

AGE AND PETROLOGY OF THE JACKSON DOME IGNEOUS-VOLCANIC COMPLEX, MISSISSIPPI: IMPLICATIONS FOR THE TECTONIC HISTORY OF THE MISSISSIPPI SALT DOME BASIN

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ABSTRACT

The Jackson dome, which is centered about Jackson, Mississippi, has produced a significant amount of natural gas and minor crude oil since the 1930's. The dome is cored by an exotic suite of alkalic igneous intrusions of Cretaceous age, some of which vented to produce a volcanic island during this time period. The petrology and age of igneous rocks of the Jackson dome provide new information on the general tectonic environment attending the development of the Mississippi Salt Dome Basin during the Cretaceous.

Approximately 200 samples, consisting primarily of coarse cutting and some drill core from 7 wells that penetrate igneous rocks in the center of the dome, provide the basis for characterizing the petrology, geochemistry, and age of the Jackson dome. Most of the intrusions have undergone extensive hydrothermal alteration, and data generated for this study comes from relatively unaltered to mildly altered samples that appear to be representative of the overall igneous rock suite. The igneous rocks fall into two general types: 1) phonolites, and 2) mafic alkalic rocks. Phonolite of the Jackson dome typically consists of phenocrysts of sanidine and nepheline in a fine-grained groundmass of similar composition. Mafic alkalic rocks contain variable amounts of nepheline, clinopyroxene (aegerine, aegerine-augite, or titanaugite), biotite, magnetite, garnet, and sphene. The latter rocks are best classified as ijolite, melteigite, nephelinite, and jacupirangite based on their relative mineral abundances. Whole-rock chemical analyses indicate that the rocks are nepheline-normative, are silica deficient, with SiO₂ as low as 26.7 wt. %, are enriched in titanium (TiO₂ as high as 8%) and alkalis, with Na+K typically exceeding 14%. Igneous rocks of the Jackson dome are mineralogically and geochemically very similar to the Cretaceous Magnet Cove carbonatite complex of central Arkansas, indicating that the Jackson dome may be a carbonatite complex as well.

K-Ar age dates were determined on either whole-rock samples or biotite separates from 4 core samples from two different wells. Age dates ranged from 79±2.9 to 69±2.9 Ma indicating that volcanic/plutonic activity at the Jackson dome lasted almost to the beginning of the Tertiary. Mafic alkalic rock suites (including carbonatite) originate from magmas formed by complex partial melting paths in the mantle (generally thought to be controlled by high CO₂ contents) in intraplate rift environments. The 79-69 Ma age for rocks of the Jackson dome is the youngest reported age of alkalic rocks in the northern Gulf Coast subsurface and indicates that basement rifting was proceeding to at least about the K-T boundary in the Mississippi Salt Dome Basin. This has important implications for Mesozoic sedimentation rates in the basin, and may have resulted in relatively high geothermal gradients along the northern basin margin. In addition, this study indicates that the same tectonic processes responsible for basin formation may also produce igneous rocks capable of forming hydrocarbon traps within the basin.

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