

Quadrio Lake: we've found the barite, where are the sulfides?

by

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Barite–hematite mineralization is present at Quadrio Lake, 400 km northeast of Wiluna in the Oldham Inlier (northwestern Officer Basin). This mineralization occurs as veins containing anomalous gold, arsenic, and antimony with gold values up to 110 ppb. The mineralization is in the Quadrio Formation, a shale-dominated unit of probable Mesoproterozoic age in the Oldham Inlier that was previously part of the Cornelia Formation (see below). The Quadrio Formation probably correlates with the Edmund Group (Bangemall Basin) to the west, but may also correlate with the Throssell Group to the north.

The vein material is composed of barite and Fe oxides (mostly hematite) that form an easterly trending stockwork system. The veins cut siliciclastic rocks, mainly shale and siltstone, which are deformed into a local northwest-plunging upright anticline. The host rocks near the veins are silicified and exhibit silica-filled, multidirectional hairline fractures. These hairline fractures are probably the result of hydraulic fracturing due to high-pressure fluids. Scattered barite–hematite veins up to 30 cm across can be traced for at least 2 km towards the northwest, along the margins of Quadrio Lake. Core from the Trainor 1 drillhole, about 10 km to the northeast of Quadrio Lake, contains thin to hairline barite–hematite veinlets, locally associated with pyrite, in hydrothermally altered dark-grey

shale. This rock unit is regarded as the Quadrio Formation, thus suggesting an extensive but northwards-waning mineralized area. Hydrothermal alteration in the core consists predominantly of disseminated carbonate porphyroblasts.

Results of analyses of three samples collected from the vein system are shown below. These samples were taken randomly, from barite-rich material. Gold, arsenic, and antimony show anomalous abundances and are shown in boldface.

Regional geological and geophysical data suggest that the stockwork system may be part of a larger mineralized system. A major change in magnetic character and structural orientation is recognizable about 15 km to the southwest, along the northern margin of the Oldham Range. This marks the boundary between the Oldham and Cornelia Sandstones and is a major fault, possibly a thrust, because of the stratigraphic relationships. No other change in magnetic character is present between the area in question and Trainor 1, or over Quadrio Lake. However, the Cornelia Sandstone occupies a gravity 'terrace', the northern boundary of which is just south of Phenoclast Hill, so another fault could be present south of the hill. A gravity low below Phenoclast Hill may represent a basement feature.

Table 1. Stratigraphy of the Oldham Inlier

<i>Williams (1995) and earlier stratigraphy</i>	<i>Hocking et al. (in prep.) stratigraphy</i>	<i>Lithology</i>	<i>Age, correlation</i>
Cornelia Formation	Oldham Sandstone	Silicified sandstone; moderately dipping	?1 – 1.2 Ga, ?Collier Group
	Quadrio Formation	Shale, minor sandstone; subvertical.	?1.6 Ga, ?Edmund Group
	Cornelia Sandstone	Intensely silicified sandstone; steeply dipping	?1.6 Ga, ?Edmund Group

Table 2. Selected trace element abundances of barite vein material

Sample No.	Au ppb	V ppm	Mn ppm	Ni ppm	Cu ppm	Zn ppm	As ppm	Mo ppm	Ag ppm	Sn ppm	Sb ppm	Ba wt%	W ppm	Pb ppm
161270A	90	24	200	50	64	11	70	2.2	<0.1	<0.1	19.0	27.5	0.7	24
161270A (repeat)	110													
161270B	40	26	125	6	82	19	42	0.9	<0.1	0.1	8.6	39.0	0.5	10
161270C	80	42	120	9	44	12	80	2.6	<0.1	0.2	27.5	26.0	1.1	16

NOTE: Analysis performed by Genalysis, Perth. Au analysis of sample 161270A was repeated by fire assay

An ore deposit model for the auriferous barite–hematite veins must consider the tectono-stratigraphic context of the region. The Ba±Au mineralization is epigenetic because it cross-cuts deformed sedimentary rocks. Two groups of mineralizing events and associated orogenies can be distinguished in the region (Fig. 1): one Palaeoproterozoic, associated with the Capricorn Orogeny (c. 1800 Ma); and a second, younger group (~700–600 Ma) between the Miles and Paterson Orogenies (Tyler et al., 1998). The Telfer gold mineralization is associated with this younger event. The Quadrio Lake mineralization, being epigenetic, is younger than 1600 Ma. Since there is no recorded mineralizing event between 1600 and 800 Ma, the Quadrio Lake barite is probably related to the event that produced the Telfer gold and other metalliferous occurrences in the Throssell and Lamil Groups.

Barite deposits are generally grouped into those associated with continental margins in foreland basins, and those associated with intracratonic rifts (Maynard et al., 1995). In the latter, barite is commonly a distal facies to stratiform Pb and Zn deposits. The northwest Officer Basin is intracontinental, and thus conducive to SEDEX deposits. In our preferred model, there are three main facies associated with feeder channels: a vent complex, proximal stratabound sulfide ore, and distal stratabound sulfate and oxide ore. Mineralization can extend for hundreds of metres to tens of kilometres from feeder channels, and a halo of hydrothermal alteration (albite, chlorite, carbonate, and silica) surrounds the feeder channel.

The feeder channels most readily lie along structural breaks, such as faults or shear zones. The known and probable faults bounding the Cornelia Sandstone could be the structural controls and fluid channels for mineralization. A typical feeder channel is a vent complex, characterized by brecciated material cemented by sulfides. Sedimentary rocks lie above the feeder and form a stratabound/stratiform massive sulfide zone. In the general model, layers and stockworks of barite are present distal to the sulfide zone. The Quadrio Lake stockwork may be this distal zone. The presence of trace amounts of gold in the barite suggests that hydrothermal fluids carried gold and other metals in solution, most of which precipitated in sites closer to the venting structures. The ‘spent’

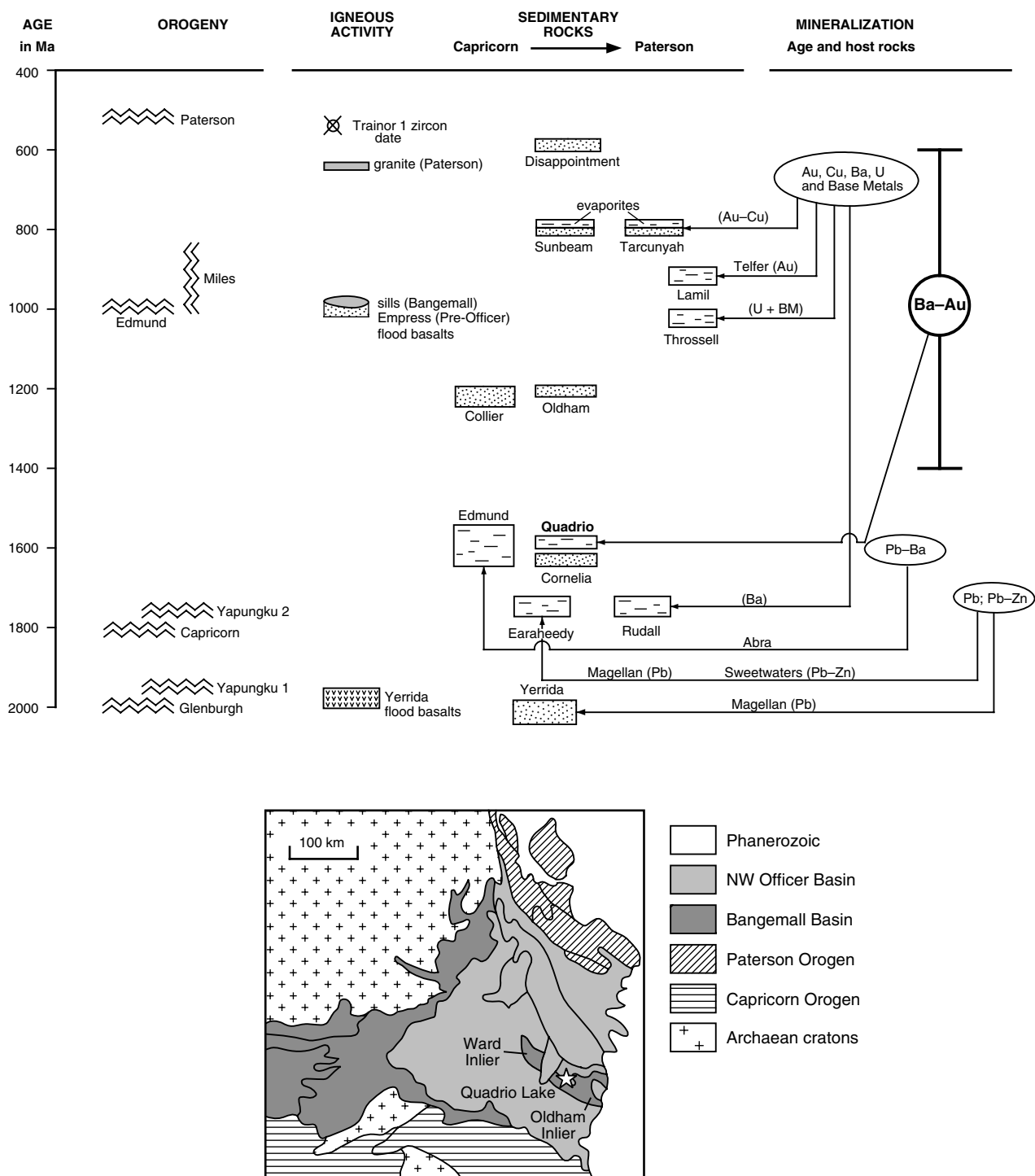
solutions always carry trace amounts of the main solutes, which in this case probably included gold, arsenic, and antimony. Interestingly, silica alteration is present around the barite veins, whilst carbonate alteration is present in the barite–sulfide mineralization detected in the Trainor core.

The Ward Inlier, to the northwest, is also prospective but has not been assessed. From aeromagnetic imagery, Landsat/SPOT images and existing mapping, the southern part of the Ward Inlier appears to be Oldham Sandstone, and the northern third, Quadrio Formation. If the Cornelia Sandstone is present, it is less extensive than in the Oldham Inlier.

The Quadrio Lake deposit is significant by itself because it is a signpost to possible SEDEX mineralization in the Oldham and Ward Inliers. This deposit has similarities to the Abra deposit in the Bangemall Basin but probably developed during a different event, so the two areas are not genetically linked.

References

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Figure 1. Orogenies, igneous activity, sedimentary successions, and mineralizing events relevant to the Quadrio Lake region, and location of Quadrio Lake mineralization