

# **Phapon gold deposit, Laos: A unique orogenic gold deposit with calcite as the main gold-bearing mineral**

LINNAN GUO<sup>1</sup>, YANWEN TANG<sup>2</sup> AND ZHIWEI HAN<sup>3</sup>

<sup>1</sup>Chengdu Center, China Geological Survey

<sup>2</sup>Institute of Geochemistry, Chinese Academy of Sciences

<sup>3</sup>Tianjin North China Geological Exploration Bureau

Presenting Author: [linnanguo@163.com](mailto:linnanguo@163.com)

The Phapon gold deposit, located in northern Laos, is a unique large gold deposit in the Luang Prabang (Laos) – Loei (Thailand) metallogenic belt. It is hosted in lower Permian limestone and controlled by a NE-trending ductile-brittle fault system. The lode gold orebodies are composed of auriferous calcite veins filling faults and surrounded by limonite- and siderite-bearing alteration zones. The ore-related minerals are primarily pyrite, with lesser siderite and magnetite. The gangue minerals mainly consist of calcite with minor quartz, realgar, and orpiment. Due to weathering processes, leaching of primary sulfides has led to their widespread replacement by limonite. Gold is basically present as free gold grains within thin fracture networks or along grain boundaries in calcite, and in many of these sites in close association with limonite or magnetite. The geological characteristics of the Phapon gold deposit are in sharp contrast to the regionally widespread porphyry-related skarn and epithermal gold deposits. Fluid inclusion and H-O isotopic data indicated the ore-forming fluids were characterized by medium–low temperatures (157–268°C) and low salinities (1.6–9.9 wt% NaCl eq.), and are likely to have a dominantly metamorphic source. Fluid-wallrock interaction played a major role in ore formation, although locally processes of fluid unmixing may have played a role in gold deposition. New calcite LA-SF-ICP-MS U-Pb dating indicates the gold mineralization event occurred at 221.4±8.9 Ma. In conclusion, we suggest that the Phapon gold deposit is best considered to be an epizonal orogenic deposit, with an origin related to closure of the Paleo-Tethys Ocean and subsequent collision between the Sibumasu terrane and Indochina block in Late Triassic.

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