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The sources of oil erupted at Lusi, NE Java, Indonesia

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Lusi is a sediment-hosted hydrothermal system located 10 km to the NW of the Arjuno-Welirang volcanic complex, in the NE Java back-arc basin. The eruption has been active since May 2006, bursting boiling mud, water, rock clasts, oil and gas. Whereas the sources of gas and water are studied in detail, the oils have so far not been addressed.
In 2017 we sampled oil films and rock clasts erupted at Lusi and accessed three boreholes (up to 980 m deep in the Pucangan Fm.) from oil and gas fields near Lusi. This part of NE Java is a petroleum province, where shales of the Upper Kalibeng Fm. (Pleistocene) and Ngimbang Fm. (Eocene) are potential hydrocarbon source rocks. Hydrocarbon accumulations are typically confined to the clastic Pucangan Fm. (Pleistocene) and the carbonate reefs of the Kujung Fm. (Oligocene-Miocene).
In order to perform oil – source rock (SR) correlation, a set of organic geochemical methods including Rock Eval pyrolyis on the rocks clasts, GC and GC-MS-MS analyses on oils and bitumen extracts were carried out. The data show that samples of the Upper Kalibeng Fm. are organic lean, suggesting a negligibly small hydrocarbon contribution in this part of the petroleum province. In contrast, the Ngimbang Fm. has a high generation potential and high organic matter content. Alkane distribution in the a) oils from the sampled production fields, b) Lusi oil films, and c) bitumen extracts from Ngimbang SR show a similar unimodal peak distribution with maximum in the higher molecular weight zone. The distribution of C27, C28 and C29 regular steranes indicates that organic matter in all samples has significant contributions from terrestrial sources. Our data indicate the Ngimbang Fm. as the major SR for the sampled oils. However, the relative abundance of regular sterane isomers show that the oil from the Pucangan Fm is more mature compared to that vented at Lusi. This observation suggests that the Lusi oil could either be seeping from the Kujung Fm or from other reservoir intervals within the Pucangan Fm, which have not been produced.