

Gold mineralisation along the Nam Xiang Fault, Vieng Kham project, northeast Laos

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Abstract

The Palaeozoic rocks of northeastern Laos are an attractive target for gold explorers due to the complex tectonic history and lack of past exploration in the region. Alluvial workings along the Nam Xiang River and its tributaries have highlighted the potential for gold mineralisation in the Vieng Kham Region. The Nam Xiang River follows a regionally extensive NNE striking thrust fault. Adjacent to the Nam Xiang Fault, the dip of the main foliation steepens and in many places the stratigraphy is overturned as a result of this faulting.

United Minerals and Mining Company has conducted regional exploration program to explore for gold. This included stream sediment and rock-chip sampling and airborne geophysics. Geochemical anomalies were followed-up with more detailed exploration including geological mapping and soil sampling. Despite the relatively deep weathering profile, gold mineralisation is associated with a low-level, but well-defined gold in soil anomaly. Drilling has shown that gold mineralisation occurs on structures and fabrics parallel to the main Nam Xiang Fault. The highest gold grades are associated with brecciated sandstones that have experienced strong carbonate alteration. This suggests that the late stage structures such as the Nam Xiang Fault are the major control on gold mineralisation in the region.

Introduction

The Vieng Kham Project is centered on the township of the same name located approximately 145 km east along sealed roads from Luang Prabang in northern Lao PDR (Fig 1). The area has a long history of alluvial gold mining along the banks of the Nam Xiang River and its tributaries. However, the source for this gold has been elusive and a recent exploration program conducted by United Mining and Minerals Company (Lao) Pty Ltd (UMMC) has aimed to evaluate the potential of this primary gold mineralisation.

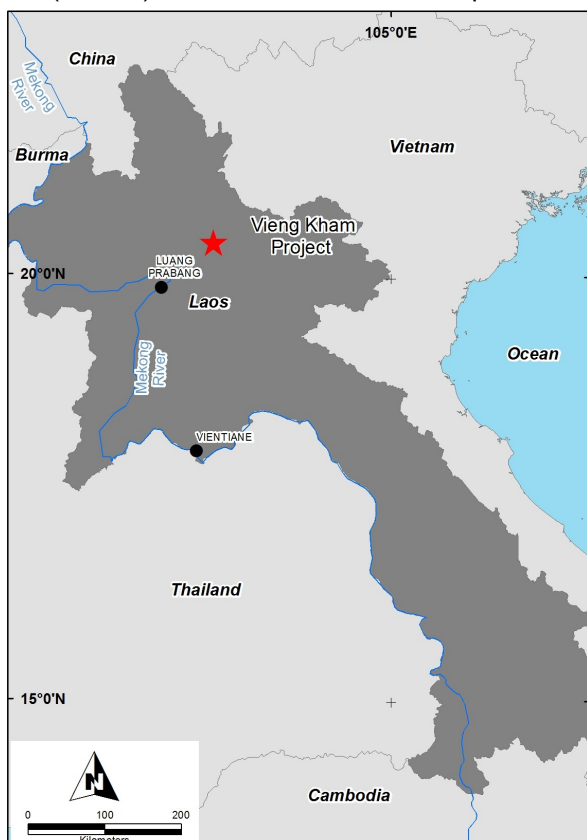


FIG 1 – Site Location

Exploration

Prior to UMMC's exploration in 2012, there had been no modern exploration work conducted in the Vieng Kham region. Therefore, UMMC began a systematic exploratory work program. This included a regional geochemical stream sediment and rock chip sampling program, geological mapping and an airborne geophysical survey. Based on the results from this initial work program, a number of prospects were identified. These prospects were followed up with detailed soil sampling, trenching and diamond drill programs. The exploration work was carried-out by UMMC geologists and contractors with SRK Consulting geologists providing guidance in terms of work plans, standard operating procedures, sampling and rigorous QAQC protocols to ensure the program was conducted according to JORC Code (2012) guidelines.

GEOLOGICAL SETTING

Geology

The Vieng Kham project is situated in northeastern Laos and consists of Palaeozoic – Mesozoic marine sedimentary sequences. Within the project, fine-grained Triassic sandstones are reported to be unconformably overlying Silurian – Ordovician and Carboniferous rocks. Siluro-Ordovician rocks include carbonaceous shales, siltstones, fine-grained quartz sandstones, polymictic conglomerates and rare limestones (Fig 2). Gold mineralisation has been identified within both the Silurian-Ordovician and Carboniferous rocks.

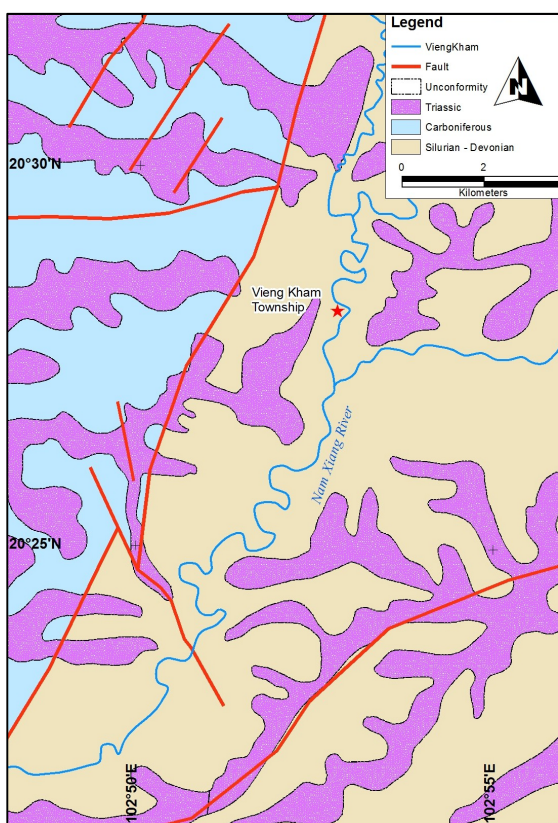


FIG 2 – Geological setting

Structure

The dominant structure in the project area is the north–northeast striking Nam Xiang Fault, a westerly dipping dextral transpressive fault (Fig 2). The strike extent of the Nam Xiang Fault is unknown, but it may represent a part of the regionally significant Dien Bien Phu Fault system, which extends to the north-northeast into Vietnam and has similar kinematics and timing of displacement (Lin et al., 2009).

Gold exploration has focused on subordinate NNE-striking faults which are anomalous in gold. These structures are found on both the hangingwall and footwall of the Nam Xiang Fault. Although it is difficult to gauge, the displacement along this fault is evident from field mapping and drilling, with much of the stratigraphy tightly folded and overturned in places. The presence of both ductile and brittle structures suggest multiple phases of movement along the Nam Xiang Fault with the development of drag folding as well as the presence of fault breccias.

The Ordovician sedimentary rocks have a well-developed slaty cleavage, which varies from a moderate westerly (~40°) to a sub-vertical dip, steepening with proximity to the Nam Xiang fault. There are at least two

overprinting cleavages found regionally, one typically dipping towards the north (~ 15 to 35°) and another dipping steeply (~ 70 to 80°) to the west and recording a shear component.

Regolith

The tropical climate and high seasonal rainfall have led to the development of deep lateritic weathering of the rocks in this region with the depth of total oxidisation extending to over 60 m. The residual saprolite clay is typically deep red to brown in colour and is thickest along the ridgelines, but absent along the banks of the Nam Xiang River where alluvial deposits and outcropping rocks are visible. In areas of thick regolith it is noted that geochemical response from soil sampling is less pronounced and broader, suggesting a level of dispersion of gold and other elements within the regolith profile.

GOLD MINERALISATION

Along the length of the Nam Xiang River, artisanal workers pan for coarse-grained gold along its banks and tributaries (Fig 3). The river follows the course of the Nam Xiang Fault, and the location of these workings suggests multiple sources of the primary gold mineralisation along strike. Within the Vieng Kham Project area, gold-mineralisation occurs as coarse-grained (< 0.1 mm) gold and is associated with faults which have intersected the carbonaceous shales, siltstones and sandstones.



FIG 3 – (A) Artisanal mining along Nam Xiang River (B) Panned gold from Nam Xiang River

The rocks are thinly bedded and in areas known to host gold mineralisation. The rocks are commonly brecciated and overturned by faulting and folding. In detail, the gold mineralisation is localised along the slaty S1 foliation and lithological contacts between shales and sandstones (Fig 4 A, B). This suggests gold mineralisation occurred relatively early and has been overprinted by later deformation events.

Commonly, higher gold grades are coincident with (1) quartz-carbonate veining (Fig 4 B), (2) quartz-carbonate-chlorite alteration (Fig 4 C), as well as a relatively high concentrations of pyrite. The pyrite is the dominant sulphide associated with gold mineralisation, with arsenopyrite, chalcopyrite, molybdenite and galena found in subordinate amounts.

Several generations of veining are evident throughout including quartz, quartz-carbonate, chlorite-carbonate and pyrite-carbonate. The quartz-carbonate and sulphide-rich veins are mineralised with gold. The more massive quartz veining appears to cross-cut the other vein types and are generally not mineralised.

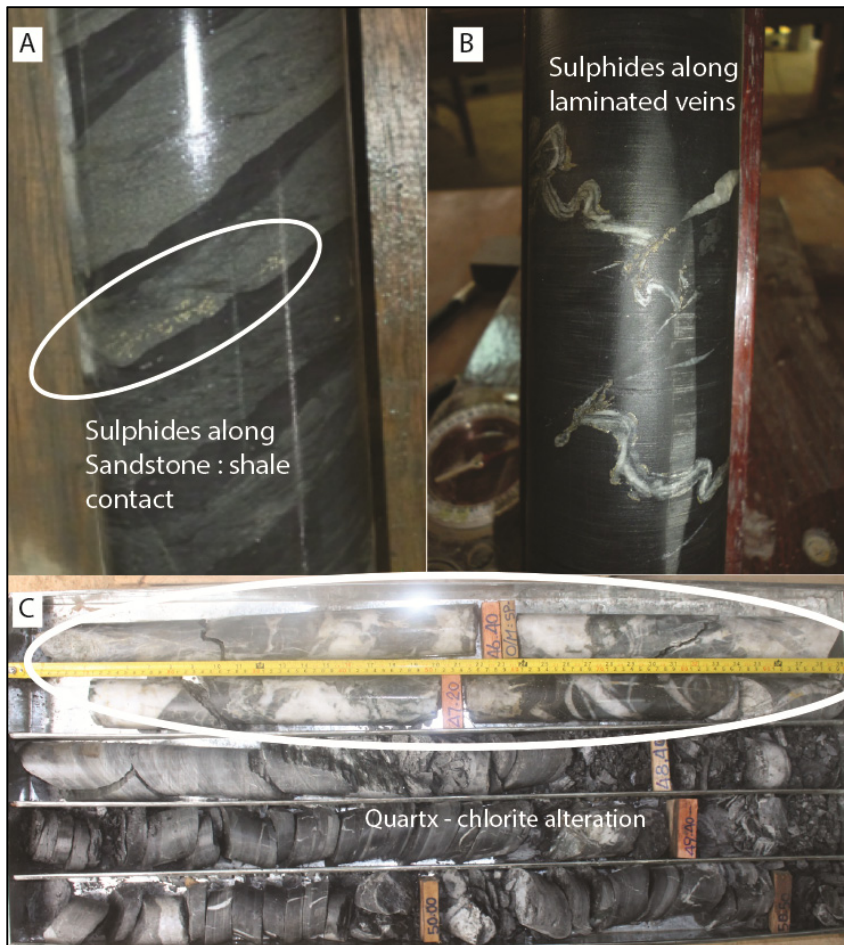


FIG 4 – (A) Pyrite on contacts between sandstone and shale,(B) folded and sheared quartz-carbonate-sulphide veins (C) Quartz veining and chlorite alteration

CONCLUSIONS

The Vieng Kham area in North East Laos has had a long history of artisanal mining, but until recently has not been subjected to modern systematic exploration. UMMC acquired the project in 2012 and has conducted a campaign of stream sediment sampling and geological mapping. Based on the results of this, a more detailed program, which included trenching and soil sampling was conducted. Due to the deep lateritic weathering (> 60 m depth) the geochemical response was subdued.

Within the Vieng Kham area, the Nam Xiang Fault is a regionally significant structure that has thrust the Silurian–Ordovician over Carboniferous sedimentary rocks. UMMC’s exploration program is centered on the Nam Xiang fault and has identified structurally controlled gold mineralisation hosted by a package fine grained carbonaceous and siliciclastic rocks adjacent to the fault. Gold mineralisation is localised in structures in both the hangingwall and footwall of the Nam Xiang fault. Typically gold mineralisation has a number of local controls including the slaty cleavage which dips variably towards the west. Gold is typically coarse grained (< 0.1 mm) and is associated with carbonate alteration with presence of pyrite and subordinate arsenopyrite, molybdenite and galena.

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The JORC Code (2012 Edition), Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves. Prepared by the Joint Ore Reserves Committee of The Australasian Institute of Mining and Metallurgy, Australian Institute of Geoscientists and Minerals Council of Australia (JORC).