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Evolution of the Indian subcontinent: Introduction

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Peninsular India is a complex collage of crustal blocks and orogenic belts, which preserve the records of almost the entire history of our planet ranging from >4.0 Ga up to the Recent. The timing of growth of the cratonic nuclei and crustal fragments in the Indian Shield, and the associated tectono-magmatic and metamorphic processes provide insights into crustal evolution and recycling, as well as crust–mantle interaction processes. These are also important in understanding the secular changes in tectonic styles of our planet. The crustal fragments in India were incorporated into various supercontinent assemblies and are hence important in the content of supercontinent cycles, as well as life evolution and palaeoenvironment. The rapid northward voyage of the Indian Plate following the final fragmentation of the Gondwana core in Pangea assembly, the nearly one million km^2 of basaltic eruption that built the Deccan Plateau, and the collision that erected the great Himalayan Mountains are also topics of wide interest. The Indian subcontinent is also a classic region to study the role of tectonic control in shaping of the modern topography, the triggers of natural hazards including earthquakes, among various other aspects. In this special issue of *Geological Journal*, we assemble a set of contributions that address the various aspects of the tectonic evolution of the Indian subcontinent from its history in the Early Earth to Recent processes. The first paper by **Mazumder, Chaudhuri**, and **Biswas** (2019—this issue) traces the sedimentation and magmatic history of the eastern Iron Ore Group within the Singhbhum cratonic block of eastern India. The sedimentary succession is characterized by a basal terrestrial to shallow marine deposits that progressively became deeper up section. The basal terrestrial deposits also provide insights on the Palaeoarchaean fluvial systems. **Ganguly, Santosh**, and **Manikyamba** (2019—this issue) present an overview of the geochemical features of the Sargur Group and Dharwar Supergroup greenstone belts of the Dharwar Craton in southern India. The Mesoarchean–Neoarchean komatiites in Dharwar provide evidence for heterogeneous, hydrated Archean upper mantle trapped by ascending mantle plumes. Komatiites from both the Sargur Group and Dharwar Supergroup record a distinct temporal transition and geochemical heterogeneity in the Archean mantle beneath the Dharwar Craton, which the authors attribute to Archean upper mantle hydration by flat slab subduction of >3.3-Ga oceanic crust at shallow level. Vestiges of primordial oceanic crust formed in the deep cratonic mantle roots. In the next contribution, **Han, Santosh, Ganguly**, and **Li** (2019—this issue) present petrological, geochemical, and zircon U–Pb geochronological data on serpentinized dunite, dunite, pyroxenite, and clinopyroxenite from an ultramafic complex along the collisional suture between the Western Dharwar Craton and the Central Dharwar Craton in southern India. Zircon U–Pb data from the ultramafic suite define different age populations, with the oldest ages at 2.9 Ga and the dominant age population showing a range of 2.8–2.6 Ga. The early Palaeoproterozoic (ca. 2.4 Ga) metamorphic age is considered to mark the timing of collision of the two crustal blocks. The geochemical data suggest fluid–rock interaction, melt impregnation, and refertilization processes. The Mesoarchean to Neoarchean ultramafic complex in this study provides important insights into crust–mantle interaction in an Archean suprasubduction zone mantle wedge. **Nandy, Dey**, and **Heilimo** (2019—this issue) investigate Neoarchean magmatism in the eastern Dharwar Craton. Whole-rock major and trace element geochemical data on these rocks are consistent with diverse sources, including both crust and enriched mantle in an evolving subduction zone. A convergent orogenic setting is proposed by the authors with the intrusion of crustally derived, highly silicic, alkali-rich granite, and mantle-derived gabbro in a postsubduction regime. Their study provides significant insights into the mechanism of Neoarchaean crustal growth. In the next paper, **Sindhuja, Khelen**, and **Manikyamba** (2019—this issue) present results from a geochemical study of Archean-Proterozoic shales in the Dharwar Craton. The Archean shales are depleted in transition metals (Ni and Co) but enriched in V, Cr, and Sc relative to the upper continental crust, whereas the Proterozoic shales are depleted in Cr, Co, Ni, Sc, and V, suggesting negligible mafic source during their deposition. The overall geochemical signature indicates granitic and tonalitic provenance for the Archean and Proterozoic shales, which were deposited in an active and passive continental margins. **Rai, Srivastava, Samal**, and **Sai** (2019—this issue) investigate Palaeoproterozoic mafic dyke swarms from the southern margin of the western Dharwar Craton. They identify three geochemically distinct groups of mafic dykes and show that these dykes were emplaced within an intracratonic setting. A comparison of the mafic dykes with those of the eastern Dharwar Craton suggests the possibility of different mafic magmatic events in the WDC and EDC. **Khan, Dongre, Viljoen, Li,** and **Le Roux** (2019—this issue) focus on the petrogenetic history of lamprophyres, which are coeval with kimberlites in the Wajrakarur kimberlite field of the Dharwar Craton, considered to be of Mesoproterozoic age. They suggest that these geochemically contrasting rocks, although coeval, were derived from heterogeneous lithospheric mantle sources, which they link with a thermal anomaly in the underlying convective asthenosphere. The shallower mantle source region of the lamprophyres preserves imprints of plate convergence and subduction associated with the evolution of the Dharwar Craton. In the next paper, **Raghuvanshi** et al. (2019—this issue) explore the relationship between the spatial and temporal association of Mesoproterozoic lamprophyres and kimberlites in the Wajrakarur Kimberlite field in the Eastern Dharwar Craton. From geochemical data, they propose carbonatite metasomatism in the source region of the lamprophyres. The authors envisage an extremely heterogeneous and layered lithospheric mantle beneath the Eastern Dharwar Craton. **Joy** et al. (2019a—this issue) evaluate the depositional history and provenance of the cratonic basins in southern Peninsular India using a geochronological approach. The detrital zircon populations from the clastic rocks of two major basins show distinct age patterns indicating a different source of sediments. They also present new U–Th–Pb and Rb–Sr radiometric ages, which indicate deposition at around 800–900 Ma. Their study unveils a complex and multistage burial and unroofing history of the Archean Dharwar Craton throughout the Proterozoic. **Bhowmik** (2019—this issue) provides an update on the Central Indian Tectonic Zone, which is a critical region that preserves information on the assembly and dispersal of Columbia and Rodinia supercontinents through the growth of the Greater Indian Landmass. Based on a synthesis of petrological and geochronological data, the author traces the three stages of evolution along this zone, from accretionary orogenesis at c. 1.6–1.5-Ga, Middle Proterozoic extension and Himalayan-style continental collision between 1.06 and 0.93 Ga. The Salem mafic–ultramafic Complex occurs within the Southern Granulite Terrane (SGT), India along the trace of a major Neoproterozoic suture zone. **Yellappa, Santosh,** and **Manju** (2019—this issue) present the results from petrological and geochemical studies of this complex. They equate this suite with typical Alaskan-type complex. They also present zircon U–Pb data, which suggest an emplacement age of ca. 819 Ma. **Chakraborty, Ray, Chatterjee, Deb**, and **Das** (2019—this issue) present results from petrology, geochemistry, and zircon-monazite geochronology of S-types granites from the Chotanagpur Granite Gneissic Complex (CGGC) in eastern India. Their geochemical modelling suggests that water undersaturated melting of khondalite was responsible for the formation of the parent magma. The 1.0–0.90-Ga age of high-grade metamorphism and anatexis in the CGGC can be correlated to the Rayner Complex–Eastern Ghats Belt during the assembly of Rodinia. **Kadowaki** et al. (2019—this issue) present petrological and geochronological data from khondalites in the western part of the Trivandrum Block and discuss the pressure–temperature–time (*P*–*T*–*t*) path. Phase equilibria modelling of the khondalite indicates peak *P*–*T* conditions of 920°C–1,030°C and 6.0–7.6 kbar, suggesting ultrahigh-temperature (UHT) metamorphism. Prograde partial melting is dated at 582 Ma, which was followed by peak UHT metamorphism at 555 Ma. Their results suggest a long-lived thermal event possibly related to the input of radiogenic heat. **Manu Prasanth, Hari**, and **Santosh** (2019—this issue) provide an overview of the Deccan large igneous province (DLIP) of Peninsular India, predominantly composed of tholeiitic basalts with a minor amount of alkaline, carbonatite, and silicic rocks. The mineralogical and geochemical data suggest that these rocks were derived from a mantle plume with extensive assimilation of crustal components. They also evaluate the impact of the magmatism on the atmosphere and hydrosphere, as a possible trigger for the mass extinction event at the K–Pg boundary. In the next paper, **Shaji** et al. (2019—this issue) report the discovery of Santonian magmatism associated with the Marion hotspot in southern India. They present petrological, geochemical, and zircon U–Pb data from an alkali gabbro in the Madurai Block. The ca. 85-Ma emplacement age reported in their study is correlated with the final phase of the magmatism during India–Madagascar rifting. **Kapur** and **Khosla** (2019—this issue) evaluate the faunal elements from the Deccan volcano-sedimentary sequences. Constraining the age of the Deccan-volcano sedimentary sequences has a direct bearing on the studies that discuss the origin, evolution of the biota in a palaeobiogeographic framework, and also in the context of changes in the palaeoenvironment and palaeoecology. Their study emphasizes the age, environment of the Deccan-volcano sedimentary sequences, and the origin/affinity of the faunal elements recovered from within these sedimentary deposits. **Saha** et al. (2019—this issue) report geochemical data on the submarine volcanic pumice from the Andaman subduction system. They show that the precursor magmas of these rocks were derived by partial melting of a mantle wedge metasomatized by variable slab–mantle interactions and influx of slab-dehydrated fluids and sediments. They propose that the volcanic pumice from Andaman is geochemically and tectonically analogous to those from the Mariana arc and Okinawa Trough of the Pacific Ocean. **Rajendran** et al. (2019—this issue) assemble evidence from Nepal and India to gain insights on the elusive mid-14th century earthquake in the central Himalaya. Based on multiple pieces of evidence, in combination with new data inputs from two trench locales, suggest the 1344 CE as the last of the medieval sequence of earthquakes. With a rupture length of ~600 km of the central Indian Himalaya and an average slip of 15 m, this earthquake is consistent with moment magnitude of $M_w \geq 8.5$. They also alert that an earthquake of similar size is overdue in this part of the Himalaya, considering the long elapsed time of ≤700 years. In the final contribution to this special issue, **Ramkumar** et al. (2019—this issue) analyse the tectono-morphological evolution of some of the major river basins in Peninsular India with implications on landscape evolution. They identify the inheritance of Mesozoic valley/structures during the Late Jurassic–Early Cretaceous, drainage reversal and initiation of Cenozoic–Recent river basin evolution, intense peneplanation during Miocene–Pliocene, intense incision during Pleistocene, periodic climatic extremes during Early Cenozoic, Palaeocene–Eocene, Oligocene and corresponding pedogenesis, and terrace formation and sedimentation. We also include a discussion on one of the articles to this special issue by **Pillai, George, Ray**, and **Kale** (2019—this issue) on the depositional history of the Purana basins in southern India. In their reply, **Joy** et al. (2019b—this issue) provide a detailed clarification. We thank the authors of all papers to this special issue for their valuable contributions and the referees, who provided insightful comments, which helped in improving the manuscripts. We also express our sincere thanks to Prof. Ian Somerville, Editor-in-Chief, who extended valuable guidance and support throughout the process of assembling and editing this special issue and the colleagues at Wiley for their sincere support.

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