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STRUCTURAL GEOLOGY OF THE BIG LEDGE AREA (82L/8E)

By Ian Duncan
Graduate Student

Department of Geological Sciences, University of British Columbia

INTRODUCTION

James T. Fyles (1966) reviewed the geology and economic potential of lead-zinc mineralization in the Kootenay Arc and the Shuswap Complex. Polyphase deformation and high-grade metamorphism of Shuswap deposits necessitates detailed structural mapping for evaluating their economic potential.

Mapping around the margins of the Frenchman Cap gneiss dome by Fyles (1970) represents the first significant study of the structural geometry of stratabound lead-zinc mineralization in the Shuswap Complex. Mapping around the Big Ledge and Mount Symonds prospects on the southern margin of the Thor-Odin gneiss dome by Reesor and Moore (1970) and Höy (1977) indicated considerable structural complexity. The present study was initiated to complete a detailed structural analysis of the southern margin of the Thor-Odin dome.

The project has involved three summers' field work supported in part by the British Columbia Ministry of Mines and Petroleum Resources, the Penrose Fund of the Geological Society of America, and National Research Council Grant No. 4222 to H. J. Greenwood. Tony Hodge, Dita Runkle, Joan Grette, Randy Parrish, Mark and Sue Harrison, and Graeme Nixon acted as field assistants at various times. Each contributed greatly to the completion of the fieldwork. The project was supervised by Hugh Greenwood who has been a constant source of ideas and suggestions. Peter Read and Trygve Höy discussed aspects of the project at various times, and made useful comments.

GENERAL GEOLOGY

The general geology of the Thor-Odin gneiss dome has been described by Reesor and Moore (1970) and in part by Höy (1977). The area can be divided into three domains:

- (1) the 'Core zone,' an autochthonous core domain, dominated by massive and layered 'granitic' gneisses of Hudsonian age (at least in part);
- (2) the 'Mantling zone,' an imbricate domain, consisting of infolds of quartzite, calc-silicate, and schist cover rocks, sandwiched between thrust sheets of core gneisses; and
- (3) the 'Fringe zone,' an allochthonous domain consisting of a complexly folded and imbricated sequence of cover rocks: quartzites, marbles, calc-silicates, schists, gneisses, and amphibolites possibly correlative with the Hamill quartzite-Badshot marble sequence of the Kootenay Arc.

Lead-zinc mineralization occurs in rocks of the Mantling zone as sporadic massive sulphide lenses and disseminations within thin units of quartzofeldspathic graphitic rocks and/or arenaceous marble. The mineralization occurs near, but not in, the massive white marble units that Reesor and Moore (1970) and Höy (1977) suggest could be equivalent to the Badshot Formation. The lead-zinc mineralization is stratabound and appears to have been involved in most, if not all, of the deformational and metamorphic events imposed on the cover rock sequence.

GENERAL STRUCTURAL GEOLOGY

Detailed structural mapping and careful observation of refolded folds and geometrical patterns of lineations have enabled identification of the following sequence of distinct phases of deformation:

Phase 1 structures occur as rootless isoclinal folds with generally north-south-oriented fold axes. Interference with later phases of deformation has produced complex, elongate dome and basin structures. Phase 1 structures are typically isolated outcrop-scale folds; however, a few folds on a scale of kilometres have been mapped.

Phase 2 structures are tight to isoclinal recumbent folds with generally east-west-oriented fold axes. Detailed mapping has revealed that phase 2 was a multiple event, composed of two distinct generations of co-axial folding. Both generations, labelled F2A and F2B, refold phase 1 folds and lineations. All three folds can be identified superimposed on one another in a single outcrop.

Phase 3 folds are northwest-trending flexural slip folds with upright axial planes. These folds are rarely developed on an outcrop scale.

Phase 4 folds are southwest-trending flexural slip folds with upright axial planes. Large-scale (chevron style) phase 4 folds are conspicuous on the western margin of the dome.

Phase 5 folds are broad, open flexures with upright north-south-trending axial planes and a nonpenetrative axial-plane fracture cleavage.

STRUCTURE OF THE BIG LEDGE AREA

Preliminary mapping by Höy (1977) suggested that the distribution of lithologies in the Big Ledge area is controlled by large-scale isoclinal folds overturned to the north. Höy further suggested that the mineralized zone occurred in the hinge of an antiform. Detailed mapping has confirmed the essential features of Höy's interpretation.

Mesoscopic structures in the area are dominated by open to isoclinal F2B folds with axial planes dipping 15 to 25 degrees to the south. These structures refold co-axial, isoclinal F2A folds with more upright axial planes that are the same generation as the large-scale structures outlined by lithological repeats. As the large-scale folds are isoclinal and plunge subhorizontally, mainly parallel to the topography, it is rarely possible to trace units around their hinges. Hence, careful observation of the vergence of rare F2A mesoscopic folds is necessary. The existence of an F2A antiformal structure cored by the Big Ledge-Mount

Symonds mineralized zone is suggested by: (a) lithological repeats of the mineralized unit, a distinctive sillimanite-garnet rock and an arenaceous marble and (b) by a systematic reversal of F2A fold vergences. The hinge of this structure and clear overprinting by F2B structures can be seen on the eastern face of Mount Symonds.

To the west of Mount Symonds graphitic rocks in the same structural position as the Big Ledge horizon have been traced for 7 kilometres toward Mount Fosthall. At this point the sequence is doubled back on itself by a large-scale phase 1 antiformal closure, plunging steeply to the southwest and outlined by arenaceous marbles.

Structurally above the Big Ledge horizon, a mineralized unit has been mapped along the northern flank of Fosthall Ridge. This unit, which is on the shallow-dipping northern limb of the Mount Fosthall syncline (an F2B structure), is within a sequence of rocks lithologically similar to that in the Big Ledge area. It is possible that the two mineralized units are correlative and repeated by a high-angle normal fault, subparallel to the layering that has been mapped along the side of Fosthall Ridge. Movement along this fault could be coincident with the formation of the gneiss dome as has been suggested for the Standfast Creek slide by P. B. Read (personal communication).

CONCLUSIONS

The superficially simple outcrop pattern in the Big Ledge area reflects firstly, the intensity of F2A deformation and secondly, the co-axial nature of F2A and F2B. An understanding of the state of finite strain in these rocks, developed during this study, should be useful in interpreting drill-hole data and re-evaluating the economic potential of the area.

In a regional sense it is interesting to compare the Big Ledge structural sequence with that described by Fyles (1970) on the southern flank of the Frenchman Cap dome. The two generations of generally east-west-trending folds (F2A and F2B) at Big Ledge are similar in style and orientation to Fyles' F1 and F2. It is not possible, however, to correlate these structures until structural studies by other workers in the intervening area are completed.

REFERENCES

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