

## IODP Proposal Cover Sheet

 New Revised Addendum**595-Full4**

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|--------------------------|--|-------|--------------------------|--------------------------|
|                          | Please check if this is Mission proposal   |       | <input type="checkbox"/> | <input type="checkbox"/> |
| Title:                   | Deep Drilling on the Indus Fan and Murray Ridge: Reconstructing Erosion of Tibet, western Himalaya and the Karakoram from the Detrital Record  |       |                          |                          |
| Proponent(s):            | Peter Clift, Hidekazu Tokuyama, Christoph Gaedicke, Peter Molnar, Dirk Kroon, Youngsook Huh, Rosemary Edwards, Yani Najman, Ali Tabrez, Tim Henstock, Gerome Calves, David Limmer, Youngsook Huh, Asif Inam, Muhammad Tahir, Asif Khan, Iqbal Hajana, Peter Hildebrand, Kip V. Hodges, John Grotzinger, Eduardo Garzanti, Peter Miles, Maureen Raymo, Mike Searle and Ashraf Uddin |       |                          |                          |
| Keywords:<br>(5 or less) | Tectonics, erosion, climate  | Area: | Arabian Sea              |                          |

## Contact Information:

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Permission to post abstract on IODP Web site:  Yes 

Abstract: (400 words or less)

We propose to investigate the erosional record of the Indus Fan since India-Asia collision, and assess its relationship to regional and global climate change. The detrital record in the Indus Fan allows erosion to be quantified in a region where the Neogene paleoceanographic evolution is well documented and linked to monsoonal strength especially at 8.5 Ma, and where the sediment source regions have also been the focus of detailed radiometric thermochronology work. If the links between continental tectonic evolution, oceanographic circulation, continental climate and erosion are to be understood then the history of each of these needs to be reconstructed and correlated to one another. Drilling of the Indus Fan within the context of a regional seismic stratigraphic framework can provide an erosion budget for the Cenozoic. Provenance studies can reveal changes in the sediment source and uplift rate, while clay mineralogy and geochemistry can be used to assess continental weathering regimes. We propose to drill the Indus Fan along its western edge where it is uplifted on the Murray Ridge. In this revised submission we propose a single non-riser drill site that will allow us to sample a reduced but mostly complete Neogene erosion history and critically to sample the Paleogene record which is missing onshore in the foreland. Coring will span periods of change in monsoon strength at 23, 15, 8.5 and ~3 Ma. Changes in erosion rates and weathering style triggered by these events will be determined. Drilling at MU-3A should recover the Eocene, penetrate the fan base, and sample pre-fan sediment and basement. Documenting the Middle Miocene is important to test models proposing an earlier onset to the monsoon. The Lower Miocene-Oligocene will date the onset of Greater Himalayan exhumation. The arrival of material from north of the Indus Suture into the Arabian Sea constrains the controversial age of India-Asia collision. Drilling will date the onset of fan sedimentation in a more proximal location than has previously been possible. Because the rate of India-Asia convergence is known, the age of collision allows us to determine whether the volume of crust added to Asia greatly exceeds that now in the orogen. If the volume added exceeds the present total then lateral extrusion or crustal subduction must be invoked, in addition to horizontal compression, as a mode of orogenic strain accommodation.

Scientific Objectives: (250 words or less)

The objectives of the drilling are to date the initiation of the Indus Fan and to recover a clastic record for the upper Indus Fan from that time to the present day. Application of single grain provenance and thermochronology techniques to the sediment grains recovered will allow the evolving patterns and rates of exhumation to be calculated for the Indus drainage basin during the construction of the Himalaya and Tibet. Studies of clay minerals will constrain evolving weathering regimes over the same period. The drilling will further provide ages for the three dimensional seismic stratigraphic framework being constructed for the Arabian Sea. This will allow accurate estimates of sedimentation rate to be determined for the Indus system, thus permitting the relationships between erosion, tectonics and climate to be tested in detail in the global type area. The erosion record can be directly correlated to the existing records of paleoceanographic evolution from the Oman margin, and to continental weathering records in the foreland using the nannofossil biostratigraphy. Drilling below the level of the Indus Fan will provide paleoceanographic constraints on ocean circulation patterns in a critical area during the Paleocene-Early Eocene, a time of intense oceanographic change.

Please describe below any non-standard measurements technology needed to achieve the proposed scientific objectives.

None

Proposed Sites:

| Site Name | Position  | Water Depth (m) | Penetration (m) |     |       | Brief Site-specific Objectives  |
|-----------|---|-----------------|-----------------|-----|-------|---|
|           |   |                 | Sed             | Bsm | Total |   |
| MU-3A     | Murray Ridge-Indus Fan, 22° 34.9' N, 64° 35.6'E | 2310            | 1860            | 10  | 1870  | Recovery of the Paleogene Indus Fan and pre-Indus sediments, as well as reduced Neogene section |