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Abstract

The Riversleigh World Heritage Area in Queensland contains a vast array of Oligocene-Pleistocene vertebrate, invertebrate and plant fossils. The existing suite of fossil deposits contains a number of temporal gaps in the faunal succession, and exploration is turning to large expanses of recently-discovered Cenozoic carbonates to the west and south of Riversleigh. Previous exploration for new deposits has been primarily based on visual detection of bone or tooth fragments in outcrops or by excavation of sites where lithofacies or mineralogy indicates potential host structures. This study examines the application of field-portable X-ray fluorescence spectrometry (fpXRF) to detecting lithogeochemical or mineralogical indicators of fossil fragments and host structures where visual indicators are absent or subtle. Elemental analysis of outcrops by fpXRF has permitted geochemical differentiation of Cenozoic from underlying Cambrian limestones using Sr/Ca and Mn/Ca ratios. Potentially productive depositional environments and structures such as caves and palaeo-channels can be mapped using various combinations of Ti, Zr, and other relatively immobile elements associated with heavy minerals. Detection of finely-divided vertebrate fossiliferous materials is also possible, using ratios of U, Zn and Pb against Ca, or simply by detecting elevated P. The provision of real-time lithogeochemical data by fpXRF offers potential to accelerate the current exploration program in the Riversleigh area, at regional to local scales, and the detection of important vertebrate fossil deposits otherwise overlooked using the conventional visual survey methods.

Keywords: Geochemical mapping; fpXRF; vertebrate fossils; Riversleigh; lithogeochemistry

Highlights

- Significant geochemical differences between fossil-bearing structures and wall-rock limestones
- Field portable XRF can be used in-situ to identify potential host structures
- Technique will accelerate discovery of new fossil deposits in the Riversleigh area

1. Introduction

The Riversleigh World Heritage Area of NW Queensland (Fig. 1) hosts a large array of Oligocene to Pleistocene mammals, birds, reptiles, amphibians, fish, invertebrates and plant fossil assemblages. This includes unusual creatures such as the giant toothed platypus *Obdurodon tharalkooschild*, the sun-bear-like *Nimbadon lavarackorum*, some of the world's largest birds and other megafaunal species, and many species of bats (Archer et al., 1989, 2006; Hand and Archer, 2005).