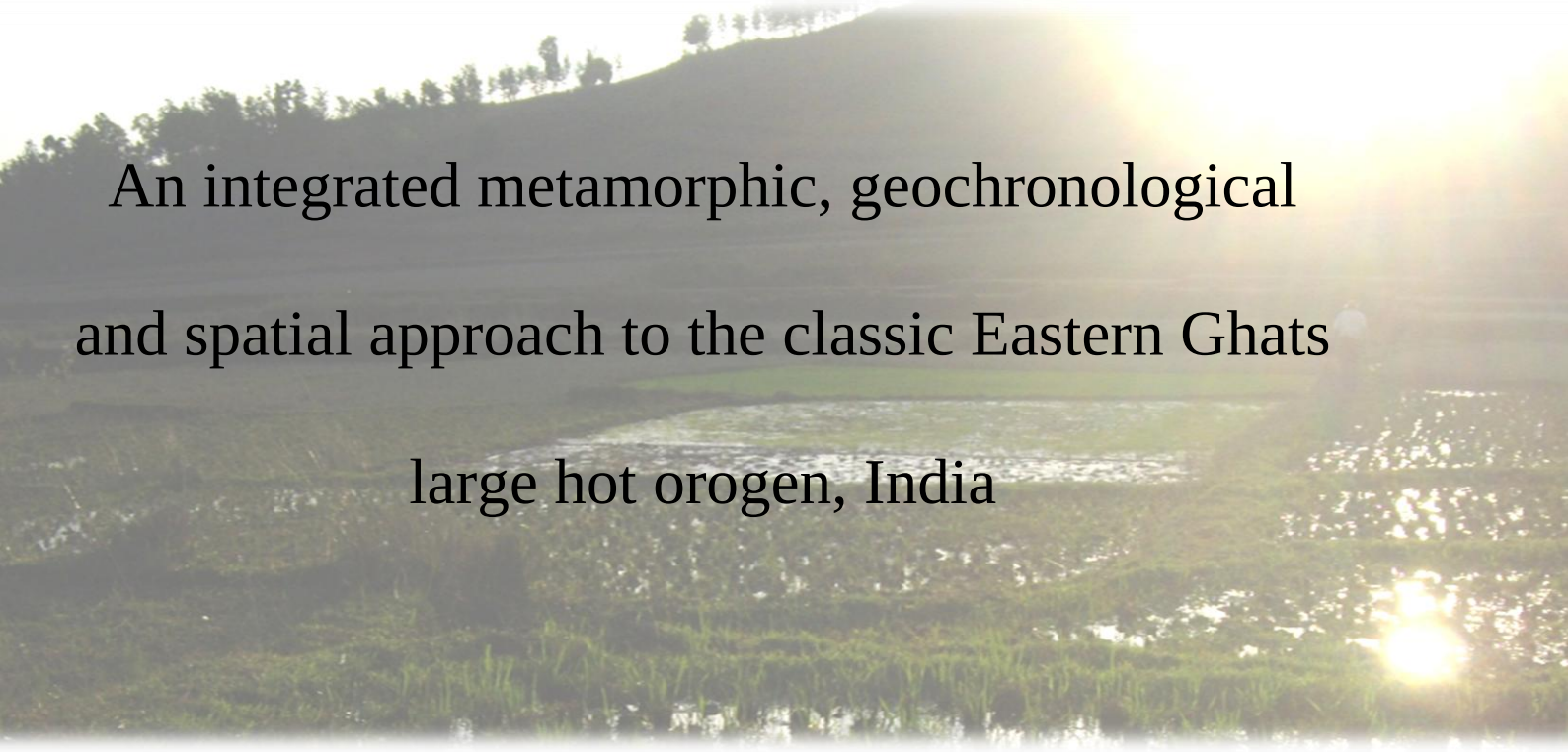

An integrated metamorphic, geochronological and spatial approach to the classic Eastern Ghats large hot orogen, India

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ABSTRACT

The Eastern Ghats granulite terrain experienced one ultrahigh-temperature (UHT) metamorphic event, slow cooling, and a Pan African thermal overprint. The style of metamorphism preserved in the Eastern Ghats depends on its location across the belt, rock type and structural setting. *P-T* pseudosections have been combined with *in situ* U-Pb monazite geochronology to produce *P-T-t* paths from various localities across the high-grade metamorphic belt to clarify the existence of one metamorphic event at *ca.* 975 – 930 Ma The metamorphic episode is characterised by ultrahigh-temperature metamorphism with peak temperatures of 880 – 1050 °C and peak pressures of 8 – 12 kbar followed by either near-isothermal decompression or isobaric cooling, depending on the sample location across the belt.

In situ SHRIMP and LA-ICPMS U-Th-Pb monazite gechronology is used to constrain the contrasting metamorphic evolutions. Detailed analysis of both monazite compositional mapping and textural location of monazite grains within samples reveal that there is a spatial trend in ages to partner the variation in *P-T* paths. At *ca.* 975 Ma, metamorphism is found to be older in the east where samples are confined within a steep, upright fabric that contains structural evidence for two deformational events. In the west of the belt, the foliation is flat, and leucosomes confined sharply between compositional foliations, as in the east. Metamorphism in the west occurred at *ca.* 930 Ma.

To provide inferences about the duration of metamorphis coupled-phase diffusional modelling is applied to various samples across the belt. Results reveal that the Eastern Ghats experienced very slow cooling, with rates of 0.8 – 5 °C/My over potentially as long as 300 million years. The prolonged, extreme thermal conditions experienced by mid- to lower- crustal granulites in the Eastern Ghats leads to a comparison of this metamorphic terrane with the concept of a large hot orogen. The source of heat and tectonic settings of ultrahigh temperature metamorphism still remain contentious; however robust *P-T-t* paths such as those produced in this study are considered a primary component to understand UHT metamorphism and large hot orogens using thermo-mechanical models.