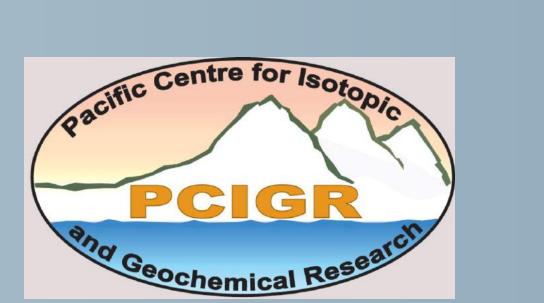


LAYERED INTRUSIONS

LAYERED INTRUSIONS

- an Update on Regional Geology of Nootka Sound Area, Vancouver Island, British Columbia



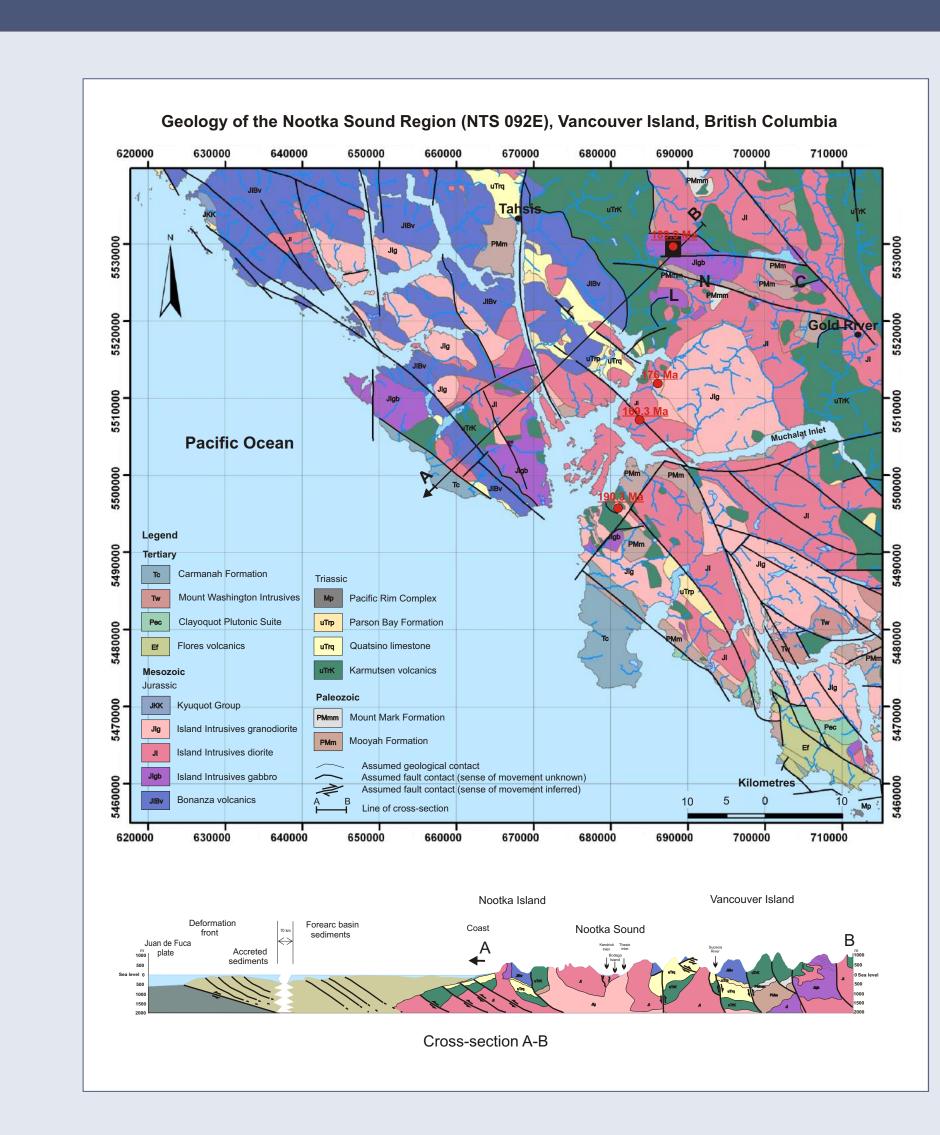


INTRODUCTION

Layered intrusions identified in the Conuma River area consist of alternating cyclic ultramafic and mafic units of olivine hornblendite and hornblende gabbro intruded by diorite and granodiorite. These intrusive rocks form a continuum within the Jurassic Island Intrusive Suite. The layered intrusions display fractionate cumulate textures and magma flow structures.

Other ultramafic and mafic bodies have been mapped within the area. Detailed petrography and mineralogy of these rocks is consistent with similar lithology types worldwide known to host Platinum Group Element (PGE) mineralization.

REGIONAL GEOLOGY



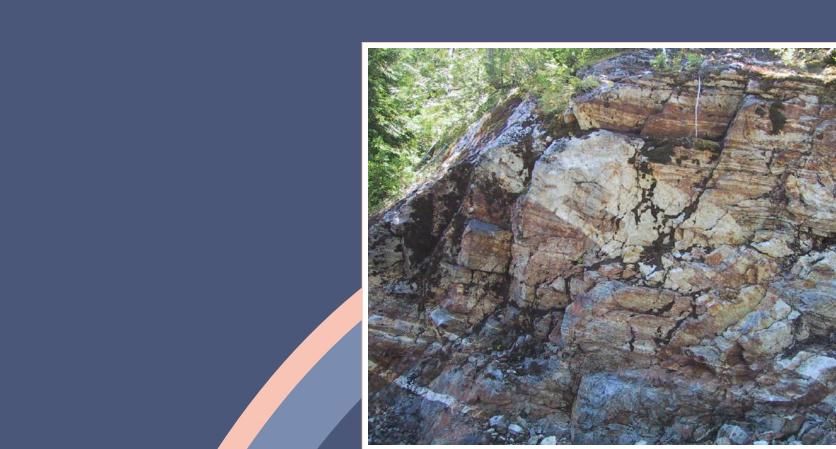
Geological mapping concentrated in Gold River area in 2007 contributed to an update of a geological map of Nootka Sound region.

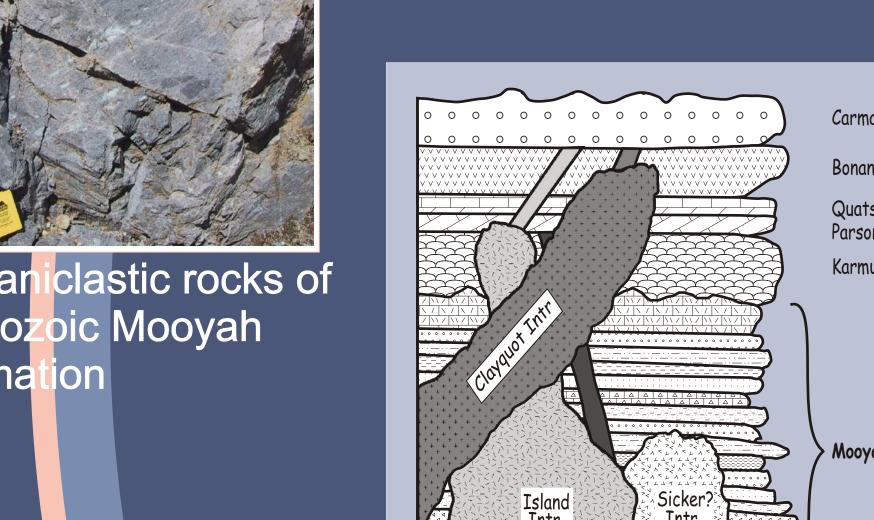
Black rectangle depicts the location of Conuma layered

New Ar-Ar dates from diorites indicating a Jurassic age are also shown on the map (190.1±1.4 Ma; 189.9±2.1 Ma; 176.4±1.3 ma; 169±1.2 Ma).

A cross-section through Nootka Sound region is a result of compilation of 2004-2007 data (Marshall, 2006; Close, 2006;) and data from Muller (1981), Massey et al (2005) and Yorath et al. (1999). Regional faults are interpreted to be NW trending reverse faults being listric at depth and the N-S trending faults are assumed to be normal faults, possibly with a strike-slip component, with kilometre-scale offsets to accomodate relative moveme between major thrust blocks.

brittle deformation in a series of N-NW and SE trending faults The faults are steeply to moderately dipping and are considered to be a response to the recent transpressional regime.

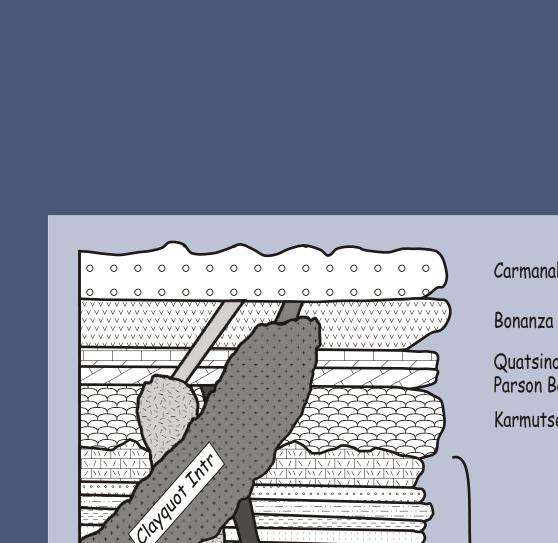




Stratigraphic column of rock units occuring in Nootka Sound region



Tertiary quartz-feldsparepidote vein in Jurassic

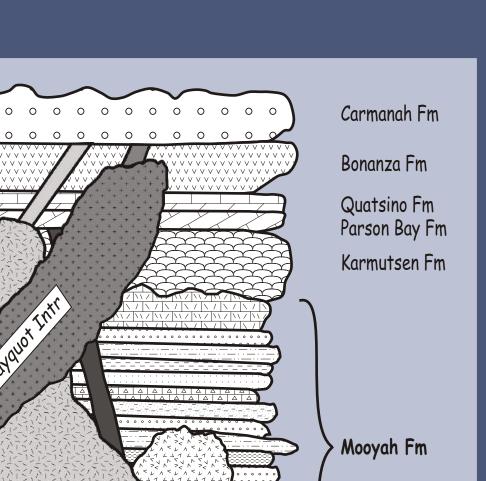


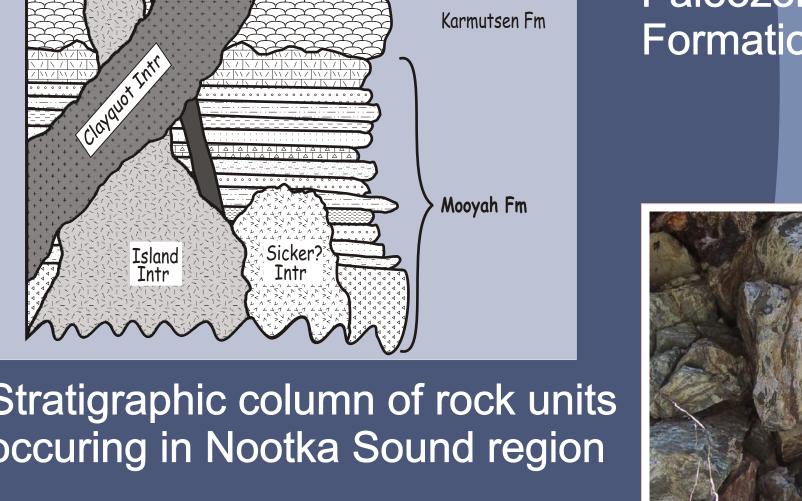


Very coarse grained olivine

hornblendite brecciated by dioritic and tonalitic intrusions (Jurassic Island Intrusive Suite)

laminated sedimentary





sps and deformed and undeformed clasts of country rock in urassic dioritic intrusion

granodioritic intrusions. The belong to the Jurassic Island Intrusive Suite. Contacts between individual

Dominant rock types in Conuma

River area are gabbroic-dioritic-

Local geology

intrusions are marked by abrupt change in grain size, texture or modal abundance.

Dominant intrusion type is hornblende gabbro with:

fine to coarse grain size

Layered intrusions from Conuma River

area were mapped during 2007 fieldwork.

Layered intrusions outcrop in a 70 x 450 m

They are in intrusive contact with varieties

of hornblende gabbros (green), which are

Conuma layered intrusions display two types of

Type 1: Rhythmic layering of 20-50 cm thick unit of olivine hornblendite alternating with

Type 2: Layering in olivine hornblendite, in which

20-50 cm thick layers alternate with 2-10 cm thick

differential weathering and is probably due to either

slight change in chemistry within the unit or change

Layers strike on average 040°±20° and dip 50°±10°.

gabbro with occasional

layers. The layered appearance is a result of

in orientation of hornblende megacrysts.

20-30 cm thick unit of hornblende gabbro.

also inclusions in dioritic intrusion (pink

with green).

narrow band, oriented N-S (dark purple).

- acicular to prismatic hornblende crystals
- 35%-80% hornblende abundance
- equigranular, pegmatitic and spotted textures

Layering and other structures

Detail of a

of hornblende

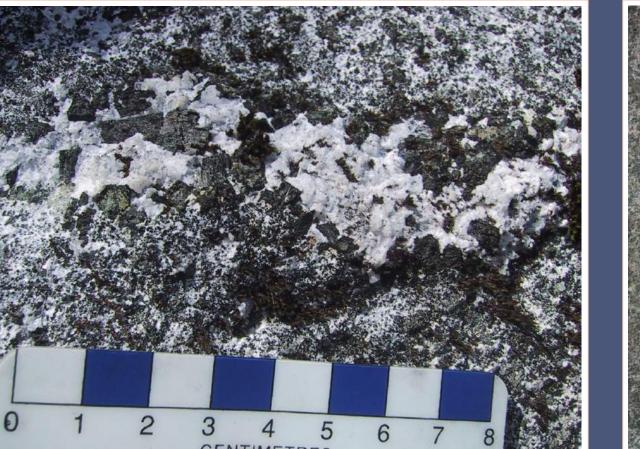
Coarse grained spotted hornblende

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diorite in medium grained hornblende gabbro



plagioclase crystals

5 15 25 0 10 20

Detail of convoluted, irregular small scale antiforms

and synforms consisting of a variety of hornblende

fragments caught in a density current of hornblende

gabbro are also evidence of a dynamic environment

in a magma chamber during deposition of ultramafic

Pegmatitic pods and lenses with continuous strings and streaks (red arrow) or random distribution (yellow arrow) of hornblende and

Example of density current

displaying convoluted layering

Detail of a convoluted

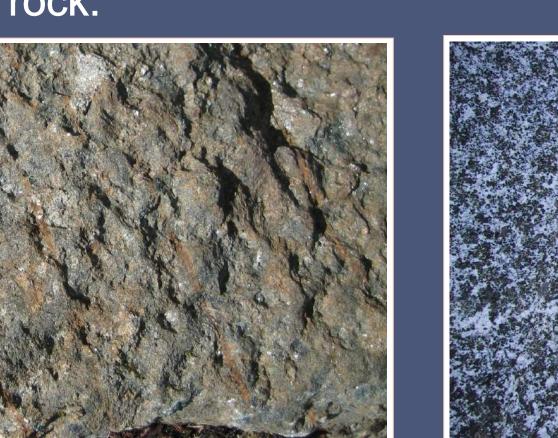
in olivine hornblendite unit

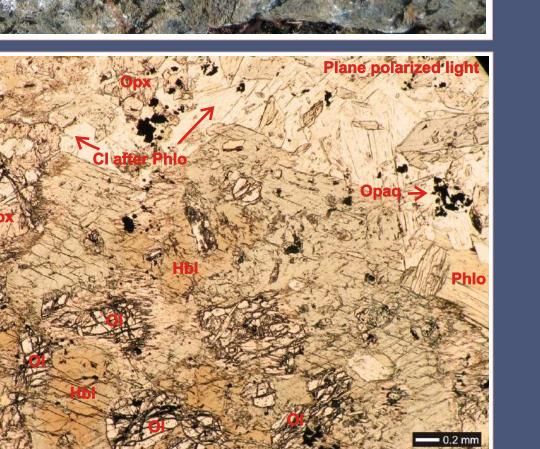
preserved in an outcrop

red arrow)

Lithology

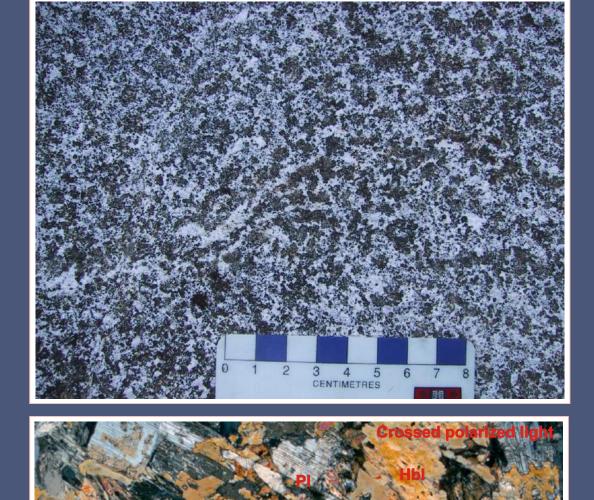
dark green fresh, very coarse grained ultramafic

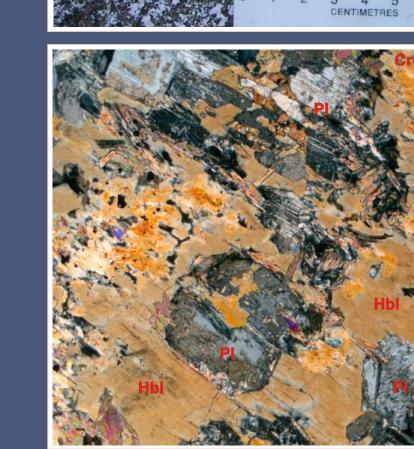


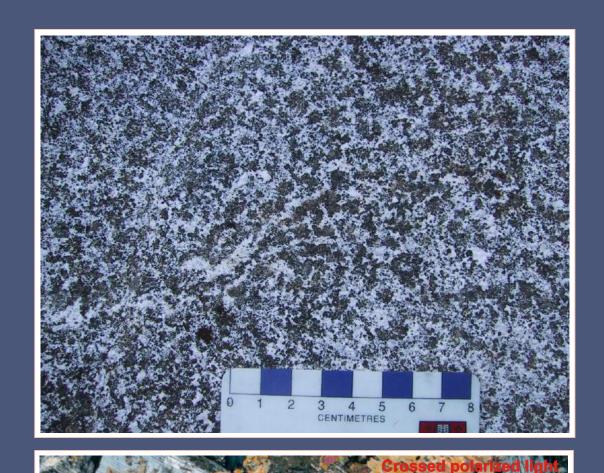


hornblendite consisting of 38% gabbro consisting of 35-90% (OI), 20% pyroxene (Opx), enclosing 65-10% plagioclase 10% phlogopite (Phlo) and (PI) 5% opaques (Opaq)

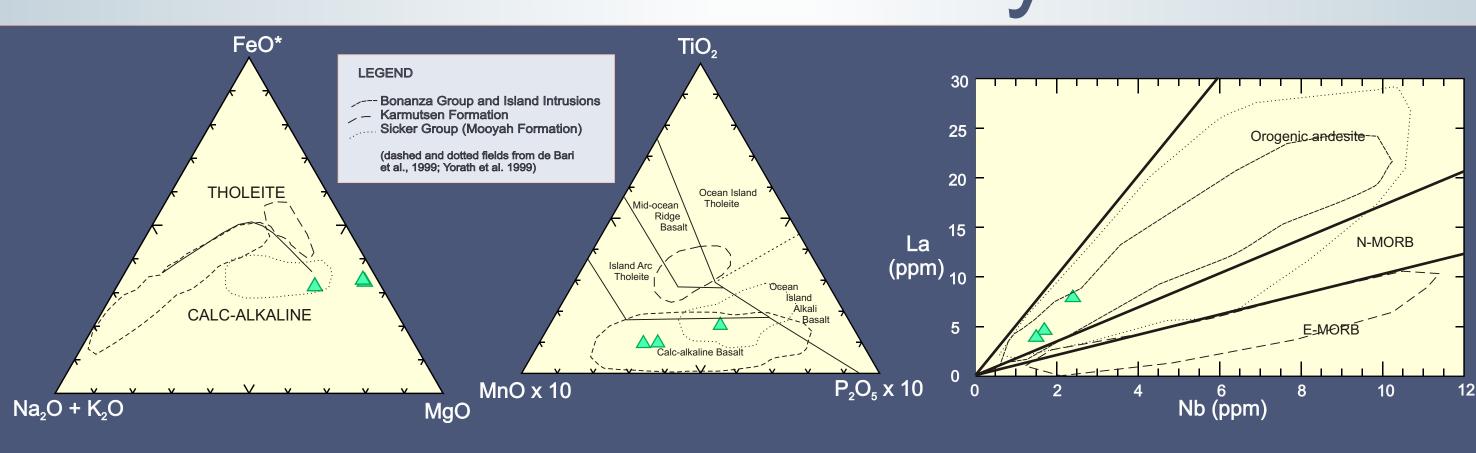
green-white fresh, medium grained mafic plutonic rock.





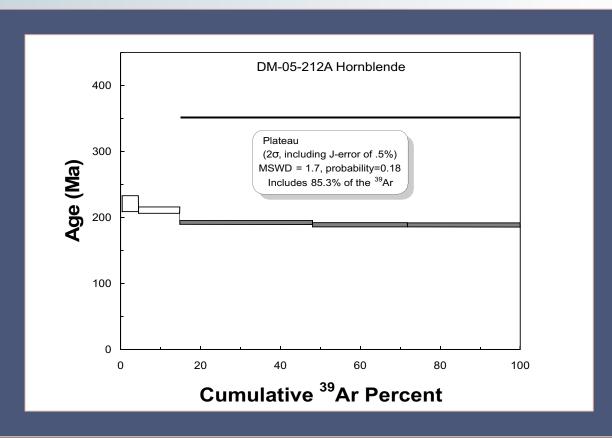




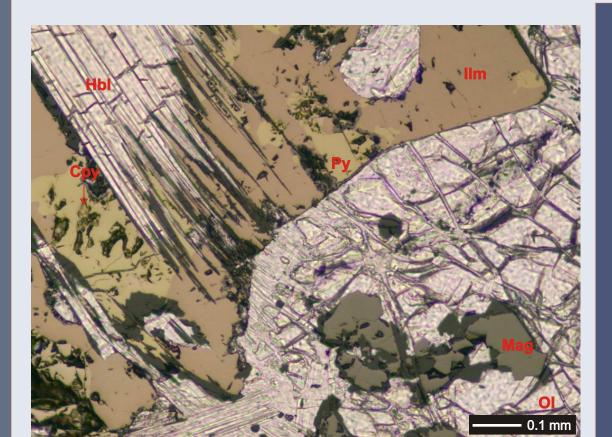


Triangular AFM plot suggests that samples of olivine hornblendite and hornblende gabbro represent early stages of a later calc-alkaline trend. MnO/TiO₂/P₂O₅ diagram indicates calc-alkaline geochemical signature. La-Nb plot displays orogenic (island arc) affinity of three units of Conuma layered intrusions. Sicker, Jurassic Island Intrusives and Karmutsen basalt (dashed and dotted fields) are shown for comparisson.

Geochronology



MINERALIZATION



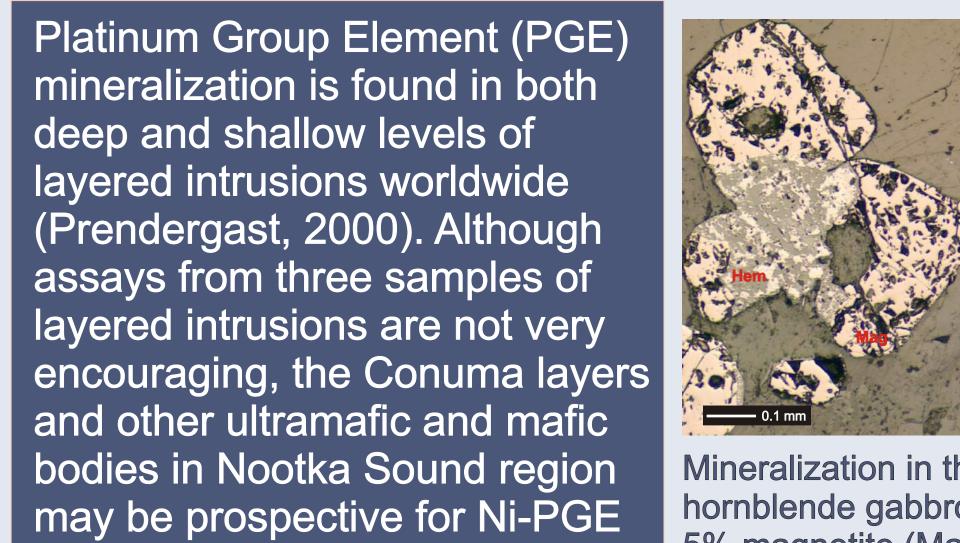


Table of geochemical results of rock samples from Conuma layered intrusions (OI = Olivine; NA = Not Applicable)												
Sample	Lithology	Au (ppm)	Cu (ppm)	Ni (ppm)	Zn (ppm)	Ag (ppm)	S (wt%)	Co (ppm)	Cr (ppm)	Pt (ppm)	Pd (ppm)	Mn (ppm)
DM 05-212 A	Ol Homblendite	<0.03	47	994	124	<1	0.13	108.5	2340	<0.03	<0.03	917
DM 05-212 C	Hbl gabbro	NA	16	144	42	<1	0.01	30	580	NA	NA	224
KF 07-JN2	Hbl gabbro	<0.03	28	823	123	<1	0.14	100.5	2200	<0.03	<0.03	566

CONCLUSIONS

- → The closest analogy to Conuma layered intrusions are "Alaskan peridotites" (Jackson, 1971). They share similar characteristics such as:
 - occurrence in island arcs settings
 - syn-orogenic or post-orogenic emplacement
 - association with andesitic volcanism
 - association with granodioritic, tonalitic and gabbroic intrusions
- PGE mineralization can be correlative with Ni, Au and Cu, and can also be associated with magnetite and chromite, which makes ultramafic and mafic bodies in the Nootka Sound region prospective for Ni-PGE exploration.

ACKNOWLEDGMENTS

The authors are very thankful to Geoscience BC for supporting the project financially. The authors would also like to thank to Mr. Efrem Specogna and Hard Creek Nickel Corporation for being allowed to access their properties. Nick Massey from the BC Geological Survey and Kevin Cameron from the Simon Fraser University are gratefully acknowledged for valuable comments.

REFERENCES

BC Geological Survey (2006): MapPlace GIS internet mapping system; BC Ministry of Energy, Mines and Petroleum Resources, MapPlace website, URL http://www.MapPlace.ca [November 2006].

lose, S. (2006): Geology and tectonics of the Nootka Island region, British Columbia; M.Sc. thesis, Simon Fraser

eBari, S. M., Anderson, R. G. and Mortensen, J. K. (1999): Correlation among lower to upper crustal components in an island arc: the Jurassic Bonanza arc, Vancouver Island, Canada; Canadian Journal of Earth Sciences, v. 36, p.

Jackson, E. D. (1971): The origin of ultramafic rocks by cumulus processes; Fortschritte der Mineralogie, v. 48, no. 1, p.

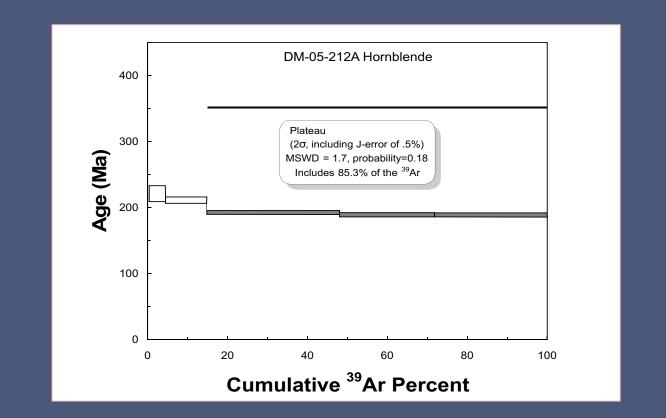
Muchalat-Hesquiat region, Vancouver Island; in Geological Fieldwork 2005, BC Ministry of Energy, Mines and Petroleum Resources, Paper 2006-1 and Geoscience BC, Report 2007-1, p. 1-9.

Massey, N. W. D., McIntyre, D. E., Desjardins, P. J. and Cooney, R. T. (2005): Digital geology map of British Columbia; BC

Muller, J. E., Cameron, B. E. B and Northcote, K. E. (1981): Geology and mineral deposits of the Nootka Sound map-area.

Yorath, C. J., Sutherland Brown, A. and Massey, N. W. D. (1999): LITHOPROBE, southern Vancouver Island, British Columbia; Geological Survey of Canada, Bulletin 498, 145 p.

Geochemistry



Ar- Ar dating (Marshall et al., 2006) of nornblende in very coarse grained olivine hornblendite unit suggests the ultramafic intrusions are of Jurassic age (189.9±2.1Ma).