The fundamental influence of tectonics and deformation in the emplacement and modification of komatiitic nickel sulphide deposits of the Eastern Goldfields province of the Archaean Yilgarn Craton

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This paper attempts to highlight the fundamental role played by tectonics and deformation in the formation and subsequent modification of many komatiite associated nickel sulphide deposits in the Eastern Goldfields province of the Archaean Yilgarn Craton of Western Australia. The influence of tectonics and deformation is manifest at a variety of scales, ranging from hand specimen to craton scale, and has a real impact on how these deposits are targeted, explored, delineated and mined. The influence of tectonics and deformation is as fundamental to the genesis of these deposits as are the well documented magmatic and volcanic processes generally considered to be crucial to their formation.

Post emplacement tectonism has led to the deformation, and in many cases, substantial modification of these essentially magmatic deposits. This ranges from centimetric scale remobilisation as a consequence of metamorphic recrystallisation, through the localised predominantly mechanical remobilisation of sulphides during brittle-ductile deformation of the rock mass, to partial or complete decoupling of sulphides from their parent ultramafics over distances of up to 800 metres in brittle-ductile shear zones and even nappes. Recognition of such modifying processes and consequent three dimensional architecture is essential for successful exploration, orebody modelling and mining of these deposits.

Furthermore, regional tectonic processes may also exert a considerable fundamental influence on the primary emplacement and localisation of komatiites and associated nickel sulphide mineralisation. Many of the thick komatiite sequences and major nickel sulphide accumulations of the Eastern Goldfields province are proximal to cratonic scale NNW trending shear zones which are generally accepted to represent D2 reverse and strike slip fault systems formed during the closure of ensialic greenstone basins. It is proposed that some of these structures represent inverted early extensional faults and that the ultramafics were extruded and emplaced as local volcanic centres adjacent to these basin bounding faults in rift basins and half grabens. If valid, this has important implications for the targeting of, and exploration for komatiite associated nickel sulphide deposits in the Archaean Yilgarn Craton.

This paper explores these ideas by specifically highlighting key geological features of the Emily Ann, Maggie Hays, Waterloo and Honeymoon Well nickel sulphide deposits together with general observations from other deposits within the large scale regional geological context and four dimensional structural framework of the Eastern Goldfields province as a whole.