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# THE LEXINGTON PORPHYRY, GREENWOOD MINING CAMP, SOUTHERN BRITISH COLUMBIA: GEOCHRONOLOGY (82E/2E)

By B.N. Church

*KEYWORDS:* Geochronology, Lexington, copper-gold porphyry, Precambrian basement, zircon dating.

## INTRODUCTION

This report provides the results and interpretation of U-Pb analyses of zircon from the Lexington porphyry at the City of Paris mine in the Greenwood mining camp. The Greenwood camp is in Quesnel Terrane in the eastern part of the Intermontane Belt of southern British Columbia (Figure 2-8-1).

The geology and history of the Greenwood mining camp has been reviewed by Little (1983), Church (1986) and Fyles (1990). The Lexington copper-gold porphyry deposit and associated veins have been the target of exploration and development since 1890 on both sides of the International Boundary (Figure 2-8-2). In 1900 development at the City of Paris mine, 10 kilometres southeast of Greenwood, yielded 1900 tonnes of ore grading 13.7 grams per tonne gold, 71 grams per tonne silver and 3.12 per cent copper. In a similar geological setting, the Lone Star mine in Washington State produced 5900 tonnes of ore (1890-1920) that yielded 1.1 grams per tonne gold, 6.5 grams per tonne silver and 2.6 per cent copper; an additional 360 000 tonnes was mined from the same area in an open-pit operation in 1977-78.

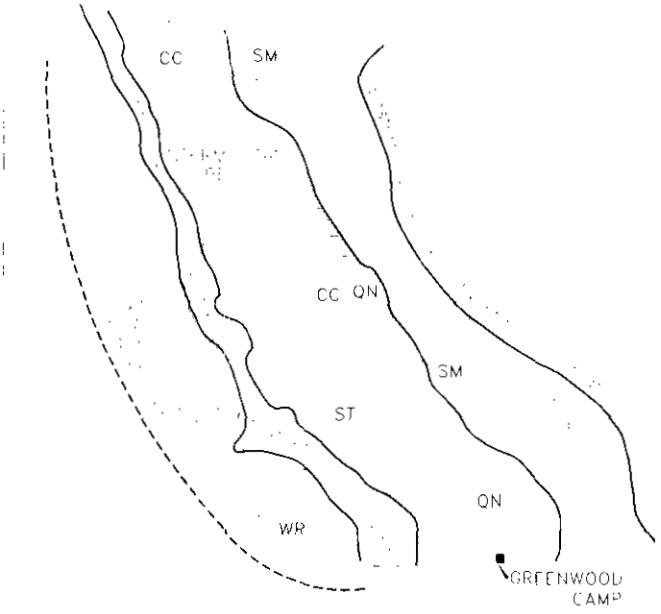


Figure 2-8-1. Major tectonic belts and terranes in the Canadian Cordillera. Key to abbreviations CC = Cache Creek Terrane, SM = Slide Mountain Terrane, WR = Wrangellia, ST = Stikinia, QN = Quesnellia (Price *et al.*, 1985).

## GEOLOGICAL SETTING

The Lexington intrusion is an elongate quartz porphyry emplaced in a shear that extends 3 kilometres southeast from the headwaters of Goosmus Creek, through the City of Paris mine, across the International Boundary to the Lone Star mine in Washington. The intrusion follows a major zone of serpentinite and appears to be related to a larger quartz feldspar porphyry on the same break, exposed to the west on Gidon Creek and Hippolite Creek. These bodies cut Paleozoic units including chert, schist, argillite, limestone and greenstone of the Knob Hill and Mount Attwood groups (Figure 2-8-2).

The age of the Lexington porphyry was previously thought to be Cretaceous or earliest Tertiary by Little (1983), however, analyses of diamond-drill core samples submitted by the author to P. van der Heyden of The University of British Columbia give an Early Jurassic and a Precambrian age (Table 2-8-1 and Figure 2-8-3). The lower concordia intercept (200 Ma) indicates the age of intrusion of the porphyry; the upper concordia intercept (2445 Ma) is believed to be the result of a relict zircon fraction assimilated from (early Proterozoic) basement rocks.

## DISCUSSION

The Intermontane tectonic belt is underlain by at least four allochthonous oceanic and off-shore island-arc terranes that evolved separately in middle and late Paleozoic and early Mesozoic time and were subsequently accreted to the North American craton. Knowledge of the temporal and spacial conditions of accretion is incomplete, however, it is known that the eastern terranes onlap the continental rocks and that this onlapping or docking was mostly achieved by middle Mesozoic (Price *et al.*, 1985).

In the Greenwood area the Knob Hill, Attwood (Paleozoic) and Brooklyn (Triassic) groups comprise multiple slabs of oceanic and transitional crust partly delaminated from their mantle and lithospheric base and overthrust onto the margin of the Precambrian craton. On the basis of strontium isotope studies (Armstrong *et al.* 1991), early Proterozoic rocks are believed to outcrop and subcrop in the Grand Forks area and to the east, and as far west as the Okanagan valley.

The Lexington porphyry is evidently contaminated by or rooted in the Precambrian basement rocks. This is suggested by an inherited zircon fraction dated 2445 Ma in core samples. Intrusion of the porphyry into the thrusted terrane in the early Jurassic, at 200 Ma, appears to pin the position of the terrane at this date and suggests that accretionary docking of oceanic rocks on the continental craton was completed by this time. This is in close agreement with the interpretations of Monger (1984).

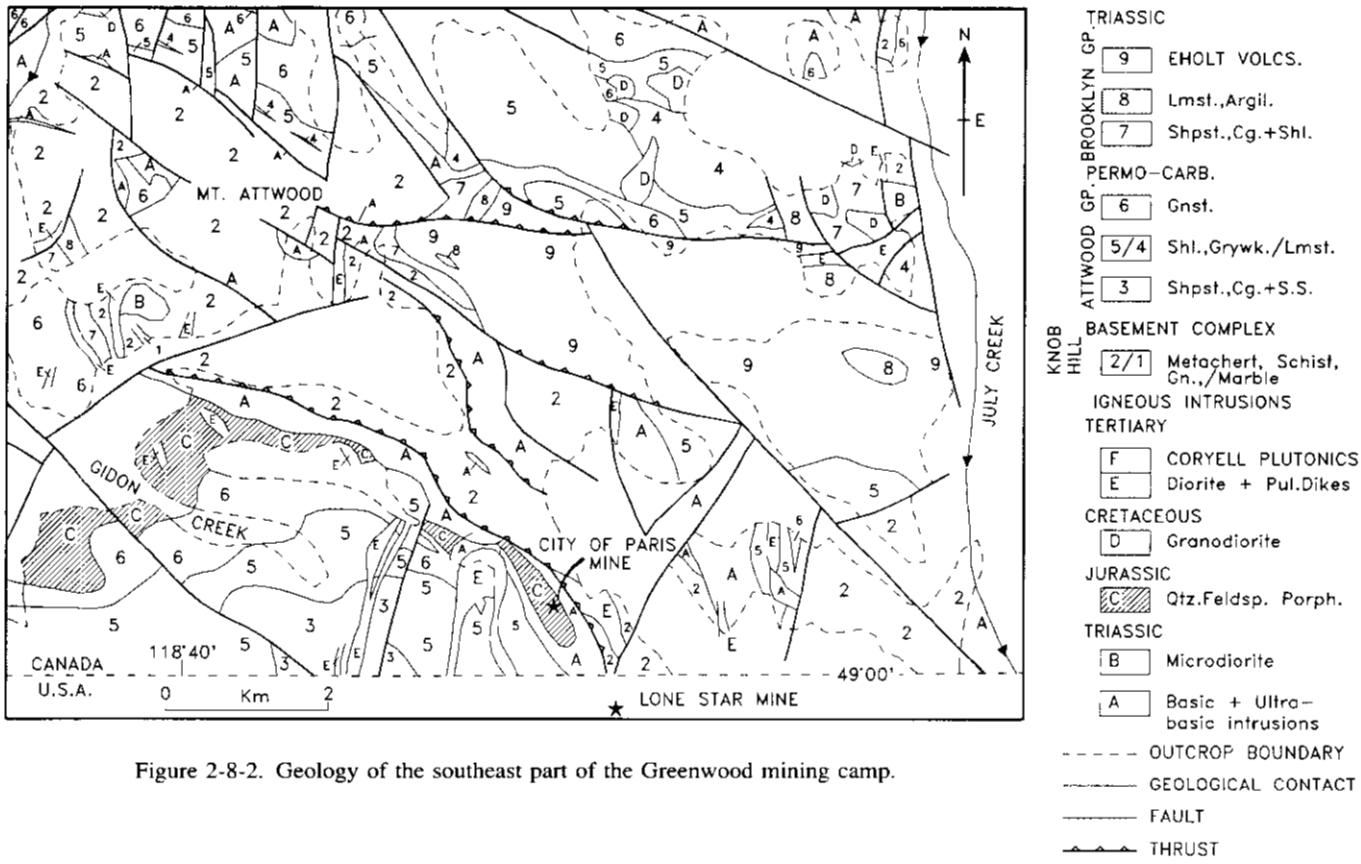


Figure 2-8-2. Geology of the southeast part of the Greenwood mining camp.

**TABLE 2-8-1**
**URANIUM-LEAD ZIRCON DATA FOR LEXINGTON QUARTZ PORPHYRY**

| Sample No. | Location | Sample Properties | Weight (mg) | Concentration Observed (ppm) U | Pb | $^{206}Pb/^{204}Pb$ | Atomic Ratios[3,4] $^{206}Pb/^{238}U$ | $^{207}Pb/^{235}U$ | $^{207}Pb/^{206}Pb$ | Model Ages (Ma)[4] $^{206}Pb/^{238}U$ | $^{207}Pb/^{235}U$ | $^{207}Pb/^{206}Pb$ | Concordoria Intercepts low | high |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FLY 86-1 | 49°0.5' 118°36.5' | nm,<100μm | 0.8 | 130.6 | 4.0 | 1438 | 0.03141±0.00023 | 0.2177±0.0028 | 0.05027±0.0050 | 199.4±1.4 | 200.0±2.3 | 207.5±23.1 | 200 | 2445 |
| | | m, 100-200μm | 4.6 | 166.7 | 5.4 | 1555 | 0.03219±0.00024 | 0.2302±0.0033 | 0.05187±0.0061 | 204.3±1.5 | 210.4±2.7 | 279.6±26.5 | | |
| | | m,>200μm | 2.4 | 197.5 | 6.3 | 2808 | 0.03175±0.00023 | 0.2286±0.0020 | 0.05223±0.0024 | 201.5±1.4 | 209.1±1.6 | 295.5±10.2 | | |

Note: Sample submitted by B.N. Church, analysis performed by P. Van der Heyden.

A cluster of other Early or Middle Jurassic felsic intrusions in the Nelson area, that may be related to the Lexington porphyry, has been noted by Dunne and Höy (1992, this volume). These include the Rossland monzonite and the smaller Aylwin and Lectus bodies. Although these are slightly younger than the Lexington body, they are similarly mineralized and show early Proterozoic zircon inheritance. It may be that felsic intrusions of this character in this region of the Quesnel Terrane are favoured for porphyry-gold mineralization, however, data are insufficient to be conclusive.

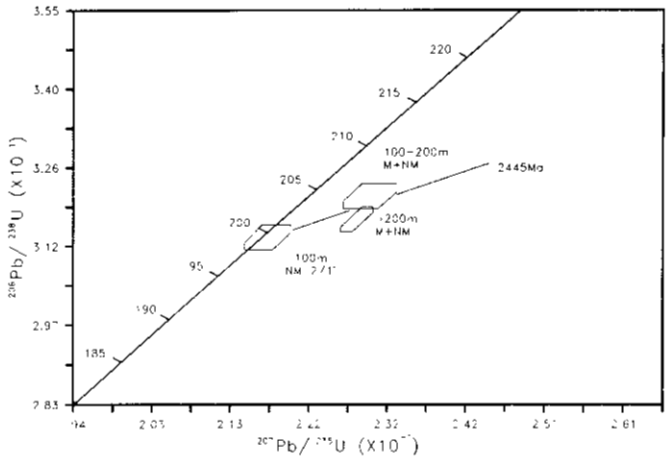


Figure 2-8-3. U-Pb concordia diagram for the Lexington porphyry. Lower intercept at 200 Ma is interpreted to be crystallization age of intrusion; the upper intercept at 2445 Ma is inherited from basement rocks.

## ACKNOWLEDGMENTS

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## REFERENCES


Armstrong, R.L., Parrish, R.R., van der Heyden, P., Scott, K., Runkle, D. and Brown, R.L. (1991): Early Proterozoic Basement Exposures in the Southern Canadian Cordillera: Core Gneiss of Frenchman Cap, Unit I of the Grand Forks Gneiss, and the Vaseaux Formation; *Canadian Journal of Earth Sciences*, Volume 28, Number 8, pages 1169 to 1201.

Church, B.N. (1986): Geological Setting and Mineralization in the Mount Attwood – Phoenix Area of the Greenwood Mining Camp; *B.C. Ministry of Energy, Mines and Petroleum Resouces*, Paper 1986-2, 65 pages.

Dunne, K.P.E. and Höy, T. (1992): Petrology of Lower Middle Jurassic Intrusions, Rossland Group, Trail Map-area; *in* Geological Fieldwork 1991, Grant, B. and Newell, J.M., Editors, *B.C. Ministry of Energy, Mines and Petroleum Resources*, Paper 1992-2 this volume.

Fyles, J.T. (1990): Geology of the Greenwood – Grand Forks Area, British Columbia; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Open File 1990-25, 19 pages.

Little, H.W. (1983): Geology of the Greenwood Map-area, British Columbia; *Geological Survey of Canada*, Paper 79-29, 37 pages.

Monger, J.W.H. (1984): Cordilleran Tectonics A Canadian Perspective; *Bulletin de la Societé Geologique de la France*, Volume 26, pages 255 to 278.

Price, R.A., Monger, J.W.H. and Roddick, J.A. (1985): Cordilleran Cross-section; Calgary to Vancouver; *in* Field Guides to Geology and Mineral Deposits in the Southern Canadian Cordillera; *Geological Society of America*, Cordilleran Section Meeting, Vancouver B.C., May '85, pages 3-1 to 3-85.

# NOTES