

学位論文要旨

Facies model, Geochronology and Sequence analysis of the Singhora Group of rocks: implications to age and basinal forcings in early history of the Chhattisgarh basin, central India (Singhora 層群の堆積相モデル、地質年代およびシーケンス解析、特に、中央インド Chhattisgarh 堆積盆形成初期における年代論と堆積盆強制力について)

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Study of fossil-less Precambrian sedimentary successions remains a challenge in absence of (a) geophysical back-up, (b) poor chronological constraint, (c) continuous and well-preserved outcrop, and finally (d) dominance of intra and/or epicratonic basin setting for which there is no available present day analogue. Multidisciplinary approach involving (i) systematic process-based facies and paleoenvironmental study supported by high-resolution litholog measurement, identification of key surfaces and tracking of surfaces in space, (ii) bulk geochemistry and/or isotope geochemical study, (iii) geochronology of concordant/discordant lithodemic units has shown potential in overcoming the hindrance to a large extent. The present thesis dwells with such multidisciplinary study on three contiguous Formations i.e., Rehtikhol, Saraipalli and Bhalukona Formations from the Mesoproterozoic Singhora Group of Chhattisgarh Supergroup, central India. The study unravels (i) time of opening of the Chhattisgarh basin; (ii) processes (terrestrial, transitional or marine) operative in the early depositional history of the basin; (iii) variability in depositional milieu in space and time, and (iv) allokinetic and autokinetic forcings, which triggered such variations. A sequence stratigraphic appraisal allowed understanding of relative sea level stands under which different stratigraphic intervals were deposited, which despite being Proterozoic in age is reasonably well constrained in time through geochronological backup.

Facies associations within the Rehtikhol and Saraipalli Formations represent products ranging between continental alluvial fan and distal marine shelf beyond storm wave base stacked in a transgressive motif. Sandstones of Bhalukona Formation overlie the Saraipalli Formation with an unconformity and constituted of products belonging to continental fluvial to wave-influenced delta through wave-dominated shallow marine set up. Application of sequence stratigraphic rationale allowed subdivision of studied interval into two depositional sequences *viz.* Depositional sequence-1 (DS-1) that includes sediments of Rehatikhol and Saraipalli Formations and Depositional sequence-2 (DS-2) constituted of Bhalukona and Chuipalli Formation sediments. Bounded between non-conformity at its base and Type-I intraformational unconformity at the top, the DS-1, made up of Rehatikhol alluvial fan, braid-plain and delta products

followed successively upward by volcanoclastic tuff and storm-influenced shelf sediments of the Saraipalli Formation, preserve record of early transgression in the Singhora Sea. Estimation of paleohydraulic parameters from the Rehatikhhol braid-plain revealed a higher gradient (0.015 to 0.024m/m) character for Mesoproterozoic fluvial systems as compared to their modern analogues. The west-northwestward paleocurrent in the Rehatikhhol fluvial system suggests source area in the east-southeast. A northeast- southwest shoreline trajectory is interpreted for the early Singhora Sea from crest line trends of swash-generated bedforms. High velocity storm return flow was operative on the Saraipalli shelf that incised deep narrow scours on the proximal shelf and made it a 'zone of bypass'. Deposition under storm action was restricted only within then distal part of the shelf.

With forced regression and formation of Type-I unconformity, Bhalukona fluvial system encroached the Saraipalli shelf. From reversal in paleocurrent direction (from WNW to ESW) and abrupt shift in 'Nd' isotope value across the unconformity, a tectonically triggered basin-reversal is inferred. The low-gradient Bhalukona ramp experienced a long distance (~ 15 km) regression. The onset of slow, steady rise in sea level established wave-dominated Bhalukona coast line. Wave reworking of fluvial sediments in the lowstand shoreline resulted development of pebbly ravinement deposit (within the wave base), which correlates with unconformity in landward part. With aggradational stacking the beach-foreshore, upper- and lower-shoreface sediments record lowstand deposition. A basin-scale transgression formed Transgressive Surface of Erosion at the top of the Bhalukona succession and established the Chuipalli shelf.

Two phases of tectono-thermal activities recorded from the studied stratigraphic interval. A 2 to 5 m thick bedded tuff demarcating boundary between the Rehatikhhol and Saraipalli Formations represents the older phase and a discordant diabase intrusive within the Saraipalli Formation represents the younger one. The rhyolitic to dacitic tuff akin to volcanic arc granite yields an age ca. 1500Ma. This ~1500 Ma tectono-thermal event is also identified as the forcing behind basin subsidence and transgression of Saraipalli marine shelf on to the Rehatikhhol braid-plain. On the other hand, the diabase intrusive is compositionally basalt to andesitic basalt with subalkaline basalt affinity and possibly resulted from crustal assimilation/sediment mixing. $\epsilon^{14}\text{Nd}$ values (+0.3-+2.3) indicate depleted isotopic character and calculated T_{DM} age is 1.7-1.9 Ga. The calculated Sm-Nd mineral-whole rock isochron age of 1420 Ma is suggestive of its age of emplacement. It is surmised that the tectonic destabilization that triggered the emplacement of diabase intrusive, is also responsible for the forced regression and generation of Type-I unconformity marked by incursion of Bhalukona fluvial system on the Saraipalli shelf.