

Kiangi Creek Formation paleogeography and the geological setting of the Abra polymetallic deposit

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The Kiangi Creek Formation is a ~0.2 to 2.6 km-thick succession of mostly fine-grained siliciclastic and carbonate sedimentary rocks that forms the middle part of the Mesoproterozoic Edmund Group of the Bangemall Supergroup. The formation is disconformable on older parts of the Edmund Group, and also rests unconformably on Gascoyne Complex basement. It is conformably overlain by the locally developed Muntharra Formation, or is disconformably overlain by the Discovery Formation. The Kiangi Creek Formation, together with the Muntharra Formation, make up the third of four depositional packages that Martin and Thorne (2004) used to interpret the major stages in the evolution of the Edmund Basin.

Constraints on the age of the Kiangi Creek Formation are poor. It is younger than the 1680–1620 Ma granites in the Gascoyne Complex, and older than c. 1465 Ma dolerite sills that intrude it (Martin and Thorne, 2004).

In central, southern, and western parts of the Edmund Basin the Kiangi Creek Formation is 0.8 to 2.6 km thick and is dominated by mostly fine-grained, deep-marine shelf deposits. Thick-bedded submarine-fan sandstones occur locally in the lower part of the stratigraphy at Cobra and on CANDOLLE* (Fig. 1). Their distribution appears to coincide with the presence of large Edmundian Orogeny faults, and suggests that sedimentation of the Kiangi Creek Formation in these areas began with the infill and burial of a horst-and-graben basin architecture.

Two areas of fluviodeltaic and shallow-marine shelf sedimentation have been identified: northeast of the Talga Fault on the Pingandy Shelf (Muhling and Brakel, 1985); and near the Coobarra Dome, immediately east of the Abra polymetallic deposit (Fig. 1).

On the southeastern Pingandy Shelf the Kiangi Creek Formation is about 0.2 km thick and comprises deltaic sandstone and siltstone derived from the northeast, with local stromatolitic carbonate deposits. Disconformable contacts separate several of the major lithostratigraphic units. When traced to the northwest and southwest, the sedimentary

facies are transitional into deeper marine shelf deposits consisting largely of very thick- to thin-bedded sandstone turbidites and mudstone. The formation here is 550 m thick and the proportion of sandstone increases significantly southwest of the Talga Fault. The uppermost Kiangi Creek Formation appears to have been deposited in response to a local shallowing of the Edmund Basin on the Pingandy Shelf, which was accompanied by a marked decrease in siliciclastic supply to the basin. During this time high-energy carbonate grainstone of the Muntharra Formation was deposited in shallow water close to the line of the Talga Fault, whereas sulfidic mudstone accumulated in deeper water towards the southwest.

The Abra polymetallic deposit lies near the western closure of the Coobarra Dome (Fig. 1). Here, the Kiangi Creek Formation equates to rocks previously mapped as the Coobarra, Kiangi Creek, and Jillawarra Formations by Muhling and Brakel (1985), and the West Creek and Jillawarra Formations by Vogt (1995). The underlying Gap Well Formation of Vogt (1995) equates to the Irregularly Formation.

Kiangi Creek Formation sedimentation in the Abra area reflects the interplay between a coarse-grained alluvial-fan system to the east and a rapidly subsiding fault-bounded marine depocentre to the west. Proximal alluvial-fan sandstone and conglomerate lie immediately south of the Bujundunna Fault (Muhling and Brakel, 1985), where they unconformably overlie c. 1797 Ma granitic rocks of the Moorarie Supersuite (Gascoyne Complex). Here, the most easterly outcrops record southeasterly directed paleocurrents, whereas outcrops further west indicate a southwest, then westerly paleoflow. Small, lenticular bodies of rhyolite lava and thin felsic volcanoclastic units (Tangadee Rhyolite) are interbedded with the alluvial-fan facies between 6 and 17 km east of the Abra deposit (Gee et al., 1976).

At Abra, alluvial-fan sandstone and conglomerate facies (equivalent to unit WC1 of Vogt, 1995) of the Kiangi Creek Formation are relatively thin (about 40 m) and disconformably overlie Irregularly Formation siltstone and fine-grained sandstone. Both the Kiangi Creek Formation alluvial-fan deposits and the underlying Irregularly Formation host the Abra polymetallic mineralization and associated alteration assemblage described by Collins and McDonald (1994) and Pirajno et al. (2009; this volume). The upper

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* Capitalized names refer to standard 1:100 000 map sheets, unless otherwise indicated

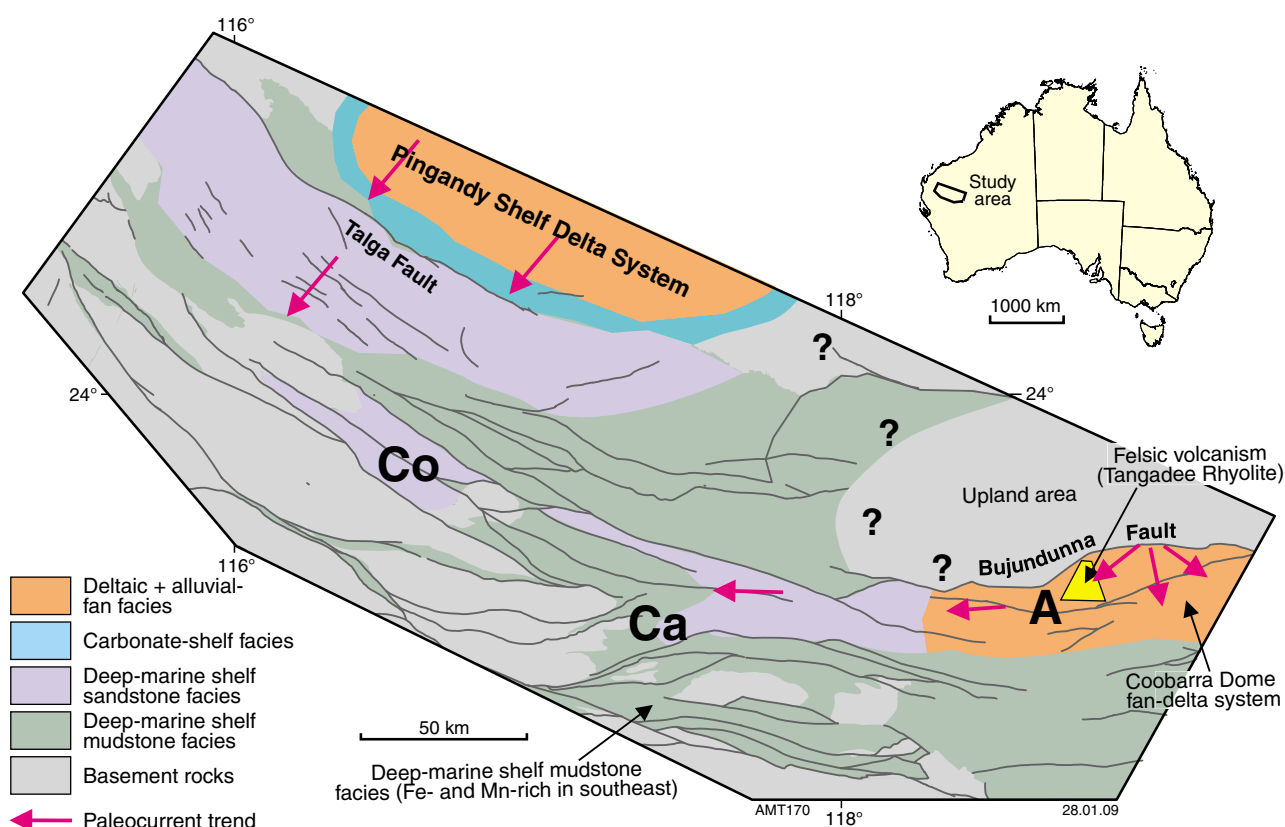


Figure 1. Diagrammatic reconstruction of lower Kiangi Creek Formation paleogeography. A = Abra polymetallic deposit, Ca = Candolle, Co = Cobra

surface of the alluvial-fan deposits is truncated by an erosional marine-flooding surface, or ravinement, that also marks the upper limit of Abra polymetallic mineralization and alteration. This relationship suggests that the timing of Abra mineralization coincided with a period of active growth faulting, alluvial-fan sedimentation, and minor felsic volcanism at the start of Kiangi Creek Formation deposition.

The lowermost unit of alluvial-fan sandstone and conglomerate at Abra is overlain by up to 1.3 km of fan-delta and deep-marine shelf deposits comprising siltstone interbedded with massive to normally graded, or locally cross-stratified fine- to very coarse-grained sandstone and minor conglomerate (equivalent to units WC2, WC3 of Vogt, 1995). Cross-stratified units consistently record a westwards paleoflow. These siliciclastic deposits, and local interbedded laminated dolostone units, generally show little evidence of reworking by wave or coastal processes other than in the uppermost quartz sandstone (unit WC4 of Vogt, 1995).

The upper Kiangi Creek Formation at Abra, corresponding to the Jilawarra Formation of Muhling and Brakel (1985), is up to 0.9 km thick and records a period of decreased siliciclastic supply and expansion of the marine basin to the north and east. The stratigraphy is dominated by parallel planar-laminated mudstone and minor fine-grained sandstone, interbedded with dolomitic mudstone and

planar-laminated dolostone. This unit has a sharp, apparently gradational contact with the overlying chert and silicified siltstone of the Discovery Formation.

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