## Keys to the Production of Eastern Yilgarn Au deposits: Chemical and Structural Architecture Controls on Sites of Fluid Mixing

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Whilst the structural analysis of an area reveals sites which are suitable to host gold deposits for example in dilational sites, it produces false positives with sites which did not have the right fluid chemistry, i.e. the fluid did not contain gold or gold complexes were not destabilized. It is argued here that combining the structural architecture with the chemical architecture has the potential to reduce the search area significantly more then with simple structural analysis alone.

A number of Eastern Goldfields gold deposits are located at sites where the hydrothermal alteration assemblages change over short distances (e.g., deposits in the St. Ives gold camp, Kanowna Belle and Wallaby deposits). Typically the chemistry changes from reduced and acid hydrothermal alteration (e.g., muscovite, paragonite, pyrrhotite, arsenopyrite) to oxidized and alkaline assemblages (e.g., pyrite, magnetite, hematite, phengitic mica).

At a regional scale, oxidized assemblages relate to porphyry intrusive complexes situated in subsurface domal structures as indicated by seismic profiles and gravity data. Reduced fluids are likely to be associated with deeply-tapping, transcrustal structures. At the chemical gradient between the two hydrothermal cells, fluid – fluid interaction occurred and gold complexes were destabilized.

At a deposit scale (e.g., Victory-Defiance), stable isotope and mineral assemblage mapping in 3D identified distinct subvertical, oxidized fluid flow at intersections of E-W trending structures and subvertical NW- or NNW-trending structures, all of which are outlined by porphyry intrusions. Shallowly SW dipping structures typically contain reduced hydrothermal fluid flow distal to the oxidized upflow zones. Gold deposition occurred proximal to the oxidized upflow zone at sites with clear evidence of both reduced and oxidized hydrothermal fluids (i.e. mixing zone). At an ore shoot scale, mutual overprinting relationships between oxidized and reduced alteration assemblages indicate that both systems were synchronous.

## The Permian Conodont biostratigraphy of Western Australia – an update

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Earlier reports on the Permian conodont biostratigraphy of Western Australia have documented faunas from the Canning Basin (Noonkanbah Formation) and Carnarvon Basin (Callytharra, Coyrie, Wandagee and Coolkylia formations) that ranged in age from the Late Sakmarian to the Roadian. New studies have now documented additional Permian conodont faunas from the Perth Basin (Beekeeper Formation) and from the Canning Basin (Nura Nura Member of the Poole Formation, from throughout the Noonkanbah Formation, in the Lightjack Formation and from the Kirkby Range and Cherrabun Members of the Hardman Formation). These faunas range in age from the Late Sakmarian to the Wuchiapingian.

In the high latitude faunas of the Western Australian basins the conodont fauna has been dominated by the genus *Vjalovognathus* with only occasional occurrences of the genera *Hindeodus* and *Mesogondolella* and only a single occurrence of the genus *Sweetognathodus* in the Noonkanbah Formation. In the lower latitude conodont faunas from Timor, Pakistan, Tajikistan and Nepal/Tibet, the generic and species diversity of the conodont faunas is greater and this has been attributed to warmer water temperatures.

These cold water Tethyan faunas have been sparsely document from localities in the Salt Range of Pakistan, the Pamirs of Tajikistan, the Himalayas of Nepal and Tibet, and from Timor and the western margin of Australia. This study has been able to recognize a total of 9 species of the Genus *Vjalovognathus* based on prominent morphologic trends. Several of the key taxa have yet to be recognised in localities outside Australia.