

Evaluation of Potential Sapphire Source Rocks within the Catchments of Kings Plains Creek and Swan Brook, near Inverell, New South Wales

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ABSTRACT. Basaltic and volcanoclastic rocks in the East Central Volcanic Province, New South Wales, are potential sources of the alluvial sapphires being mined in the New England Gem Fields. The associated drainage catchment areas generally contain sapphire, but only four major catchments contain rich deposits: Frazers, Kings Plains, Reddestone and Marowan. These catchments are thus the most likely targets for sapphire source rocks. The Mount Buckley basalt flows and intrusives divide Kings Plains Creek and Swan Brook catchment areas for alluvial sapphire. Whole-rock analyses show mostly alkaline to strongly alkaline types becoming more undersaturated with time. The top flows are predominantly basanite and nepheline hawaiites whilst the lowest are predominantly alkali olivine basalts and hawaiites. Ultramafic xenoliths in several flows suggest rapid movement from upper mantle levels. Marked variation in major and trace elements between groups of flows suggests that flows were intercalated from different levels. Variation diagrams do not distinguish the 32 to 39 Ma sapphire-associated eastern Central Province basalts from the 19 to 23 Ma sapphire-barren western Central Province alkali-basalts. The Central Province compositional fields also overlap the volcanic provinces in north-eastern Australia, known to contain sapphire (Atherton, McBride and Chudleigh), as well as those believed to be barren. These Australian compositional fields also overlap the corundum-bearing and corundum-less fields for the south-east Asian volcanic provinces. Major and minor element chemistry of basaltic rocks is not a useful exploration tool for discriminating sapphire-bearing from sapphire-barren volcanic provinces, nor for recognising potentially high-grade areas within a sapphire-bearing province. This suggests that basaltic magmas are not the sapphire parent rocks, but only one of their potential carriers.

COENRAADS, R.R., 1994. Evaluation of potential sapphire source rocks within the catchments of Kings Plains Creek and Swan Brook, near Inverell, New South Wales. *Records of the Australian Museum* 46(1): 5–24.