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5. THE CIRQUE BARITE-LEAD-ZINC DEPOSIT, NE BRITISH COLUMBIA, CANADA

5.1 Introduction

The Cirque barite-lead-zinc deposit is a lensoid stratiform body found in the Devonian carbonaceous shales of the Akie region of NE British Columbia. The reserves are approximately 40 million tonnes of 7.8% Zn, 2.2% Pb, and 47 g/tonne Ag (Jefferson et al., 1983).

The Cirque deposit crops out poorly on surface and is largely defined by drilling. As such, structural information on the morphology of the deposit is limited. The Cirque deposit, however, occurs in a strongly thrusted region and as such the structural style is different to that of the deposits discussed in the preceding chapters.

In this chapter, I shall briefly discuss the features observed in drill core and more particularly the textural changes seen in the ore.

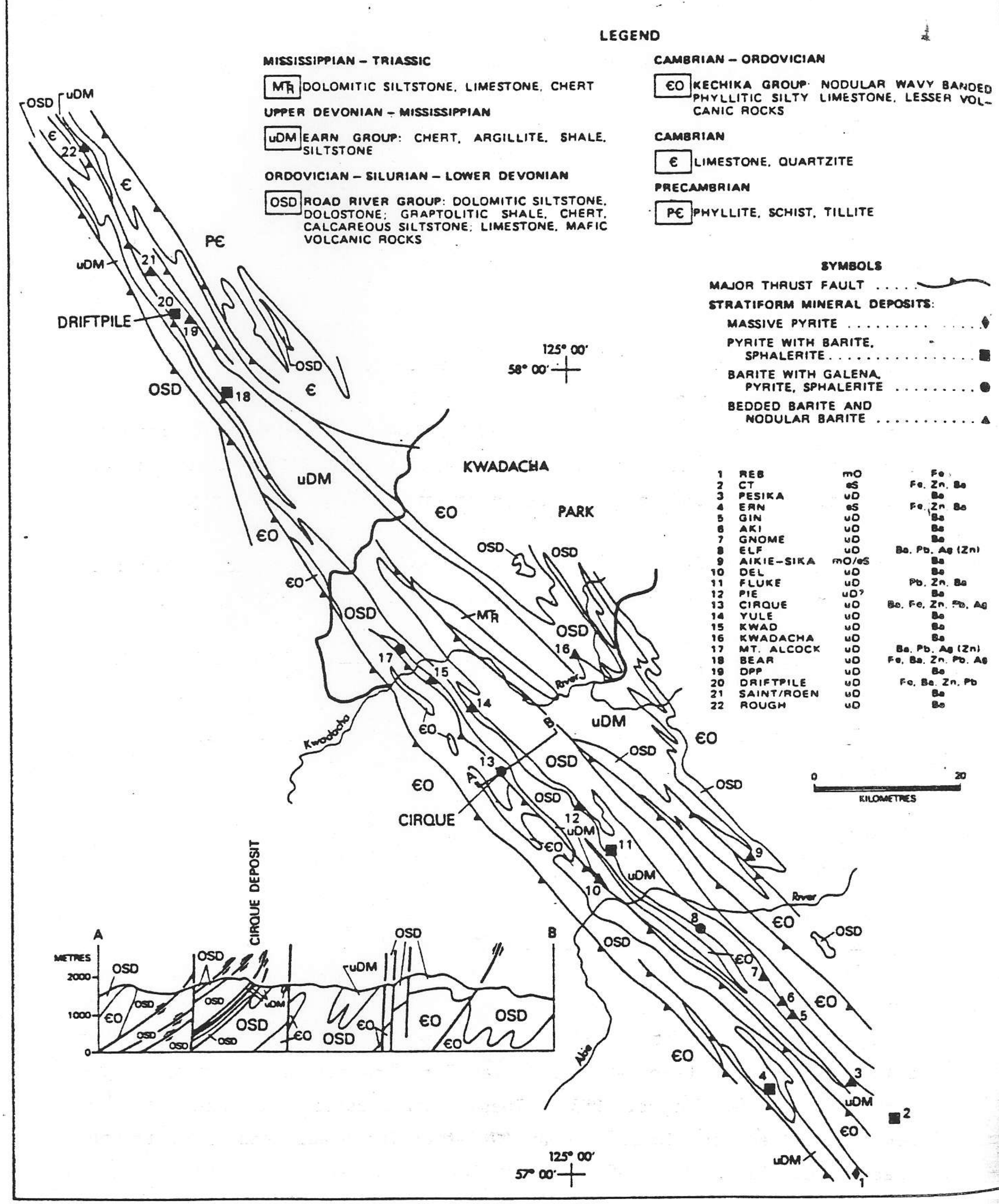
5.2 Tectonic Setting and Geological Background

The tectonic setting of the Gataga barite-lead-zinc deposits has been studied by MacIntyre (1983) and the geology of the Cirque deposit has been well documented by Jefferson et al. (1983). The reader is referred to these two papers for comprehensive accounts and bibliographies and only a brief synopsis will be given here.

<u>Regional Stratigraphy and Structure</u>

The Gataga barite-lead-zinc deposits occur in the western part of the northern Rocky Mountains, NE British Columbia (Fig. 5.1). The strata range in age from Cambrian through to Triassic and the mineral deposits occur principally in the Devono-Mississippian Earn Group black clastics of the Kechika Trough (MacIntyre, 1983). These black clastic units appear to have been deposited in long, linear NW trending fault bounded troughs (MacIntyre, 1983).

The northern Rocky Mountains consist of panels of tight, northeast



General geology of the Gataga district.

Figure 5.1 (from MacIntyre, 1983)

verging folds bounded by northeast directed thrust faults (MacIntyre, 1983; Jefferson et al., 1983) with the higher stratigraphic units (e.g. Earn Group) commonly preserved in the footwall sections of thrust panels. The deformation and low grade metamorphism appears to be largely Cretaceous in age.

Geology of the Cirque Deposit

The geology of the Cirque deposit has been described by Jefferson et al. (1983). The stratigraphy of the area is shown in Figure 5.2. The deposit occurs in the Devono-Mississippian Earn Group within the fine-grained siliceous and carbonaceous rocks of the Gunsteel Formation. Jefferson et al. (1983) recognize two facies of the Gunsteel - a ribbon bedded black, carbonaceous porcellanite and a thick bedded, black siliceous shale, locally pyritic and termed the "Pregnant Shale" (Jefferson et al., 1983). The Gunsteel Formation envelops the Cirque deposit (Fig. 5.3). The coarse-clastic rocks of the Warneford Formation are locally absent in the vicinity of the deposit but regionally overlie the Gunsteel (Jefferson et al., 1983).

Mineralization

The Cirque is a bedded barite deposit with facies that vary from barite to sulphides. Interbeds of siliceous-carbonaceous shale occur within the deposit but constitute less than 10% of the deposit (Jefferson et al., 1983). Major minerals are barite, pyrite, sphalerite and galena. Two principal ore facies occur: a baritic facies and a sulphide facies.

The baritic ore facies comprises poorly laminated barite with less than 40% sulphides (Jefferson et al., 1983). The sulphides occur as laminae of framboidal pyrite and duplex textured barite and sphalerite. Galena occurs as interstitial grains and aggregates and is commonly remobilized into fractures.

The sulphide (pyrite) ore facies consists of pyrite, barite, sphalerite and galena. Pyrite dominates. Pyrite occurs either as framboidal/spheroidal clusters, large euhedral grains and aggregates of grains and as spectacular colloform intergrowths of pyrite/sphalerite and

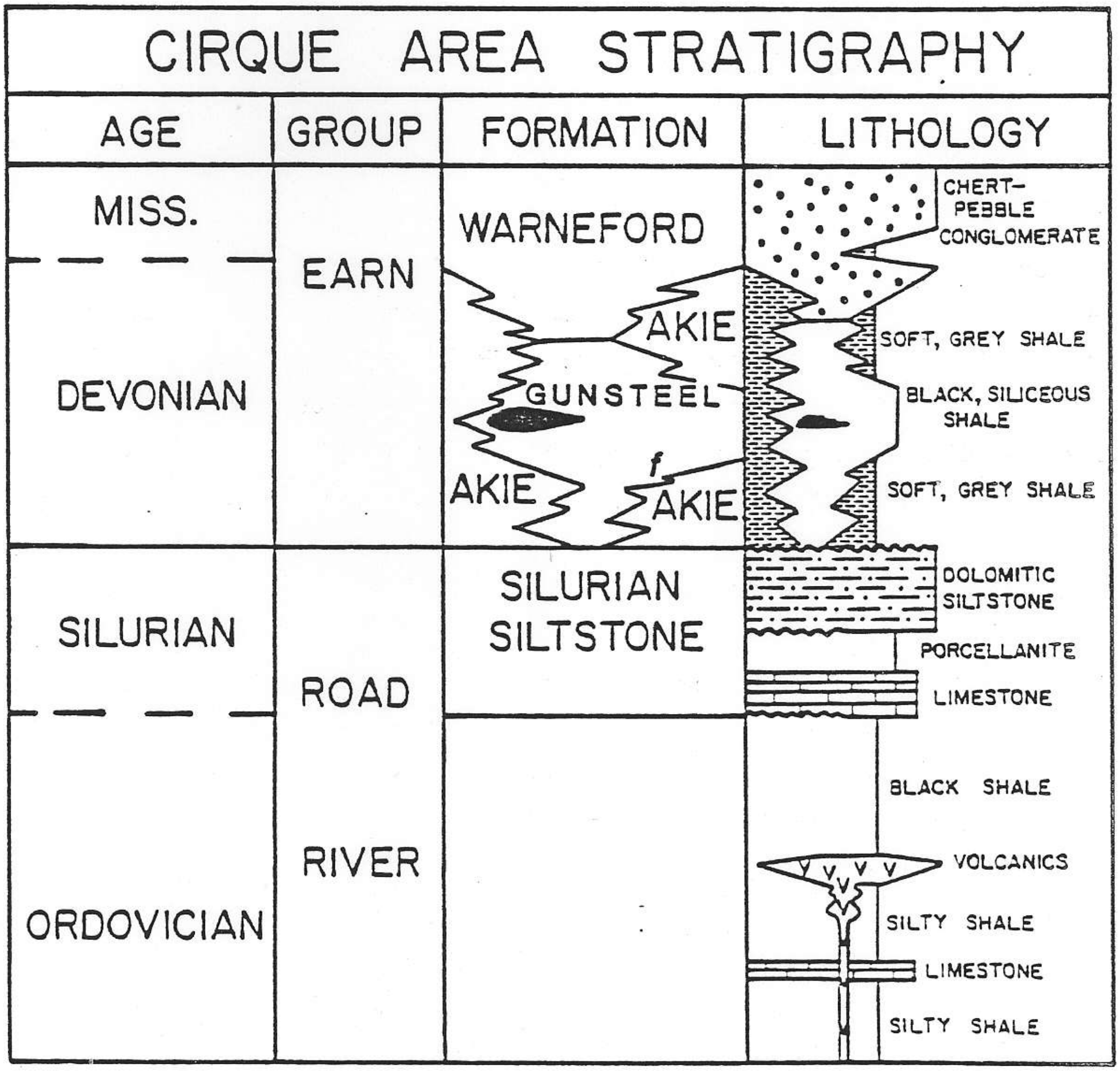


Figure 5.2 (from Jefferson et al., 1983)

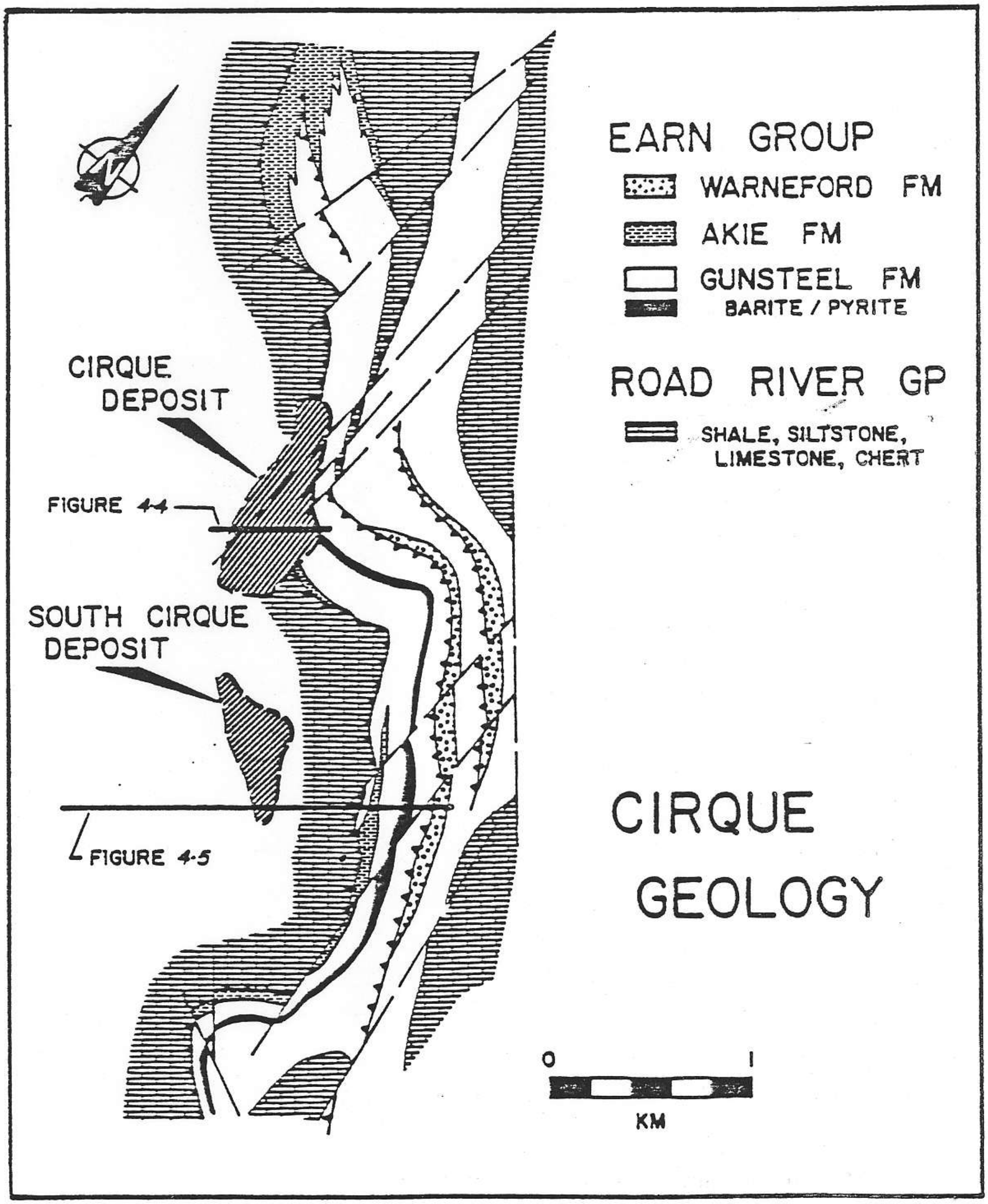


Figure 5.3 (from Jefferson et al., 1983)

pyrite/galena. These euhedral grains/aggregates of grains and colloform aggregates produce a massive pyritic ore facies. Sphalerite occurs as intergrowths and interstitial grains and as fine-grained laminations. Galena occurs principally as coarse grained recrystallized aggregates and as remobilized fracture and vein infillings.

5.3 Structure of the Cirque Deposit

The structure of the Cirque deposit as revealed by drilling and from surface exposures (Jefferson et al., 1983) is best shown in Figures 5.4 and 5.5.

The structure is dominated by NE verging thrust faults which bring an imbricated panel of Road River rocks (probably part of a duplex) over the Cirque orebody (best shown in Figure 5.5). Later normal faults (both listric and planar) cut through the NE verging thrust faults. Note that the thrusts cut up stratigraphy but the orebody itself does not appear to be strongly imbricated.

Minor folds (NE verging) occur in the sequence and two cleavages have been recognized both at surface and in drill core. Both cleavages trend NW (L. Pigage, pers. comm.).

Within the pyritic facies strong axial planar cleavages are developed (Figs. 5.6a and 5.6b), in places leading to transposition of bedding parallel to the cleavage. Shearing along fold limbs commonly leaves relict fold hinges (Fig. 5.6b). Examples of deformed ore are shown in Figure 5.7.

Careful logging of both stratigraphic features and deformation features - cleavage orientations, vergence and minor fold asymmetries, has allowed the Cyprus Anvil geologists to obtain a very detailed picture of the Cirque structure and stratigraphy.

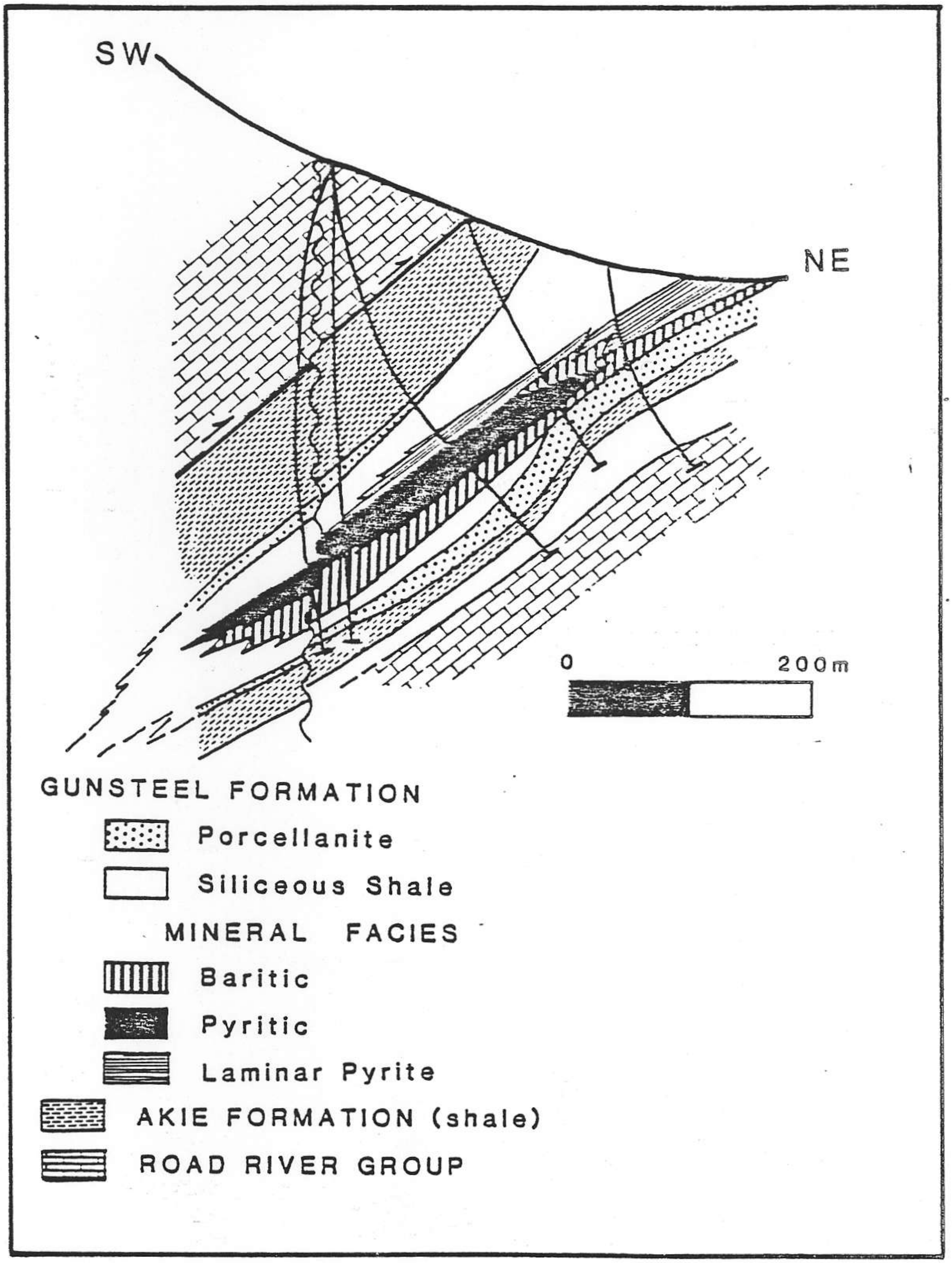
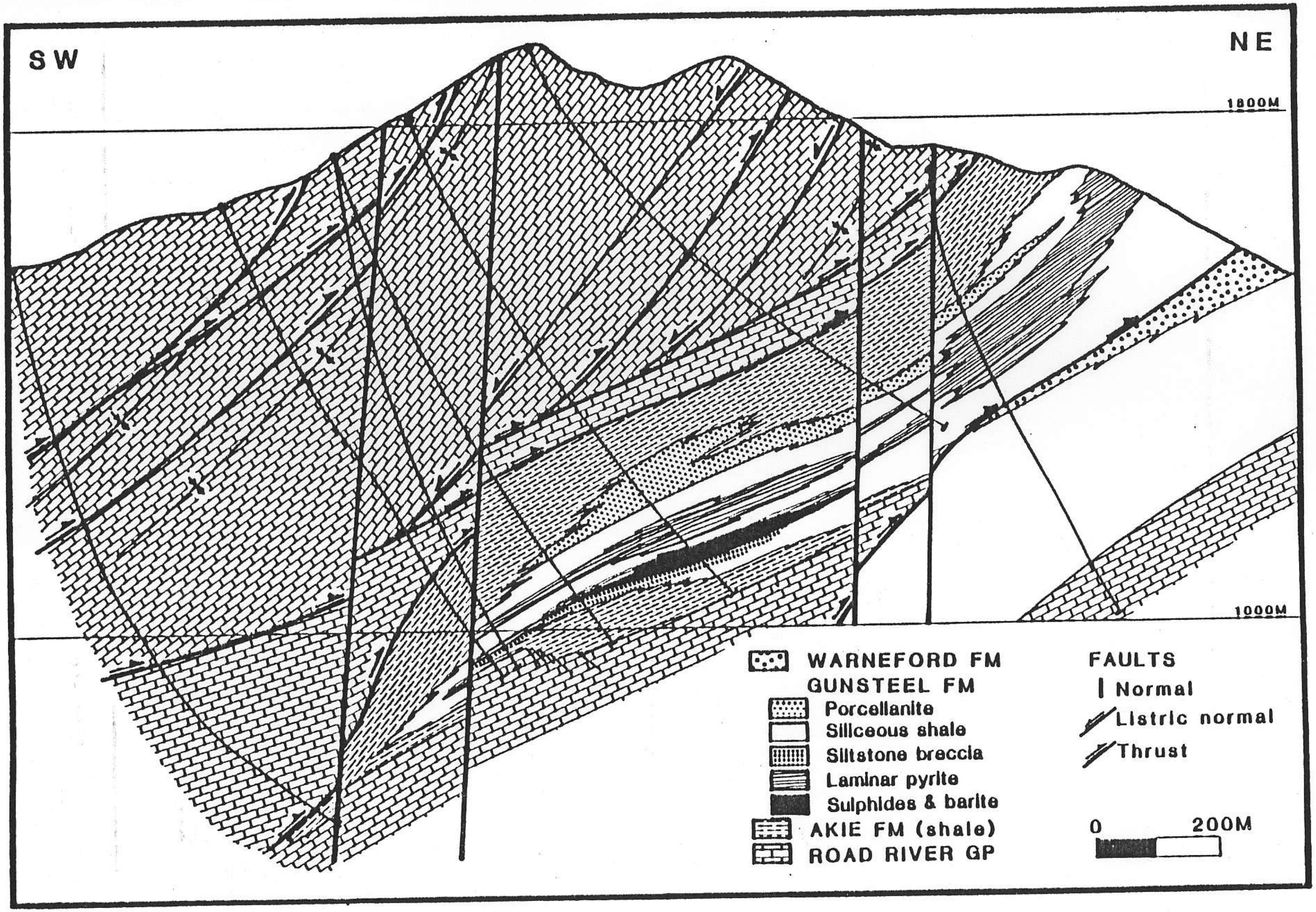


Figure 5.4 Cross-section through the Cirque deposit (from Jefferson et al., 1983)

Figure 5.5 (from Jefferson et al., 1983)



Schematic vertical cross section through South Cirque deposit. Line of section (283+00N) shown on Fig. 3; view azimuth 320°.

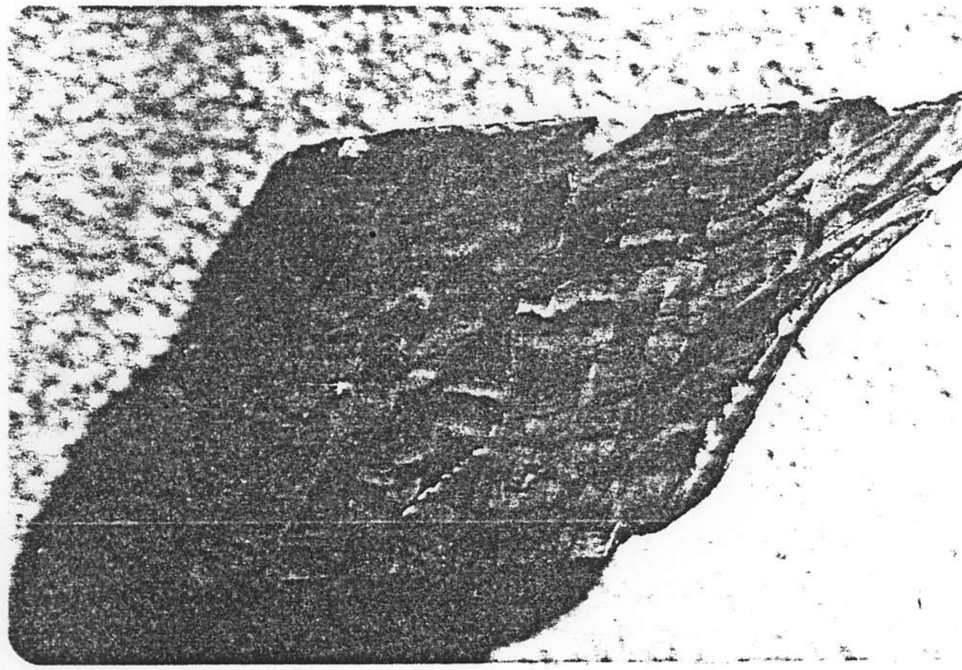


Figure 5.6a Pyritic laminated shale with a strong spaced cleavage, Cirque deposit

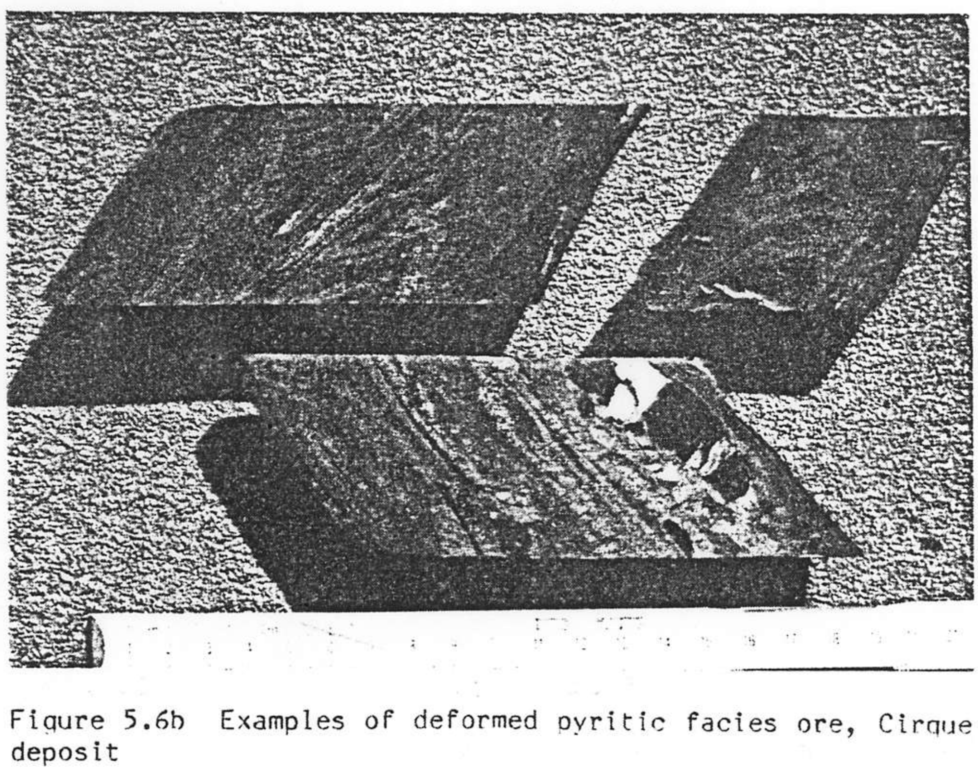


Figure 5.6b Examples of deformed pyritic facies ore, Cirque deposit

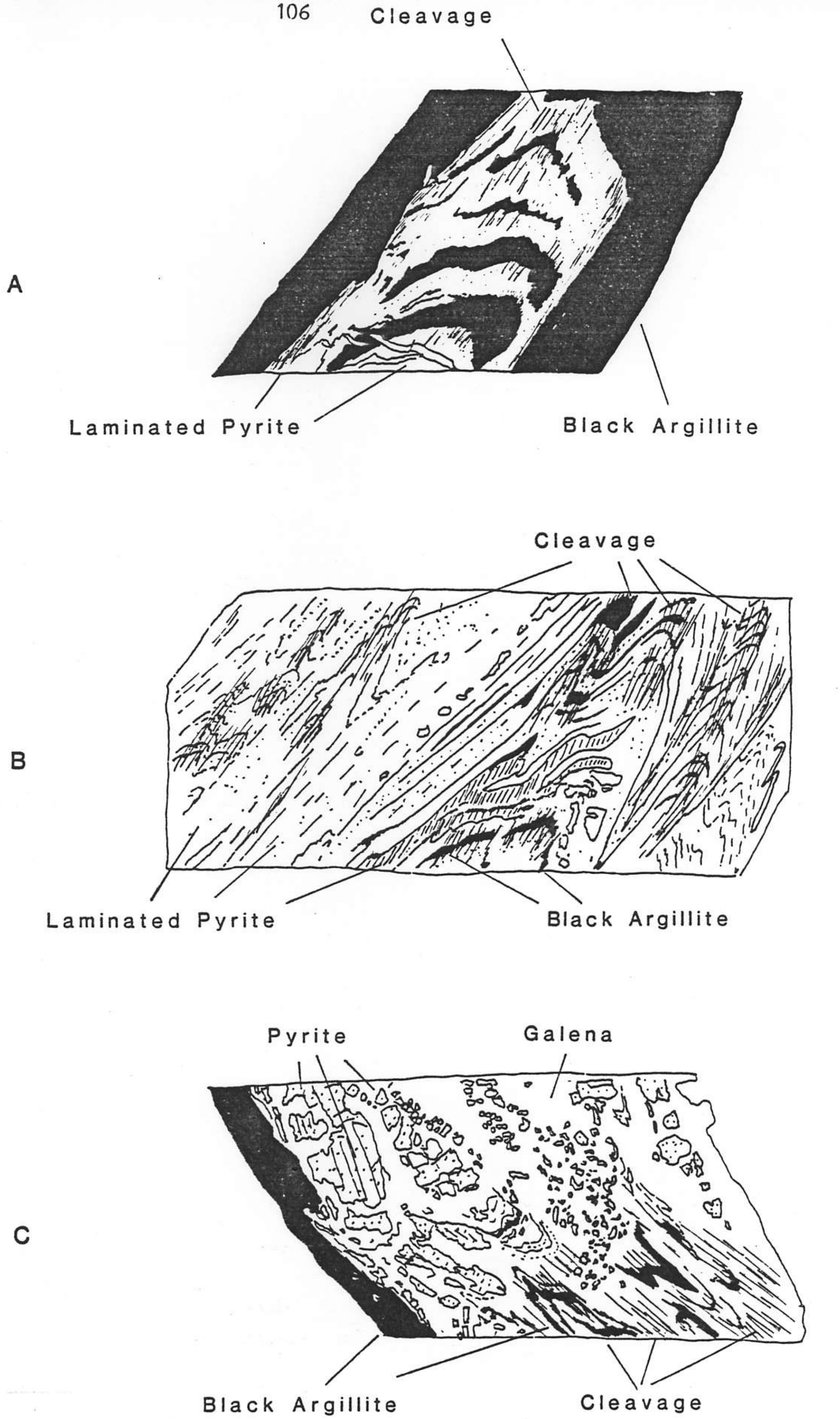


Figure 5.7 Details of deformed ore, Cirque deposit

5.4 Petrofabrics and Textures

The Cirque ores display spectacular depositional/diagenetic and deformation textures. A brief summary is given here.

Laminated Pyritic Ore

Laminated pyritic ore comprises laminae of fine-grained spheroidal, framboidal and euhedral pyrite, fine-grained sphalerite in a siliceous, carbonaceous shale matrix (Fig. 5.8a). Fine overgrowths can be seen on many pyrite grains.

Where this ore type is strongly folded, pyrite framboids are disrupted into individual crystallites, framboids and spheroids are truncated by pressure solution seams (Fig. 5.8a) and euhedral pyrite overgrowths occur in areas of low mean stress. Local shear zones are developed in fine-grained sphalerite layers.

Bedding is transposed into the foliation planes.

Massive Colloform Pyritic Ore

The massive colloform pyritic ore exhibits spectacular intergrowths of pyrite and sphalerite, and pyrite and galena - from a few 10s of microns to mms in size. Euhedral-subhedral coarse-grained pyrite aggregates are also found.

This massive ore responds to deformation in a brittle manner with abundant microfracturing of euhedral pyrite and colloform pyrite. Spectacular "blow-apart" textures result (Fig. 5.8b) with the fractures infilled with remobilized galena and sphalerite. Galena in this ore type is largely recrystallized into elongate grains reflecting dynamic recrystallization (Fig. 5.9a) but a few relict zoned galena crystals have been observed. Sphalerite is largely interstitial between pyrite aggregates and exhibits mainly grain-growth and annealing twins.

Baritic Ore

The baritic ore facies is strongly recrystallized with barite

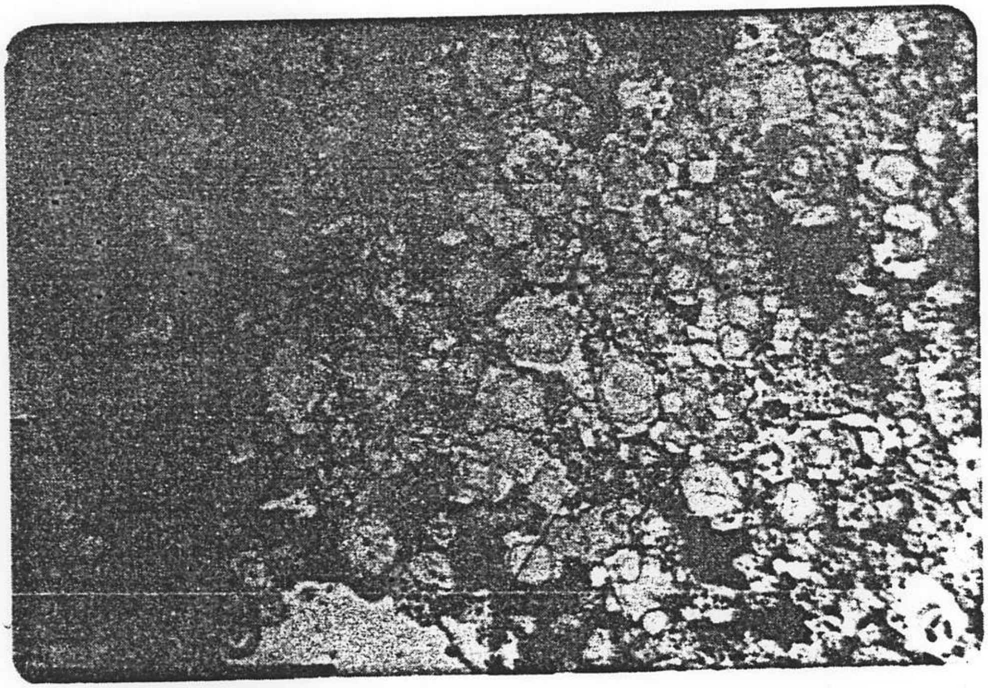


Figure 5.8a Laminated pyritic ore with fine euhedral grains and spheroids

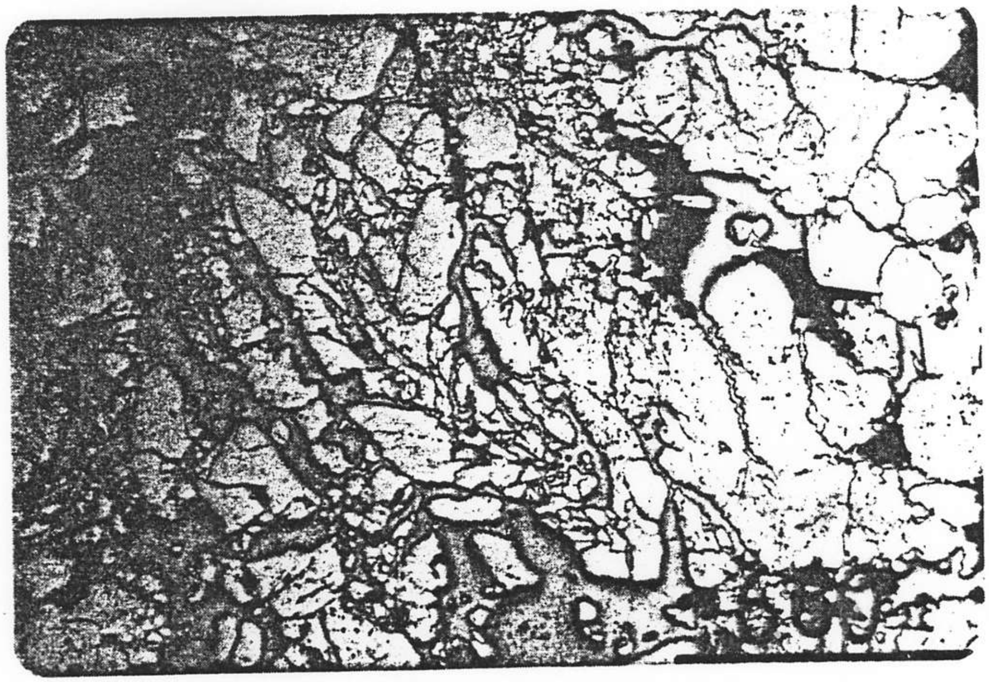


Figure 5.8b Massive pyritic ore showing spectacular blow-apart texture of pyrite with fractures infilled with remobilized galena.

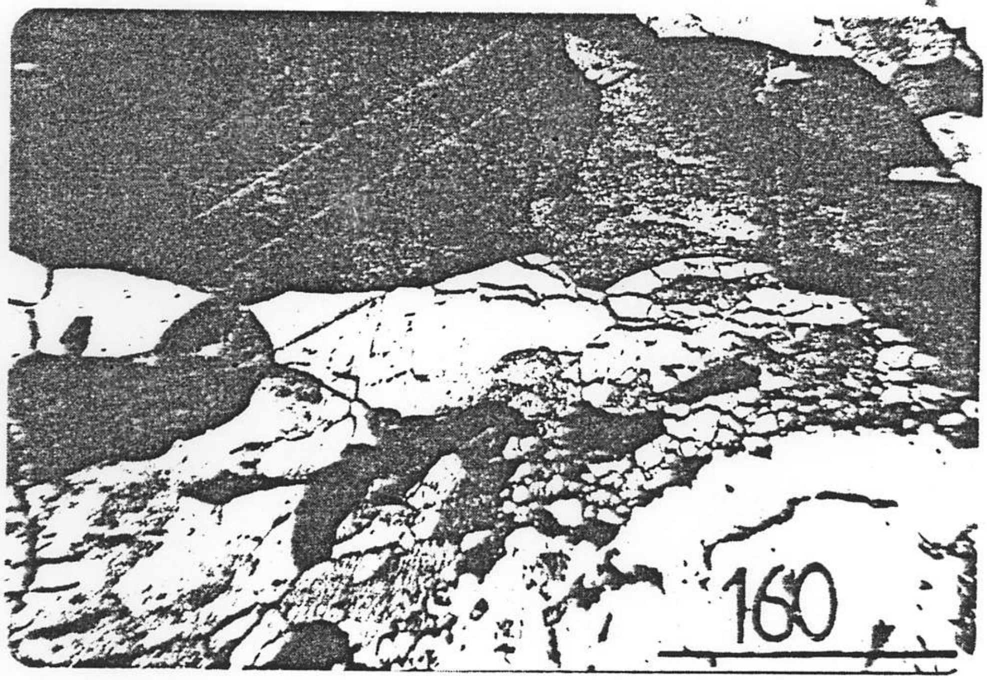


Figure 5.9a Dynamically recrystallized galena from massive pyritic ore facies

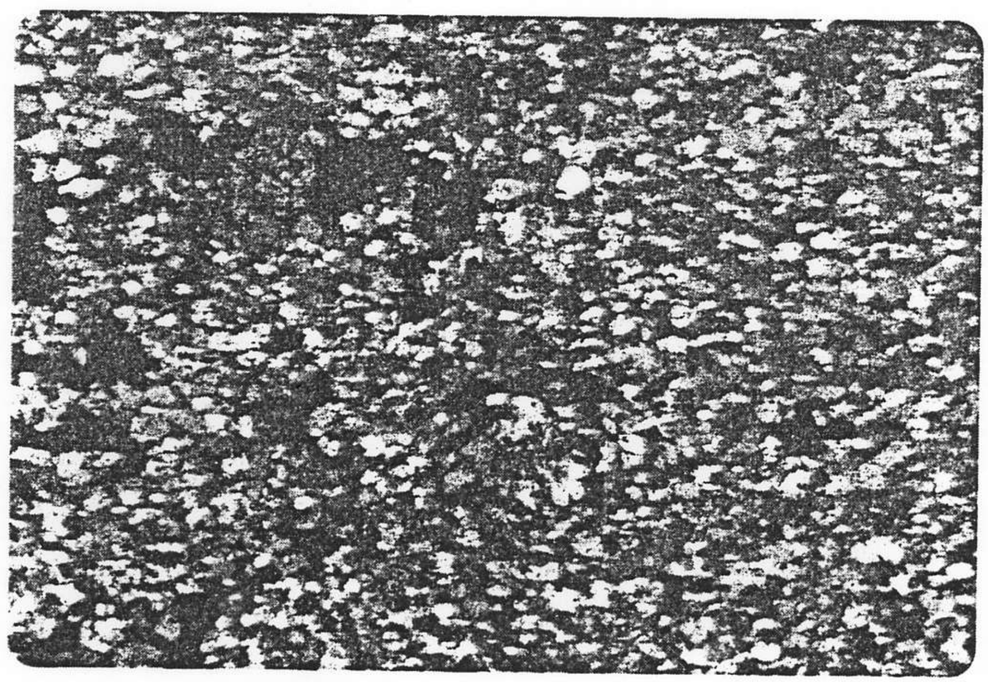


Figure 5.9b Strongly recrystallized baritic ore facies. Barite - light colours; galena and sphalerite - dark

developing a strong shape fabric and moderate preferred orientation (Fig. 5.9b). This shape fabric is principally bedding parallel. Galena and sphalerite are dominantly interstitial to barite grains and are largely recrystallized.

Primary depositional/diagenetic textures have yet to be recognized in the baritic ore facies.

5.5 Discussion and Conclusions

The structure of the Cirque deposit is dominated by thrust faulting and thrust related structures. The deposit itself has undergone ductile deformation but brittle deformation is concentrated in the footwall and hanging-wall of the deposit.

Deformation has induced significant textural changes in the deposit:

(1) The baritic ore facies shows penetrative ductile deformation with strong dynamic recrystallization of barite;

(2) The massive pyrite sulphide ore facies has largely undergone brittle deformation but galena (and to a lesser extent sphalerite) has been remobilized into fractures;

(3) The laminated pyritic ore facies has undergone penetrative ductile deformation with the development of strong axial planar fabrics and pressure solution of pyrite (and to a much lesser extent pressure solution of sphalerite).

At this stage, insufficient data for the Cirque are available to fully evaluate the effect of structure on the morphology of the ore lens and to evaluate, in detail, the structural evolution of the deposit.

5.6 References

Jefferson, C.W., D.B. Kilby, L.C. Pigage, and W.J. Roberts, 1983. The Cirque barite-lead-zinc deposits, northeastern British Columbia, in

Sangster, D.F. (ed.). Sediment-hosted stratiform lead-zinc deposits, Min. Assoc. Can. Short Course Notes, 9, 121-139.

MacIntyre, D.J., 1983. Geology and stratiform barite-sulphide deposits of the Gataga District, northeast British Columbia. ibid, 85-120.

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(PART II)

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