphyry sills are common and were originally interpreted by Ken Polk as ignimbritic block flows. My own feeling is that these acidic sills were brittler than either limestone or the fine-grained chloritic layered greenstones of the Karmutsen and that they shattered readily on the folding. They might then have been subject to percolating calcareous waters to create a more intimate relation prior to mineralization.

If you have any additional comments or questions on my views I would be happy to have them.

Yours truly,

A. Sutherland
Geologist

ASB:rm

Regards to J.J.M. & Mr Tough

TABLE OF FORMATIONS FOR QUEEN CHARLOTTE IS.

AGE		STRATIGRAPHIC UNITS (THICKNESS IN FEET)			LITHOLOGY	FOSSILS	INTRUSIVE ROCKS
QUATERNARY	RECENT				ALLUVIUM, ORGANIC TERRANE		
QUATERNARY	PLEISTOCENE		CAPE BALL FM.	500±	MARINE STONY CLAYS, TILL, OUTWASH SANDS & GRAVEL		
		CONFORMABLE TO UNCONFORMABLE					
TERTIARY	PLIOCENE / MIOCENE?		SKONUN FORMATION	4,500+	MARINE TO NON-MARINE, CALCAREOUS SANDSTONES TO POORLY LITHOFIED SANDS, SHALY MUDSTONES; MINOR CONGLOMERATE, LIGNITE	EXTENSIVE FLORA & FAUNA	
		UNCONFORMABLE, POSSIBLY INTERFINGERING WITH TOP OF TARTU FACIES					
TERTIARY			MASSET VOLCANIC FORMATION	DANA INLET FACIES 5,000+	SUBMARINE? PYROCLASTIC BRECCIAS OF MIXED BASIC & ACID CLASTS, RELATED VOLCANIC SANDSTONES, LESSER PORPHYRY & RHYOLITE FLOWS		↑
TERTIARY			MASSET VOLCANIC FORMATION	KOOTENAY INLET FACIES 4,000+	SUB AERIAL RHYOLITIC ASH FLOW TUFFS AND BRECCIAS, DACITIC FLOWS, MINOR COLUMNAR BASALT FLOWS	WOOD	
TERTIARY			MASSET VOLCANIC FORMATION	TARTU INLET FACIES 18,000: BASALT MEMBER TMC 5000	COLUMNAR BASALT FLOWS, MINOR BASALTIC & ACIDIC PYROCLASTIC ROCKS		POST-TECTONIC BATHOLITHS EMPLACED
TERTIARY			MASSET VOLCANIC FORMATION	TARTU INLET FACIES: RHYOLITE MEMBER TMB 5,5-7,000	RHYOLITE FLOWS?, ASH FLOWS, MINOR COLUMNAR BASALT FLOWS		↓
TERTIARY	PALEOCENE		MASSET VOLCANIC FORMATION	TARTU INLET FACIES: MIXED MEMBER TMA 6000-6500	BASALT BRECCIAS & COLUMNAR FLOWS, RHYOLITE AIR FALL & ASH FLOW TUFFS & FLOWS?	AGE (K-A) ON MICA IN A RELATED SILL; WOOD	RELATED SILLS, PORPHYRITIC ANDESITE PLUGS
		UNCONFORMABLE CONTACT WITH ALL OLDER UNITS					
UPPER CRETACEOUS		QUEEN CHARLOTTE GROUP	SKIDEGATE FORMATION	2,000+	WELL BEDDED, INTERCALATED, GREY SHALY SILTSTONE, GREYWACKE, & BUFF WEATHERING CALCAREOUS SILTSTONE	INOCERAMUS SP.?	
		CONFORMABLE CONTACT					
UPPER CRETACEOUS		QUEEN CHARLOTTE GROUP	HONNA FORMATION	1,300 - 4,000	POLYMICTIC ROUNDSTONE CONGLOMERATE WITH GRANITIC COBBLES, ARKOSIC GRITS; SHALE & SHARPSTONE CONGLOMERATE	INOCERAMUS SP.?	
		SEEMINGLY CONFORMABLE, PROBABLY INTERFINGERING TO UNCONFORMABLE					
UPPER CRETACEOUS	TURONIAN	QUEEN CHARLOTTE GROUP	HAIDA FORMATION 3,500 3,775	SHALE MEMBER 800 1075	GREY SHALE & SILTSTONE, CALCAREOUS CONCRETIONARY SH. & SST., THIN GREEN TUFFACEOUS INTERBEDS	INOCERAMUS LABILIUS	
LOWER CRETACEOUS	CENOMANIAN	QUEEN CHARLOTTE GROUP	HAIDA FORMATION			PSEUDOUHLIGELLA JAPONICA	
LOWER CRETACEOUS	ALBIAN	QUEEN CHARLOTTE GROUP	HAIDA FORMATION	SANDSTONE MEMBER 2,700	GREEN TO GREY WACKE, CROSS BEDDED GLAUCONITIC WACKE, GREY SILTSTONE, BUFF CONCRETIONARY SILTSTONE, RARE PEBBLY WACKE, BASAL BLACK [illegible]	PSEUDOUHLIGELLA DAWSONII; MORTONICERAS; CLEONICERAS PEREZIANUM; DOUVILLEICERAS SPINIFERUM; BREWERICERAS BREWERI; PUZOSIGELLA, [illegible]	SYNTECTONIC BATHOLITHS EXPOSED
		CONTACT WITH LONGARM FM. NOT RECOGNIZED, HIGHLY UNCONFORMABLE ON ALL OLDER UNITS					
LOWER CRETACEOUS	BARREMANIAN & HAUTERIVIAN, LATE VALANGINIAN?		LONGARM FORMATION 4,000±		DOMINANTLY DARK GREY CALCAREOUS SILTSTONE & FINE GREYWACKE WITH INOCERAMUS PRISMS, BASAL ANGULAR GRANULE BEDS WITH ROUNDSTONES, DARK BROWN WEATHERING CALCAREOUS GREYWACKE, SOME VOLCANIC ROCKS	HETEROCERAS; INOCERAMUS QUATSINOENSIS; INOCERAMUS COLONICUS; SIMBIRSKITES; CRASPEDODISCUS; BUCHIA CRASSICOLLIS	↑
		CONFORMABLE TO UNCONFORMABLE ON YAKOUN FM., HIGHLY UNCONFORMABLE TO ALL OLDER UNITS					
MIDDLE JURASSIC	CALLOVIAN	VANCOUVER GROUP	YAKOUN* FORMATION 3,000 - 6,000 (* HIGHLY VARIABLE, TYPE SECTION USED)	E MBR. 455	VOLCANIC SANDSTONE, SHALE, CALCAREOUS SILTSTONE; RARE PEBBLY VOLCANIC SANDSTONE	KEPPLERITES; CHONDROCERAS?	SYNTECTONIC BATHOLITHS EMPLACED
MIDDLE JURASSIC		VANCOUVER GROUP	YAKOUN FORMATION	D MBR. 800	TUFF, LAPILLI TUFF, CRYSTAL TUFF, CROSS-BEDDED TUFFACEOUS SANDSTONE, PEBBLY SANDSTONE		
MIDDLE JURASSIC		VANCOUVER GROUP	YAKOUN FORMATION	C MBR. 950	PORPHYRITIC ANDESITE AGGLOMERATE, & CRYSTAL TUFF		↓
MIDDLE JURASSIC	BAJOCIAN	VANCOUVER GROUP	YAKOUN FORMATION	B MBR. 100+	SHALE, TUFFACEOUS SHALE & SANDSTONE	STEPHANOCERAS; CHONDROCERAS	RELATED DYKES, SILLS
MIDDLE JURASSIC		VANCOUVER GROUP	YAKOUN FORMATION	A MBR. 650	CALCITE CEMENTED SCORACEOUS LAPILLI TUFF		
		CONFORMABLE TO SLIGHTLY UNCONFORMABLE, & INTRUSIVE					
LOWER JURASSIC	TOARCIAN / PLIENSBACHIAN	VANCOUVER GROUP	MAUDE FORMATION	UP TO 600	INTERBEDDED GREY SHALE, BLOCKY DARK GREY ARGILLITE, LIGHT GREY CALCAREOUS SHALE, GREENISH GREY SANDSTONE	HARPOCERAS; FANNINOCERAS; LEPTALEOCERAS?	
		CONFORMABLE CONTACT					
LOWER JURASSIC	SINEMURIAN	VANCOUVER GROUP	KUNGA FORMATION UP TO 3,400	ARGILLITE MBR. UP TO 1900	THINLY BEDDED BLACK ARGILLITE, DARK GREEN TUFFACEOUS ARGILLITE; LIGHT GREY CLASTIC LIMESTONE; DARK GREY FELDSPATHIC GREYWACKE	ARNIOCERATIDS; ARNIOTITES KWAKIUTLANUS	
UPPER TRIASSIC	NORIAN	VANCOUVER GROUP	KUNGA FORMATION	BLACK LIMESTONE MBR. 700-900	THINLY BEDDED BLACK CARBONACEOUS LIMESTONE, SHALY LIMESTONE, CALCAREOUS ARGILLITE, SOME GREY CROSS BEDDED CLASTIC LIMESTONE	MONOTIS SUBCIRCULARIS; DISCOPHYLLITES; HALOBIA	
UPPER TRIASSIC	KARNIAN	VANCOUVER GROUP	KUNGA FORMATION	MASSIVE LIMESTONE MBR. 200-600	GREY WEATHERING MASSIVE LIMESTONE, SOME CHERTY LIMESTONE, CLASTIC LIMESTONE, SOME WELL BEDDED	AULACOCERAS, ARCESTES	GREENSTONE SILLS?
		CONFORMABLE CONTACT					
UPPER TRIASSIC		VANCOUVER GROUP	KARMUTSEN VOLCANIC FORMATION	8,000+ TO POSSIBLY 13,000+	SPILITIC BASALT PILLOW LAVAS, PILLOW BRECCIAS, AQUAGENE TUFFS; MASSIVE SPILITIC BASALT FLOWS & SILLS; MINOR INTERLAVA LIMESTONE, LESS SHALE & VOLCANIC SANDSTONE; METAMORPHIC EQUIVALENTS, MOSTLY FINE AMPHIBOLITES	CRINOID COLUMNS	RELATED DYKES & SILLS

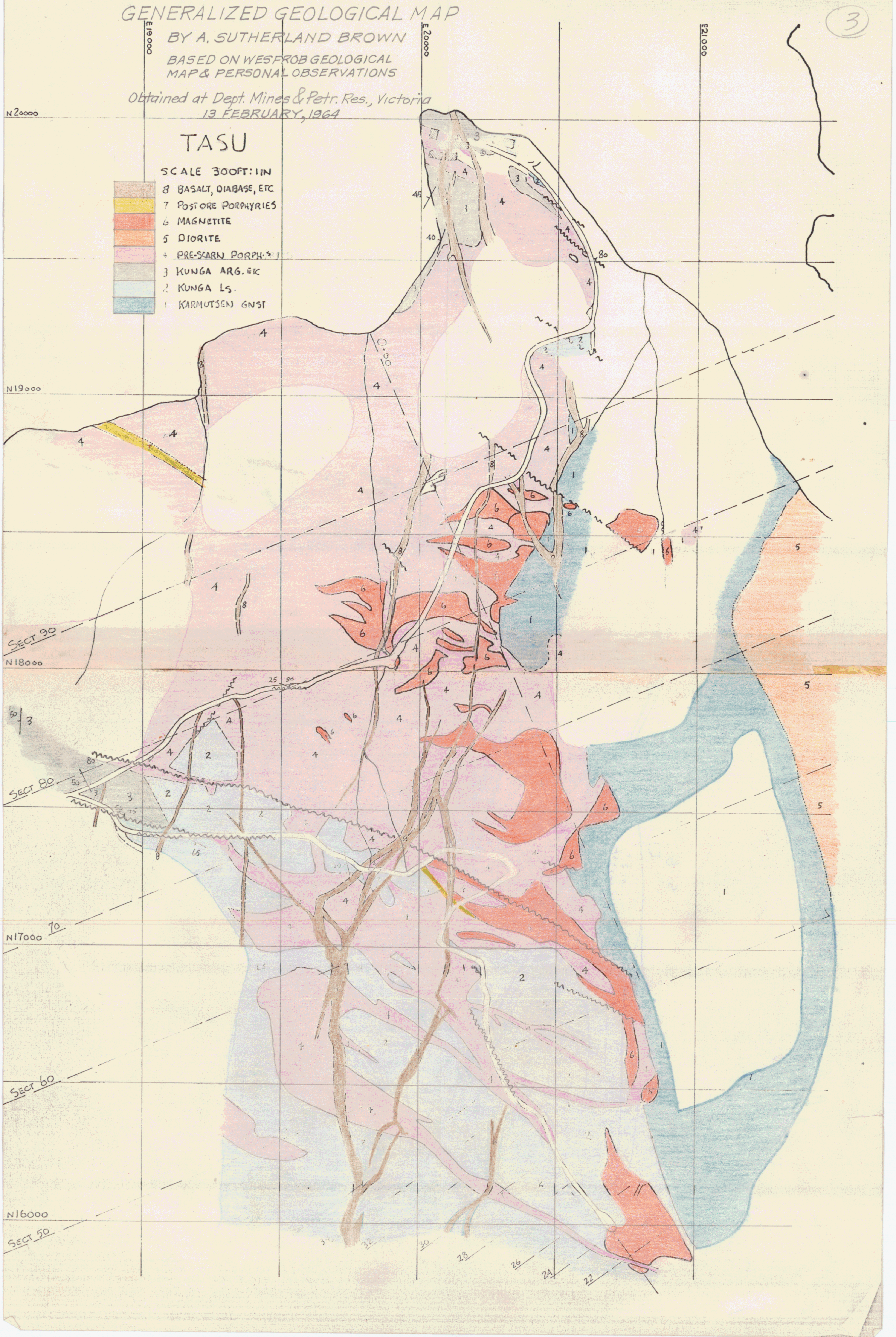
? TASU "gabbro" dykes

TASU feldspar porphyries & magnetite

TASU limestones & argillites

TASU Smoky basement (greenstone)

ASB.
13-2-64



GENERALIZED GEOLOGICAL MAP
BY A. SUTHERLAND BROWN
BASED ON WESFROB GEOLOGICAL MAP & PERSONAL OBSERVATIONS
Obtained at Dept. Mines & Petr. Res., Victoria
13 FEBRUARY, 1964
3
TASU
SCALE 300FT:1IN
8 BASALT, DIABASE, ETC
7 POST ORE PORPHYRIES
6 MAGNETITE
5 DIORITE
4 PRE-SCARN PORPH· ·
3 KUNGA ARG. EK
2 KUNGA LS.
1 KARMUTSEN GNST
E19000
E20000
E21000
N20000
N19000
N18000
N17000
N16000
SECT 90
SECT 80
70
SECT 60
SECT 50