Inorganic Aspects of Kerogens in a Hydrocarbon Producing Source Shale Bed May Hold Solutions to Yet Some Long-Standing Unresolved Issues about the Origin of Petroleum: A Lesson from the Study of Hydrocarbon Producing Late Devonian Woodford Shale in North-

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ABSTRACT

Recent studies at Kansas State University regarding isotope ages of silicate and organic material components in source shale rocks from Late Devonian Woodford Shale in Payne County and adjacent locations in north-central Oklahoma have found that while K-Ar systems yielded a range of ages between 316 and 365 million years, the organic U-Pb systems yielded a narrow range of age of 340 +/- 4 million years. It is a well-established fact that the temporal aspect of a momentous geological event may be known from analyses of appropriate isotopes to be found in geological materials which are part of the event, provided the materials met the strict requirement of having maintained at all times since the event happened a closed system condition in reference to the isotopes under consideration. In light of this requirement, the quality of confidence to be drawn from the results of these recent isotopic studies about the temporal aspect of the momentous event of petroleum formation in the Woodford Shale depends very largely on knowledge of how the isotope closed system requirement could have been met.

Minerals with ideal crystallographic structures formed at the time of a momentous geologic event built are reasonably accepted to have a capacity of maintaining within certain physical, thermal, and chemical limits their age-defining isotopes to remain in an uncommunicative posture with their immediate surroundings. The spread in the K-Ar isotope ages has many different interpretations, leaving a large uncertainty as to the definition of the temporal aspect of the petroleum formation within the Woodford Shale source bed in the north-central part of Oklahoma. But how is it possible in the first place for inherently poorly crystalline, if not completely amorphous, organic materials, which are vulnerable to catagenic alterations to formation of oil and gas, having met a closed system condition for giving an age that can be identified as the momentous oil-formation time? The answer is simple: it is not the organic material itself, but secondary stable inorganic crystalline materials produced during the organic maturation process that have yielded the U-Pb isotope age of 340 million years which can well be translated as the time of formation of petroleum in the Woodford Shale source bed. This article will provide mineralogical and chemical evidence to support this conclusion. It is tentatively suggested that a super-acid condition promoted the growth of the inorganic minerals. We suggest that knowledge of organic anatomies of crude oils and kerogens is critically essential, but that alone is highly inadequate to have a full understanding of the formation of petroleum in a source shale rock.