CHAPTER

Holocene climatic record of Ladakh, Trans-Himalaya

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3.1 Introduction

The Trans-Himalaya, with the Indus Suture Zone (ISZ) and the Karakorum Fault (KF) trailing the high mountain ranges (4000–7000 m a.s.l.) is tectonically active (Brown et al., 2003; Phartiyal and Sharma, 2009) as well as falls in the rain shadow region of the Indian summer monsoon (ISM). This region has a typical high-altitude desertic topography with approximately less than 100 mm of annual precipitation (Fig. 3.1). It is characterized by glaciated mountain ranges, valleys occupied by mighty rivers (Indus, Hanle, Zanskar, Shyok, Tangtse, etc.) preserving voluminous sediment of glacial, fluvial, lacustrine and eolian origin and also hosts several massive valley lakes viz., Pangong Tso, Tso Moriri, and Tsokar. These lakes (paleo and glacial) are good archives for studying the paleoclimate of the region. The lake expansion and/or shrinkage here result from changing precipitation and evaporation controlled by the interplay of the westerlies strength and Asian monsoon (Bookhagen et al., 2005; Chen et al., 2008; Long et al., 2010; Hudson and Quade, 2013; Dimri et al., 2016). These lakes have experienced significant changes in water level during the Holocene, that is, inferred mainly from lacustrine sediment records and the chronostratigraphy of lake terraces/paleo-shorelines.

Several lakes were formed during the late Pleistocene, in under different time spans and stretches (Fort et al., 1989; Kotlia et al., 1997; Phartiyal et al., 2005 2013 2015, 2020a, 2020b; Sangode et al.,2013; Nag and Phartiyal, 2015; Clift et al., 2014; and references cited therein). Most of them are formed just after the glacial stages suggesting climate is the major driving force. Apart from these several paleolakes, were formed by a coupled effect of neotectonic and climatic activity along the ISZ (Phartiyal et al., 2005 2013; Phartiyal and Sharma, 2009; Sant et al., 2011; Sangode et al., 2011, 2013; Nag and Phartiyal, 2015; Nag et al., 2016, 2021). Damming of the Indus River by massive landslides (Abbott 1849; Becher, 1859) and catastrophic flooding in higher precipitation regimes (Dortch et al., 2009) and breaching of these landslides generated dams/lakes (Burbank, 1983), suggest that these events are not geologically uncommon in this cold high-altitude desert. Even the Pangong Tso (Bangong Co) extended 40 km eastward along the KF was once draining into the Shyok River (Phartiyal et al., 2015), the Khalsar paleolake existed along the KF (Phartiyal et al., 2005, Phartiyal and Sharma, 2009) and the Khalsi-Saspol paleolake along River Indus (Nag and Phartiyal, 2015; Nag et al., 2016, 2021).

A complete picture of the climatic variation during Holocene is recorded in the paleolake sequences and the glacial lakes of the Indus valley and the northward Ladakh range. We present here multiproxy records of the paleolake sections at Spituk; Khalsi and published glacial lake records from North Pulu (NP) and South Pulu (SP; Phartiyal et al., 2020a, 2020b); Tsoltak and YayaTso (Joshi et al., 2020) of the

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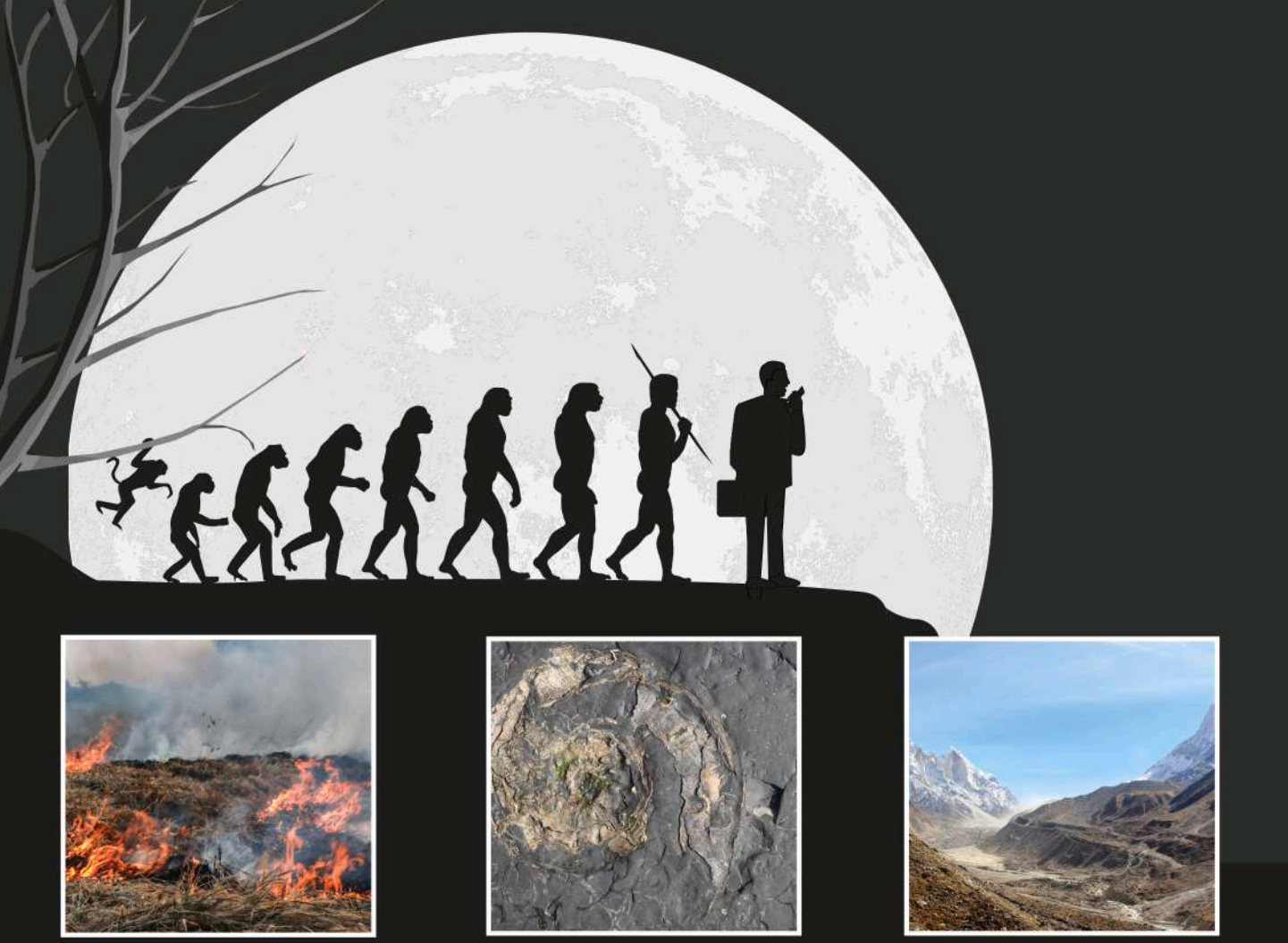

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