ANACONDA Minerals Company **Internal Correspondence**

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Subject: Underground Mapping, James G. Blaine Tunnel, Rico, Colorado
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INTRODUCTION

After a 40-hour New Miner Training course, a total of 15 working days were spent mapping in the James G. Blaine Tunnel. Mapping was concentrated in the 103 (Main) Drift, from the 102 Drift (213 meters from the portal) to the #9 Crosscut (457 meters from portal). Mapping also included the SC-6 Crosscut, for a total of 320 meters. Rib mapping, which produces longitudinal sections along the drift, was employed.

ROCK TYPES

Sedimentary rocks of the Middle Hermosa Formation make up 85% of the rocks in the mapped area. Three main types occur:

1. Chalky white, clean, fine-grained limestone with minor dolomite. These are mostly thick (1-2 m), massively bedded units, but they also occur as thinner (20-30 cm) beds intercalated with finer-grained sandstones.

2. Greyish-green to olive green, finely laminated siltstones and fine- to medium-grained light green sandstones. Some of the siltstones have shaly partings, 2-5 mm thick, and the sandstones are locally calcareous. These rocks are well-stratified, with beds 1-30 cm thick. More massive sandstones also occur (2-3 m), with individual beds 50-100 cm thick.

3. Greenish-grey coarse-grained conglomeratic sandstones. These are thickly bedded (0.5-1.5 m) and internally massive. Subangular pebbles of chloritic siltstone, 2-10 mm long, make up 15-20% of the rock.

Igneous rocks account for the remainder of the rock types mapped. These consist of dark greyish-green hornblende latite porphyry, with 30-50% phenocrysts of plagioclase (2-5 mm) and hornblende (0.5-1.0 mm) in an aphanitic groundmass. Two sills of porphyry, one 9 m thick, the other in excess of 60 m, were mapped in the SC-6 Crosscut. The thinner sill has a suggestion of flow banding parallel to its contact with the sedimentary rocks. At least one cross-cutting dike was mapped in the 103 Drift on the south rib between the SC-6 and the #9 Crosscuts.

STRUCTURE

The dominant structure in the Blaine tunnel is the Blackhawk fault. In the area mapped, the 103 Drift follows the main zone of the Blackhawk fault for 137 meters, from the 102 Drift to where the Last Chance fault crosses the drift. For the most part, the Blackhawk fault strikes N50-60W and dips 70-80NE, but at its intersection with the Last Chance fault, the Blackhawk fault veers to the east, striking N80-90W, dipping 80N. The 103 Drift again follows the Blackhawk fault beyond the #9 Crosscut, where the fault strikes N55-65W, dipping northeast.

A south-dipping fault system dominates the 103 Drift between the Last Chance fault and the #9 Crosscut. Individual faults in the system are oriented from N55W to E-W. Near the SC-6 Crosscut, the system is cut by a northwest-trending fault that dips 75° north. Since the Blackhawk fault is a wide zone rather than a single fault, it is probable that most of the faults in this section of the 103 drift are splays and offshoots from the Blackhawk fault.

Sedimentary rocks in the 103 Drift display two distinct attitudes. Between the 102 Drift and the Last Chance fault, and in the footwall of the south-dipping fault system, the rocks trend northwest and dip 40°-50° to the southwest. On the other hand, rocks in the hanging wall of the south-dipping fault system, while also trending northwest, dip 50° to the northeast.

Since the Blaine tunnel sits on the northeast flank of the Rico Dome, it is easy enough to correlate the northeast-dipping rocks with the regional structure. As for the other rocks, there are three possible explanations for their orientation:

1. The southwest-dipping rocks are on the northeast flank of a minor synclinal structure that has been faulted.

2. Secondary doming by a minor intrusion to the northeast.

3. Rotation of blocks during faulting.

Mapping was not extensive enough to fully evaluate the three possibilities, but rotation of fault blocks seems most likely.

MINERALIZATION

Mineralization in the 103 Drift is localized along the Blackhawk Fault. Most of the ore has been mined out, but pods consisting of 60% total sulfides, with pyrite:galena:spalerite ratios of 7:2:1, were mapped 11 m southeast of the 102 Drift. Scattered thin sphalerite bands and disseminated pyrite-galena mineralization are also found in the fault zone.

Veins containing mineralization are sporadic in their distribution, but tend to cluster in the clastic sedimentary rocks. They average 2-5 mm in thickness and dip steeply to the northwest. Vein types include quartz, quartz-pyrite, calcite-pyrite, and quartz-calcite-pyrite. Small (0.5 mm) pyrite cubes, totaling 0.1% sulfides, are locally disseminated in limestones and sandstones.

ALTERATION

The most extensive alteration mapped in the 103 Drift occurs adjacent to and within fault zones. Adjacent to these zones, limestones are highly fractured, with the fractures containing black granular pyrolusite. At the 107 Drift, a sandy lens in the limestone acted as a trap for manganese-bearing solutions, and the resultant pyrolusite-sandstone pod has a 10-20 cm aureole of pervasive manganese alteration in the surrounding limestone. In the same area, local development of calc-silicate minerals has resulted in pods of green coarse-grained limestone.

Within the fault zones, much of the fault gouge has been replaced by a 20-50 cm thick vein of bull quartz, ± calcite, pyrite, galena, and sphalerite. However, silica-bearing solutions were not restricted to the fault zone, and limestone beds were locally silicified to a dense, hard rock. The silica solutions did not flush the manganese totally from the system, as the silicified limestones still contain spider-thin pyrolusite-coated fractures.

Other alteration in sedimentary rocks is relatively minor. There are no alteration envelopes accompanying the thin quartz ± calcite, pyrite veins. Thin, chlorite-filled fractures were mapped in the siltstone unit near the 102 Drift.

The hornblende latite porphyry has also been locally altered. Argillic alteration occurred along three major fractures in the southern end of the SC-6 Crosscut, resulting in clay zones 20-100 cm thick. To the north, a zone of propylitic alteration 20 m wide developed in the hanging wall of a south-dipping fault. Feldspars were wholly replaced by chlorite, epidote veining developed, and the groundmass was bleached and recrystallized to a somewhat larger grain size. Other scattered zones of propylitic alteration are characterized by calcite-epidote-sericite replacement of feldspar and by widespread epidote veining.

CONCLUSIONS

Faults provided a large network of fluid conduits in the area of the Blaine tunnel. This is evidenced by the presence of thick quartz veining along the Blackhawk fault. Thick quartz veins, absent in other major faults in the region, are present in the south-dipping fault system and lend credence to the hypothesis that it is a splay from the Blackhawk fault zone.

Hydrothermal solutions were at relatively low temperatures in this area of the mine. This is supported by the absence of alteration envelopes along veins and by the generally limited occurrence of chlorite and manganese in thin fractures in the sedimentary rocks. However, silica was mobile enough to locally permeate limestones adjacent to faults.

There is not enough of a pattern in the alteration assemblages mapped to delineate a center of igneous activity.