Direct stratigraphic dating of India-Asia collision onset at the Selandian (middle Paleocene, 59 ± 1 Ma)

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INTRODUCTION

The onset of collision between India and Asia, defined as the moment when Neotethyan oceanic lithosphere was subducted completely at a point along the plate boundary and the two continental margins came into direct contact, terminated a period of very rapid Indo-Asian convergence, and brought about profound consequences on Cenozoic topography, atmospheric circulation, climate, oceanography, and faunal turnover. Defining the age of such major geological event with the best possible accuracy and precision is essential in order to understand its wide paleogeographic consequences and their mutual relationships and feedbacks. However, the range of ages hypothesized by different researchers has remained wide, ranging from as early as the latest Cretaceous (Yi et al., 2010) to as late as the earliest Miocene (van Hinsbergen et al., 2012). Unconformities identified at a lower stratigraphic level within the inner Indian margin succession and interpreted as associated with collision onset were dated around the Paleocene-Eocene boundary both in the northwestern and central Himalaya (Garzanti et al., 1987; Li et al., 2015), thus providing an older minimum age for collision onset. Considering the time required by the flexural wave to propagate across the distal Indian margin, collision must have begun somewhat earlier, a time that needs to be established from the stratigraphic record of the very distal edge of the Indian continental margin. Distal successions recording the continuous transition from continental rise to trench sedimentation, however, are only exceptionally exposed along the suture zone. The most complete of these is the Sangdanlin section of south Tibet, for which initial collision ages ranging from 50 Ma or earlier (Wang et al., 2011) to ca. 60 Ma (DeCelles et al., 2014; Wu et al., 2014) or even ca. 65 Ma (Ding et al., 2005) were suggested, based principally on detrital zircon geochronology. Here we accurately revise the radiolarian biostratigraphy, calibrated with a new firm nanofossil datum, and provide new detrital zircon U-Pb ages from the crucial interval documenting the sharp provenance change from Indian-derived to Asian-derived detritus. The onset of the India-Asia collision could thus be dated directly with improved accuracy and precision.

STRATIGRAPHY OF THE SANGDANLIN SECTION

The Sangdanlin section (29°15’28”N, 85°14’52”E; Fig. 1; Fig. DR1 in the GSA Data Repository1) includes three formations. Sili-

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1GSA Data Repository item 2015289, analytical techniques; calcareous nannofossils; radiolarian taxonomic notes; Figure DR1 (geological maps); Figure DR2 (radiolarians microphotographs); Figure DR3 (calcareous nannofossils microphotographs); Figure DR4 (detrital zircon concordia plots and standard weighted mean plot); Tables DR1 and DR2 (radiolarians); Table DR3 (summary of youngest U-Pb detrital zircon ages); and Table DR4 (detrital zircons U-Pb ages), is available online at www.geosociety.org/pubs/il2015.htm, or on request from editing@geosociety.org or Documents Secretary, GSA, P.O. Box 9140, Boulder, CO 80301, USA.

Figure 1. Simplified geological map of the Himalaya, showing study area and location of Paleogene sections discussed in text. 1—Sangdanlin; 2—Tingri; 3—Cuojiangding; 4—Zanskar.