Isotope and trace element geochemistry of Cretaceous igneous rocks of the Arkansas Alkaline Province, USA: constraints on their origin and evolution

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The Cretaceous alkaline rocks in the Arkansas alkaline province (AAP), southeastern United States, consist of seven intrusions emplaced into folded and faulted lower to middle Paleozoic rocks of the Ouachita Mountain fold belt [1]. The origin and evolution of the magmas that generated the AAP are still not very well constrained. Here we provide Pb, Sr, and Nd isotopic results (NU Plasma MC-ICP-MS) and trace elements data (Thermo Scientific iCAP Q ICP-MS) for the alkaline rocks and the sedimentary rocks that outcrop near-by, which clearly indicate that some of the igneous rocks experienced crustal contamination. On the Sr/Nd correlation diagram, the Granite Mountain syenites (88 Ma), whose weathering produced the Arkansas bauxite deposits (the only commercial bauxite deposits in the US), and the Magnet Cove carbonatites (94-97 Ma) plot in different quadrants, suggesting different magma sources. The carbonatites plot in the MORB-OIB field, suggesting a slightly depleted magma source, possibly a lithospheric source. The syenites show more evolved isotopic signatures, indicating either a more enriched asthenospheric source or crustal contamination.

On the thorogenic diagram, the alkaline rocks plot close to the 0 Ma value of the upper crust reservoir of Zartman and Doe (1981), suggesting that upper crustal rocks may have supplied some Pb to the alkaline rocks. Pb isotope analyses of the Mississippian/Devonian Arkansas Novaculite and the Mississippian Stanley Shale suggest that the Magnet Cove carbonatite may have experienced a small degree of contamination from the above-mentioned sedimentary rocks. The Granite Mountain syenites are slightly more radiogenic than the carbonatites. Pb isotope values of the Pennsylvanian Jackfork Sandstone and lower Atoka Formation plot close to the field defined by the syenites, which may indicate that the sedimentary rocks supplied some Pb to the syenites.

[1] Eby G.N. and Vasconcelos P. (2009) *The Journal of Geology* **117**, pp. 615-626.