Application of advanced nuclear magnetic resonance (NMR) spectroscopy and ultrahigh resolution mass spectrometry (MS) to studies of organic matter transformations

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The recent introduction of advanced NMR and MS methods has changed the landscape in our ability to discern the changes that natural organic matter (NOM) undergoes during processing in the environment. We can now identify molecular-scale transformations associated with both biotic reactions (biodegradation) and abiotic reactions (photodegradation, oxidation, physical separations, and thermal alteration). The strategy we have adopted for the examination of these various processes is to employ both NMR and MS together because of their complementarity in identifying molecular-level changes. Moreover, we have established ways to examine both dissolved and sedimentary OM in such a manner.

Results of our studies on biodegradation of NOM, in microcosm studies, in following terrestrial organic matter as it is exported to the oceans, have made it possible to identify suites of molecules that are recalcitrant, readily degraded, and newly produced. The MS data allow us to assign elemental formulas to these molecules, and the NMR data allow us to propose structural motifs. Our photochemical studies of DOM show that oxygenated and terrestrially-derived molecules are rapidly consumed while more aliphatic autochthonous molecules remain intact. Studies of sedimentary OM transformations have lead to the discovery of some important abiotic pathways for the reorganization of OM during diagenesis. For example, we have identified amidation reactions as important for N-sequestration in sediments. In the realm of thermal transformations, we can recognize decarboxylation as being part of a dominant process acting on kerogen.

The geochemical variation of volcanic rocks from Papandayan and Cikuray volcanoes, West Java: An existence of Gondwana continental fragment as crustal contaminant

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The Papandayan and the adjacent Cikuray Volcanoes are part of the active volcanoes in the Triangular Volcanic Complex, West Java [1]. Papandayan volcano consists of basaltic andesite (Early Stage), andesite (Middle Stage) and dacite (Late Stage); all of them belong to to medium-K series, with high $^{87}Sr/^{86}Sr$ (0.705243-0.705907) and low $^{143}Nd/^{144}Nd$ (0.512504-0.512650) ratios. In contrast to the Papandayan volcano, the Cikuray volcanic rocks exhibits a low-K series, with low $^{87}Sr/^{86}Sr$ (0.704172-0.704257) and high $^{143}Nd/^{144}Nd$ (0.512823-0.512858) ratios. Detailed petrological and geochemical studies indicate that the diversities in K_2O as well as isotopic ratios are mainly due to the influence of the Gondwana continental fragment (Fig 1a) [2] which is contaminating the Cikuray type magma to produce the Papandayan magma (Fig 1b).

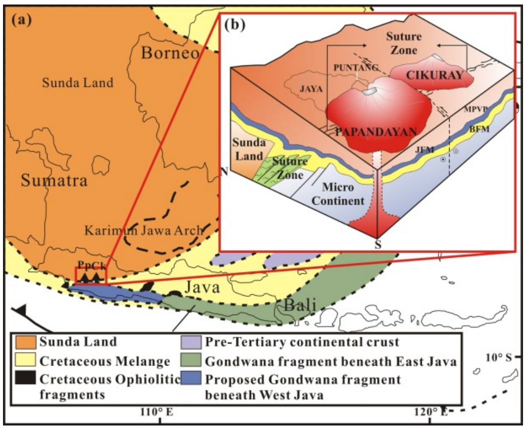

Figure 1: (a) A map showing the proposed Gondwana fragment beneath West Java [2,3,4, this study], (b) A schematic model of Papandayan-Cikuray volcanoes.

[1] Katili & Sudradjat (1984), Volcanological Survey of Indonesia, 102 pp. [2] Smyth *et al.* (2007) *Earth and Planetary Sci. Lett.* **258**, 269-282. [3] Clements & Hall (2007) *IPA31st*. [4] Sribudiyani *et al.* (2003) *IPA29th*.