Sediment Sources and Internal Variability of Miocene Mixed Siliciclastic-Carbonate Systems, East Java, Indonesia

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The East Java Basin (EJB), Java, Indonesia, lies on the southeastern Sunda Shelf directly north of the present-day Java Arc and contains a heterogeneous carbonate-siliciclastic fill with multiple reservoir horizons. The Late Aquitanian-Serravallian interval is examined using an integrated laboratory and subsurface methodology, including analysis of (1) vertical and lateral facies variability; (2) seismically imaged progradational clinoforms; (3) siliciclastic sandstone petrography and (4) U-Pb ages of detrital zircons.

Sediment dispersal patterns were constrained by structural inversion and inherited topography according to subsurface clinoforms whose multiple transport directions ranged from NW-SE to S-N. During deposition of the Tuban Formation, from 22-15 Ma, these clastics interfingered with heterogeneous shallow marine carbonates encompassing mudstones to coralgal and larger benthic foraminiferal grainstones. From 1512 Ma, carbonate production gradually decreased and then disappeared as tidally influenced angular quartz sandstone became dominant in the Ngrayong Formation.

Quartz content of the sand-size fraction ranges from 88-99%, with an average of 91% for both formations. Feldspars (dominantly potassium feldspar) constitute the bulk of the remainder, with micas, lithic grains, and heavy minerals serving as accessories; lithic volcanic grains are noticeably sparse. SEM comparisons of detrital zircons separated from Ngrayong sands identified multiple populations, indicating a diverse provenance. U-Pb dating of detrital zircons with laser-ablation ICP-MS is being used to assess the spectrum of initial source areas and investigate a northern provenance hypothesis. The subarkosic-quartzose sandstone compositions are unexpected considering their proximity to the modern and supposed Early Miocene arc.

Rather than being arc-derived, they suggest a deeply weathered, and apparently distal, low-relief cratonic source. Such extensive mass transport implies that a strong tectonic component overruled arc involvement in EJB reservoir development.