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Provenance of Indus Fan turbidites (IODP Expedition 355)

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This study presents high-resolution petrographic and mineralogical data from Indus Fan turbiditic sediments cored in the Laxmi Basin during Expedition 355 (Arabian Sea Monsoon; Pandey et al., 2016). Four stratigraphic intervals were identified in the succession cored at Sites U1456 and U1457. Unit 1 consists of carbonate ooze and clay with intercalated thin-bedded silty-sandy turbidites (lower-middle Pleistocene; 0-121 mbsf). Unit 2 consists of thick-bedded channelized sandy turbidites with intercalated silty overbank deposits and nannofossil-rich clay layers (upper Pliocene/lower Pleistocene; 121-361 mbsf). Unit 3 consists of alternating, semi-indurated to indurated thin-bedded silty-sandy turbidites, carbonate ooze, and clay (upper Miocene to Pliocene; core depth 361-731 mbsf). Unit 4 consists of mass wasting deposits, known as the Nataraja Slide, including mainly carbonate breccia in the lower part, and clay with minor carbonate breccia in the middle-upper part (Miocene; 731-1109 mbsf).
In Unit 1, moderately poor heavy-mineral assemblages consist of augitic clinopyroxene and blue-green amphibole with subordinate epidote, minor titanite, apatite, garnet, and rare hypersthene and Cr-spinel. In Units 2 and 3, rich heavy-mineral assemblages are dominated by blue-green amphibole with subordinate epidote, minor garnet, diopsidic clinopyroxene, apatite, hypersthene, sillimanite, and rare titanite and kyanite. In Unit 4, extremely poor heavy-mineral assemblages range from augite-rich with epidote and hornblende to garnet-apatite-epidote with minor titanite, tourmaline, zircon, chloritoid, amphibole, and Cr-spinel. Turbidite sands in Units 2 and 3 are litho-feldspatho-quartzose, with plagioclase > K-feldspar (P/F 0.65±0.06), and common carbonate (limestone > dolostone), shale/slate, and low-rank to high-rank largely metasedimentary and metafelsite to metabasite rock fragments. Micas are common (biotite » muscovite) and more abundant in overbank turbidite layers. Unit 4 includes breccia with shallow-water limestone clasts set in a packstone matrix with calcareous algae and benthic and planktonic foraminifera. Petrographic and mineralogical composition of Units 2 and 3 compares well with that of modern Indus river and delta sands, indicating provenance from the Himalayan orogen (Garzanti et al., 2005; Clift et al., 2010). Augitic pyroxene, common in Unit 1 and locally in slump deposits of Unit 4, testifies instead to sediment supply from the western Indian passive margin fed by the Tapti and/or Narmada Rivers.

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