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The potential record of far-field effects of the India-Asia collision: Barmer Basin, Rajasthan, India

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The timing of the collision of the Indian plate with the Asian plate to create the Himalayas is broadly dated at 55-50 Ma (Davis *et al.,* 2002; Abrajevitch *et al.,* 2005; Ding *et al.,* 2005; Green *et al.,* 2008; Dupont-Nivet *et al.,* 2010; Henderson *et al.,* 2010). However, the extent and duration of deformation caused by the collision remote from the Himalayan mountain belt remains poorly understood. In particular, the nature and extent of foreland uplift and the initial Himalayan fore-bulge is poorly defined (Bera & Mandal, 2013), whilst the extent of Himalayan compression in the greater Indian foreland remains completely undocumented.

The Barmer Basin, Rajasthan, is a long (200 km), narrow (<40 km) and deep (<6 km), north-northwest trending, failed continental rift covering ~6800 km^2 principally situated in Rajasthan, northwest India, 800 km south of the Himalayan front and 400 km from the Kirthar Mountains / Central Bruhui Range of Pakistan. This is one basin where it has been proposed that far-field effects of India-Asia collision are evident (Compton, 2009). The basin forms the northward extension of the Kutch and Cambay basins via the Sanchor and Tharad sub-basins within the West-Indian Rift System and is a major oil and gas producing region. Until recently, the scale, structure and geology of the Barmer Basin were poorly constrained. It is only since subsurface and well data became available over the last decade that the significance of the basin as a rift-related setting but with regional tilting and reactivation of basement structures, potentially the result of the India-Asia collision, has been realised.

Within the Barmer Basin, which has not experienced any compression prior to India-Asia collision, preliminary results from detailed seismic interpretation suggest three phases of compression: (1) Transpressive, top-to-NNW late Palaeocene (58.5-57 Ma) inversion along localised E-W and NNE-SSW-trending faults within the central Barmer Basin; (2) A widespread late Palaeocene to early Eocene (55-<45 Ma) top-to-SSE inversion and development of associated hanging-wall and footwall 'pop-up' structures along NNW-SSE-trending faults, predominantly within the northern Barmer Basin; (3) Late Miocene (12.5 Ma) to Present Day evidence of transpressive strike-slip faulting and sag along NW-SE-trending faults and isolated inversion structures within the southern Barmer Basin. Observations tentatively support proximal India-Asia collision datasets which indicate that India collided with Asia and/or an intra-oceanic arc (Kohistan-Ladakh Arc) prior to 55-50 Ma resulting in localised compression within the Barmer Basin before the widespread main collisional inversion effects are observed from 55-50 Ma to the Present Day.

A major Oligocene unconformity is well documented along the entire length of the Himalayan peripheral foreland basin (e.g., Kohat Plateau; Hazara Syntaxes; Sabathu / Jammu / Kangra sub-basins e.g., DeCelles *et al.,* 1998; Najman *et al.,* 2004). The significance of this unconformity has been contradicted by Bera & Mandal (2013), who suggest a near continuous stratigraphical succession within the Himalayan foreland basin with, if present, an unconformity of <40kyr. Development of this unconformity has previously been suggested as a result of tectonic processes associated with collision and / or a passage of a flexural forebulge (Najman *et al.,* 2004; DeCelles *et al.,* 1998; 2004; Irfan *et al.,* 2005; Bhatia & Bhargava, 2006; Bera *et al.,* 2010). Clift & VanLaningham (2010) suggests a climatic trigger for the development of the Oligocene unconformity. A similar-aged unconformity is identified within the Barmer Basin (Compton, 2009) but is not present in all surrounding basins. Documentation of this unconformity beyond the extent of the foreland basin and Himalayan fore-bulge could require a revision of previous suggestions regarding the cause of the foreland basin unconformity and opens up the possibility of different interpretations to explain the hiatus e.g. perturbations in the mantle such as those potentially caused by slab break off or dynamic topographic variation (Husson *et al.,* 2014).

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