Exploration of the Teena Zinc Prospect – New insights for the discovery of shale-hosted zinc deposits in Northern Australia

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Teena is the most significant zinc discovery for 25 years in the world-class Carpentaria Zinc province of northeast Australia. It is located just 8 km west of Glencore's McArthur River Zn-Pb Mine (190 Mt at 9.8% Zn, 4.3% Pb and 44 g/t Ag (Glencore 2015). Teena lies within the same stratigraphic host unit, but in a separate 4th-order sub-basin along a different structural corridor. The discovery was made by Teck in partnership with Rox Resources in 2013 whilst testing a new high-grade target in the Teena Sub-basin. High-grade stratiform mineralisation has now been intersected over a 1.5 km strike extent, at depths of 600–1000 m, with several intercepts of >10 m thickness at 13% to 17% Zn+Pb; this includes a peak intercept of 38.8 m at 16.9% Zn+Pb (Rox Resources Ltd 2015).

The sub-basin depocenter formed as an asymmetric half-graben with up to 800 m normal throw in an extensional fault relay along the south-dipping Jabiru-Bald Hills Fault Zone. We attribute formation of mineralisation at ca 1640 Ma to be related to NNW–SSE extension, not WNW–ESE compression or extension, as previously proposed (McGoldrick *et al* 2010). Despite its Paleoproterozoic age, inversion effects are minimal. This insight has important implications for target prediction.

Mineralisation is hosted by the reduced Barney Creek Formation (BCF), the transgressive facies between the Reward and Teena dolostones. The BCF transitions from basal, thinly interbedded, dolomitic-siliciclastic sandstone–siltstone beds to laminated carbonaceous and pyritic siltstone–shale beds. Importantly, stratiform mineralisation occurs in the lower dolomitic carbonaceous shale facies, significantly below the maximum flooding surface. It comprises two lenses separated by the thickest sandstone mass flow units present in the basin, reflecting maximum fault subsidence. In contrast to the McArthur River deposit, dolomite talus breccias are very restricted to the immediate Jabiru Fault hanging wall.

Two main stages of mineralisation comprise: (a) early diagenetic, fine-grained, laminated sphalerite with disseminated to laminated framboidal pyrite in carbonaceous beds; and (b) late diagenetic, medium-grained, Fe-rich sphalerite and galena replacing carbonate nodules and lenses. This deposit has negligible Ag but significant Ge, presumably as a result of low fluid temperatures. Low-grade stratabound mineralisation up to 200 m thick extends through the altered basal dolomitic–siliciclastic facies in the immediate footwall rocks; low- to medium-grade hydrothermal breccia mineralisation is hosted within the Jabiru Fault Zone.

Alteration styles include: (a) texturally-destructive green ferroan illite and phengitic illite in siliciclastic beds, (b) hematite alteration (± quartz) replacing carbonate nodules, and (c) massive, bladed to concretionary dolomite replacement lenses.

Low-level regolith geochemical responses have been detected along fault leakage zones. Applied geophysical techniques have been completed, including gravity, seismic, audio-magnetotellurics and electromagnetics, to characterise mineralisation and the host sub-basin architecture. The most effective techniques to guide new discoveries involve targeting sub-basin depocentres with maximum growth-fault throw, and detecting high-density, chargeable and conductive anomalies permissive of extensive pyrite haloes.

References

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