Provenance of Eocene Latrobe Group sandstones in the Tuna field, Gippsland Basin

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Latrobe Group sandstones host the most important hydrocarbon accumulations in Gippsland Basin, although little is known about the provenance of these sandstones. Sediment provenance can exert a significant influence on reservoir quality by controlling the composition of sediments, which in turn impacts on both the mechanical properties and chemical diagenetic processes that decrease, preserve or increase porosity and permeability (Bloch, 1994). Provenance analyses can be effective tools to reconstruct the pre-depositional history of a sediment or sedimentary rock (Pettijohn et al. 1987).

This study focused on reconstructing the provenance of good quality reservoir sands (Eocene Latrobe Group) in the Tuna field using a combination of several analytical techniques. Point count data of thin sections were used to distinguish possible source rocks (Dickinson 1985) and to derive a semi-quantitative weathering index for these sediments (Weltje 1994). The chemical variability of tourmalines was used to discriminate between different source rocks and to obtain more specific information on the petrology of the source rock (Morton 1991) while the chemistry of individual white mica grains is indicative for the degree of metamorphism which affected the source rock (Massonne & Schreyer 1987). Reconstructing the distance, size and tectonic setting of their source region, as well as specific types of source rocks, will help to decrease uncertainties in hydrocarbon exploration in southeast Australia.

The sandstone samples from the LaTrobe Group in the Tuna field are dominated by poorly to moderately well-sorted, fine to medium-grained sandstones. Quartz is the most abundant component within all sandstone samples with absolute abundances ranging from 72 to 95%. Monocrystalline quartz is more abundant than polycrystalline quartz. Feldspar is common and mainly consists of K-feldspar with some samples containing trace amounts of plagioclase. The sandstones contain a wide range of rock fragments including metamorphic, sedimentary and granitic types. The most abundant are metamorphic which consist of quartz–muscovite schist and fine-grained micaceous phyllite. Mica is a minor component in nearly all samples and is dominantly muscovite with only local biotite. Accessory and heavy minerals constitute less than 1% in all samples and are mainly tourmaline, zircon and rutile.

Petrological and geochemical analyses reveal that the Tuna field sandstones are derived from a low to medium metamorphic grade orogen, dominantly consisting of sedimentary strata and a minor contribution of silicic igneous rocks. These rocks are situated in an area of early accretion-subduction that was later subjected to extensive erosion that produced a landscape of low to gentle relief. Based on a regional geologic assessment, the Lachlan Fold Belt in southeast Australia is considered to be the most likely source of these sandstones.

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