

SCG064-04

Room:202

Time:May 24 15:00-15:15

Compositions and provenance of the sands in the southern Kumano Basin and the underlying accretionary prism, IODP Exp315

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Compositions of the submarine turbidite sands cored in the Integrated Ocean Drilling Program (IODP) Expedition 315 were examined in terms of bulk and heavy mineral modal proportions, mineral chemistries, and zircon U-Pb age spectrum to identify their provenance. Coring was conducted in the seaward flank of the Kumano forearc basin (Site C0002) and the seaward slope apron of the outer-arc high (Site C0001) at the Kumano-nada, Nankai Trough, Japan. Four lithostratigraphic units were recognised based upon core and log data in the Site C0002. The upper three units (Unit I-III from top to bottom) are the Kumano Basin sediments and the lowest Unit IV is the accretionary prism basement [1]. The Units I (0-136 mbsf) and II (136-830 mbsf) are composed mainly from alternation of non- to semi-consolidated sand and mud, and Unit III (830-922 mbsf) consists of mud. Unit IV (922-1053 m) consists of highly deformed sandstone and mudstone. Total 12 samples were collected from Units I, II and IV. At Site C0001, the upper 207 m (Unit I) is slope basin sediments composed mostly of non- to semi-consolidated mud with intercalation of volcanic ash layers. Sands are localised at the bottom of the unit where three samples were taken. The underlying Unit II (207-458 mbsf) is accretionary prism sediments composed of mudstone.

At Site C0002, sand compositions are quite different between Unit I and the deeper units. On the contrary, sands in Units II and IV are almost identical despite their different geologic settings. Heavy minerals in Units II and IV are dominated by high-pressure/temperature (high-*P/T*) type metamorphic component, which is most obviously demonstrated by the presence of sodic-amphiboles. Their compositions cover a wide range in term of Fe³⁺/Al ratio and Na (M4) content from glaucophane to riebeckite, and to winchite. Garnet compositions are characterised by higher content of grossular component and wider variation of spessartine component than those of Unit I. Zircon U-Pb age spectrum has a cluster around 60-100 Ma. Based on the comparison with sand samples collected from several representative rivers in the Pacific side of the Central Japan, petrologic features of Units II and IV sands favour the Tenryu district as the most probable candidate for the source region. Heavy mineral compositions in Unit I have both igneous and metamorphic components (but no indication of high-*P/T* metamorphic rocks), and zircon U-Pb age spectrum has a major cluster around 10-20 Ma as well as subordinate cluster around 60-100 Ma. The igneous minerals and young zircons are considered to be derived from the 15 Ma Kumano acidic rocks distributed widely in the south-eastern Kii Peninsula. Hence, the petrological features of Unit I are interpreted as a mixture of two components from the Kumano and the Tenryu districts. Change in sand compositions between Units I and II indicates a drastic change of seafloor channel at around 1 Ma. Sediments of the Tenryu River origin in the deeper part of the Kumano Basin and the underlying accretionary prism suggest that the Tenryu Canyon was the main sediment conduit to the Kumano Basin before 1 Ma, which was blocked around 1 Ma due to change of seafloor topography and the Kumano River became a main contributor of the sediments to the Kumano Basin instead.

Samples of Site C0001 are all rich in ferro-magnesian minerals, particularly orthopyroxene, which is totally different from Site C0002. Their petrologic characters are closer to those of the toe region [2], which are probably derived from the Izu-Honshu collision zone.

References:

[1] Expedition 315 Scientists (2009), Expedition 315 Site C0002. *In*: Kinoshita, M. et al. (eds.), Proc. IODP, 314/315/316.

[2] Expedition 316 Scientists (2009), Expedition 316 Site C0007. *In*: Kinoshita, M. et al.(eds.), Proc. IODP, 314/315/316.

Keywords: sand provenance, forearc basin, Nankai Trough, sodic amphibole, garnet, zircon U-Pb chronology