

From source to reservoir: Re-Os systematics for hydrocarbon maturation-migration, Iblean Plateau, Sicily

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Timing of hydrocarbon maturation, expulsion and migration is vital for exploration. Re-Os geochronology of source rocks, yielding the time of deposition, is a proven technology. Here we document ages for deposition of source rocks, hydrocarbon-impregnated shales, oil from two carbonate reservoirs, and bitumen in limestone open space, all components of the same system. These ages track a consistent progression in the history of the hydrocarbon system.

The age of the stratigraphic section on the Iblean Plateau, Sicily, is constrained biostratigraphically from Norian (Sciacca Formation), through Rhaetian (Noto Formation), to Hettangian (Streppenosa Formation), straddling the Triassic-Jurassic boundary. A Re-Os isochron for the Hettangian Streppenosa shales yields a precise age of 201 Ma, at the mid-point of the 2 m.y.-long Hettangian stage.

Underlying organic-rich Rhaetian Noto shales are intercalated with carbonates. The shale is a known source rock, and a horizon in the carbonates is a productive reservoir. The shale yields Re-Os data scattering about a ~65 Ma errorchron. Despite the scatter, the approximate age is indisputable; analyses of sub-samples from different stratigraphic levels consistently yield the same ~ 65 Ma age, far younger than the known ~205 Ma biostratigraphic age. Oils from both Noto and Sciacca reservoirs yield a 67 Ma isochron, identical to that of shale, within uncertainty.

Lastly, bitumen-filled vugs and fractures in dolomite intercalated with shale yield a well-defined 46 Ma isochron, consistent with the most recent tectonism in the region.

Together, these data define a complete history: **(1)** Late Triassic to Early Jurassic deposition of both source and reservoir rocks, **(2)** maturation and migration of oils at ~65 Ma, and **(3)** a second stage of hydrocarbon generation during ~46 Ma tectonic activity. The internally consistent Re-Os results fit known biostratigraphic constraints and regional tectonic evolution for this productive hydrocarbon system.

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