

The Biological and Reworking Metallogenic Models of the Lanmuchang Tl Deposit*

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Geological Characteristics of the Tl Deposit: The Tl deposit is located in the Southwest Guizhou depression zone, belonging to the platform sedimentary area, on the southwestern margin of the Yangtze Platform and closely adjacent to the northwestern margin of the South China Folded Belt. Orebodies occur chiefly in the Upper Permian Longtan Formation and Changxing Formation strata. Quite a large number of micro-paleoorganism fossils, especially *foraminifera* and *bryozoa*, can be seen in Tl ores formed by way of bio-enrichment during sedimentary diagenesis. Most of them have been replaced by Tl-bearing ore fluid, forming Tl minerals that have preserved bio-pseudomorphs, for example lorandite and christite. Analysis of the time limitation of biological community and bio-enrichment metallogenetic mechanism indicates that the bio-enrichment metallogenetic stage appeared in Late Permian, i. e., Late Hercynian. The ore-bearing layers are as many as fourteen in number. The main ore-bearing rocks are a hybrid sedimentary complex, i. e., composed of several lithologies^[1]. The lithofacies transformation belt is the location where the hybrid is located, and it is also the favorable locus of metallogenesis.

Metallogenic Models of the Tl Deposit: The metallogenic models of the Tl deposit can be roughly divided into two models: bio-enrichment metallogenesis and hydrothermal reworking metallogenesis. The former is contemporaneous or slightly later than the Late Permian sedimentary diagenesis, belonging to the Hercynian metallogenesis while the latter occurred in the Middle Triassic, corresponding to the Indosinian metallogenesis. At the bio-enrichment metallogenetic stage abundant bio-fossils, especially micro-paleoorganism fossils, were replaced by Tl-bearing ore-forming hydrothermal solutions (Tl, As, S, etc.), forming Tl minerals with bio-pseudomorphs, especially those with foraminiferal pseudomorphs, which are indicative of the bio-enrichment metallogenetic stage. Tl minerals crystallized during this metallogenetic stage (e. g. lorandite) display, without exception, bio-pseudomorphs, and are very fine in grain size, mostly measuring around less than 1 mm. They are distributed in disseminated, colloidal and micro-paleoorganic forms in the ore-bearing layers. The grade of Tl ores depends on the abundance of micro-paleoorganisms, both showing a positive correlation. Bio-enriched Tl-bearing orebodies still maintain the stratigraphic attitude and lithological character at the time of sedimentation, but micro-paleoorganism fossils in the ore-bearing layers have been completely replaced by Tl minerals. At this stage the Tl-bearing orebodies were almost destroyed by later hydrothermal reworking processes with little relic.^[2]

At the hydrothermal reworking metallogenetic stage, owing to hydrothermal reworking and superimposition, the picture at the bio-enrichment metallogenetic stage was almost completely changed. No significant difference is found in ore texture and occurrence from the ordinary metallic (Hg, Sb, Pb, Zn, etc.) ore deposits. Minerals, especially Tl minerals, crystallized at this stage are precisely different from those formed during the bio-enrichment metallogenetic stage, which are characterized as being large in grain size (>1mm), some individual crystals even as large as to be up to 5-10mm. The minerals are diverse in form, for instance the massive, radiated and tabular crystals. Tl orebodies are also diverse in form, including stratiform, lenticular and enveloped orebodies. No bio-fossils and Tl minerals with bio-pseudomorphs have been observed in the Tl orebodies and ores, indicating that they are typical hydrothermal minerals.^[3]

References: [1] Zhang Baogui, Zhang Zhong, Long Jiangping, and Lin Qing, 1996, Some problems of ore exploration of low-temperature ore deposits: Developments in Geochemistry (The Proceedings of the 30th International Conference on Geology): Guizhou Science and Technology Press, Guiyang China, P.22-26.

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[3] Tu Guangzhi et. al., Low-temperature geochemistry, Science press, Beijing, China, P8-15.