ORE DEPOSITS OF THE ANVIL DISTRICT, CENTRAL YUKON

G.A. Jilson
Vice President, Exploration
Curragh Resources Inc.
117 Industrial Rd
Whitehorse, YT

005139

The Anvil district is located in central Yukon, immediately northeast of the Tintina Fault, a major Cordilleran strike slip structure. There are five stratiform sediment hosted lead-zinc-silver deposits in a 25 km. long chain paralleling the fault. Before mining the aggregate tonnage of these five deposits was approximately 125 million tonnes above at least a 4% lead plus zinc cutoff averaging approximately 9 % lead plus zinc and 40 to 50 grams per tonne silver. Copper averages 0.1 to 0.2 % and most of the deposits contain 0.7 to 1.0 grams per tonne gold. The Faro deposit has been in production intermittently since 1969. Currently it is mined by open pit methods feeding a 13,500 tonne per day concentrator. Two additional open pits, Grum and Vangorda, are currently being prepared for production starting in 1990 and a small extension of the Faro deposit will be mined underground at the same time.

The district's stratigraphy has strong affinities with the Selwyn Basin and represents the most southwestern (outboard or basinward) present day examples northeast of Tintina Fault. The Late Proterozoic (?) and Lower Cambrian Mt. Mye formation, a monotonous, non-calcareous pelitic schist and phyllite at least 2 km thick, forms the basal stratigraphic unit in the district. Mt. Mye strata are correlated with the lithologically similar Gull Lake Formation toward Mackenzie Platform northeast of the district. Calcareous phyllites and lesser basaltic extrusive and intrusive rocks of the Cambrian and Ordovician(?) Vangorda formation overlie the Mt. Mye with a gradational contact. An important carbonaceous phyllite member occurs at the base of the formation. The 1 km thick Vangorda sequence is correlated with the more calcareous Rabbitkettle Formation eastwards toward the Mackenzie Platform. A 1 km thick basaltic metavolcanic sequence named the Menzie Creek formation overlies and is interbedded with the Vangorda formation. Carbonaceous phyllites, slates and siltstones containing lower Ordovician to lower Silurian graptolite fauna are interbedded with and overlie the Menzie Creek volcanics. These metasediments are lithologically and faunally similar to strata of the Road River Group with which the Menzie Creek is correlated. The Menzie Creek formation is one of the largest of several Ordovician mafic volcanic accumulations in the Selwyn Basin. The Mt. Mye, Vangorda, and Menzie Creek formations are interpreted to represent deep marine sediments which accumulated on a trailing continental margin subject to episodic extensional tectonism during which the basaltic component of the section was emplaced. The ore deposits occur in a 150 m thick stratigraphic interval including the upper Mt. Mye and lower Vangorda formations; they are thus assumed to be Cambrian. The deposits are comprised of one to five sulphide horizons in that interval. The deposits are spatially associated with a local pinchout of the basal carbonaceous member of the Vangorda formation. Most of the basaltic material is younger than the ore deposits; however, the first appearance of volcanic material in the section occurs at approximately the stratigraphic level of the ores.

Anvil District has a complex polydeformational/polymetamorphic history. Two Mesozoic regional syn-metamorphic folding events are recognized in a low pressure, Buchan-type facies series ranging from greenschist to amphibolite facies grade. Metamorphic zones decrease in grade radially outward and structurally upward from a granite cored central culmination which domes the metamorphic sequence. First phase deformation is largely overprinted but where evidence is preserved the event appears to have produced northeast verging folds with an axial planar cleavage. Second phase folds are coaxial with first phase but have shallowly dipping axial planes with a prominent low angle axial planar crenulation cleavage that characterizes rocks of the district. At deeper structural levels the recrystallization and transposition into the second schistosity is very intense resulting in a low angle shistosity that parallels lithologic contacts. The individual deposits are elongate parallel to the second phase fold axes and the overall line of deposits follows the regional trajectory of the second phase lineations. Three additional, less intense, deformation episodes of only local importance were superimposed on the earlier structures. An episode of major extensional faulting may record the final stages of uprise of the plutonic plus high grade metamorphic core of the district through the flanking low grade metasediments. Structural and metamorphic considerations are very important in the district since the form of the orebodies was determined by the first two deformations and the limits of several of the deposits are due to truncation by large displacement (1 km +) extensional faults. Metallurgical performance of the ores is largely determined by the degree and type of recrystallization and annealing which is dependent on the metamorphic and deformational history.

All ore deposits are comprised of similar ore types; they differ mainly in form and proportion of ore types and metamorphic grade. The ore deposits are thought to have originated as thin laterally extensive sheets with an ameboid outline, diameters up to 2,000 m and thicknesses up to 30 m (possibly as much as 75 m). Within the sheet the central and uppermost ores are massive pyritic sulphides with the upper portion of the massive ores typically being barite bearing. Below and peripheral to the massive sulphides are disseminated sulphide bearing quartzites. The lowest and most peripheral pyritic quartzites are typically carbonaceous and very strongly sulphide banded. They are overlain by more sulphide rich and less banded non carbonaceous quartzites. The quartzites are thought to have originated as chert sulphide exhalite interbeds; however some may represent silicified and sulphide impregnated host sediments. Some of the deposits are asymmetric in cross section with one thick side rich in low grade pyritic quartzite and semi-massive sulphide tapering to a thin banded carbonaceous pyritic quartzite at the other side with high grade massive sulphides underlain by low grade disseminated ores in between.

Metal zoning is not well developed but in general a given horizon tends to be relatively lead and silver rich at the top and zinc rich at the bottom with the periphery being relatively zinc rich as well. This metal zoning parallels the ore type zoning. Some deposits have a footwall greatly enriched in copper and gold relative to lead-zinc. At Faro the uppermost ores are relatively rich in gold as well as Pb and Ag.

Altered rocks are abundant around the ore deposits. At the Faro deposit the altered rocks are bleached schists rich in white mica but texturally identical to schists further from the ores. The altered schists form a true envelope locally best developed in the hanging wall. This alteration may originate by fluid induced metamorphic interaction between the massive sulphides and the host rocks. The other deposits are at lower metamorphic grade and have a different type of alteration. Bleached phyllites occur but are minor and are definitely footwall biased. Other altered phyllites are more widespread; typically these are medium green-gray phyllites like phyllites further from ore but with much reduced content of carbonaceous material and enhanced chlorite contents. Pyrrhotite, chlorite and carbonate bearing stringers are present locally. More strongly bleached altered phyllites are locally quartz rich, and contain disseminated sulphides. These grade into the pyritic quartzites noted above. The alteration in the less metamorphosed deposits occurs mainly in horizon footwalls but the stacked nature of horizons makes alteration distribution ambiguous in many cases. This alteration is thought to be related to ore transporting fluid interacting with host sediments.