TECTONO-STRATIGRAPHIC- SEDIMENTARY EVENTS IN GONDWANA SUCCESSION OF PENINSULAR INDIA

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The Late Paleozoic-Mesozoic Gondwana sediments of Peninsular India are dominantly clastics characterised by glaciogenic rocks at base followed by coal measures and inturn overlain by redbeds at top. Distinct lithofacies assemblages, depositional facies models, paleoslopes and texture and composition of sandstones evidently suggest three successive tectono-stratigraphic-sedimentary events of Early, Main and Late Gondwana facies during Gondwana sedimentation of Peninsular India.

Introduction

The merging of Gondwanaland in Pangea in Late Paleozoic initiated Gondwana sedimentation on southern continents (Veevers, 1988). Basins of different sizes and geometries were developed in different parts of the Gondwanaland supercontinent. In India, the Gondwana sedimentation lasted for about 160 Ma from Late Carboniferous to Early Cretaceous incorporating more than three standard time periods of Permian, Triassic and Jurassic (Geol. Surv. India, 1994). The Gondwana succession has been classified into 'TWO' or 'THREE' subdivisions largely on the basis of biostratigraphy (Sastry et al. 1977, 1979). The long span of Gondwana sedimentation in Peninsular India has not been viewed in light of lithofacies assemblages, dominant paleoslopes and tectono-sedimentary events including the fragmentation of greater India from Gondwanaland which may have significant stratigraphic implications.

Lithofacies Assemblage, Depositional Models and Paleoslopes

Besides minor marine invasion in the basal part (Talchir Formation) of central India and subsequent reports in other parts (Geol. Surv. India, 1994), the Gondwana sedimentation of Peninsular India, by and large, represents continental clastics of glacial and glaciogene sediments at base followed by coal measures and inturn overlain by redbeds at top (Tewari, 1999). Detailed lithofacies studies including field outcrops and subsurface analysis in widely separated Gondwana basins have resulted glacial and fluvio-glacial facies models for Talchir, braided and meandering facies models for succeeding Permian and Triassics, and largely alluvial fans for overlying Late Jurassic/Early Cretaceous sediments (Casshyap and Tewari, 1984; Casshyap et al. 1993; Veevers and Tewari, 1995). However, East Coast Gondwana sediments of Late Jurassic/Early Cretaceous show local variations.

Numerous paleo-ice transport and paleocurrent studies carried out in different Gondwana basins of Peninsular India yielded northerly and northwesterly paleoslopes through space and time, which was less consistent in Talchir and became more consistent and unified during overlying Permian and Triassic sedimentation (Casshyap 1979; Tewari, 1999; Tewari and Veevers, 1993; Veevers and Tewari, 1995). Indeed, the northwesterly paleoslope during Permian-Triassic Gondwana sedimentation has been an inherited feature of Indian peninsula atleast since Middle/Late Proterozoics (Casshyap et al. 1993b). The long lived northwesterly paleoslope was completely reversed during late phase of Gondwana sedimentation in Late Jurassic/Early Cretaceous and resultant sediments superimpose Permian- Triassics with prominant unconformity. The reversal of well established paleoslope is a significant tectonic event and coincides with break-up of greater India from Gondwanaland (Casshyap et al. 1993b; Tewari, 1999). As a consequence pericratonic pull-apart basins developed in Late Jurassic/Early Cretaceous in Central India and along the east coast represented by Late Gondwana sediments. These basins are characteristic of rift-drift successions and largely filled up by alluvial fan facies.

The Talchir sandstones are immature to submature lithic to arkosic wackes, whereas those of overlying Permian-Triassics are submature to mature and more arkosic and lithic arenites than wackes (Tewari, 1998).

Tectono-Stratigraphic Sedimentary Events

The tectonic cause of the origin of intracratonic Gondwana basins is not well documented. By and large, the linear Gondwana basins of Peninsular India superimpose structural trends of the Precambrian. The structural grain of India was formed by Early and Middle Proterozoic mobile

Table 1. Generalised tectono-stratigraphic-sedimentary events of Gondwana succession of Peninsular India

Stratigraphic events	Dominant lithofacies and facies models	Dominant paleoslope
Late Gondwana Facies (Late Jurassic-Early Cretaceous	Largely Alluvial Fan Dominantly conglomerate and coarse to medium sandstone and subordinate red shale	Southerly and southeasterly directed palaeoslope
---------- Unconformity ----------		
Main Gondwana Facies (Early Permian-Late Triassic and Early Jurassic)	Braided and Meandering Streams Fining upward fluvial cycles of conglomerate, coarse to medium sandstone interbedded fine sandstone-shale, shale with or without coal	Northwesterly directed paleoslope through space and time
---------- Gradational contact ----------		
Early Gondwana Facies (Permo-Carboniferous)	Glacial and Fluvio-glacial Tillite, conglomerate, coarse to medium sandstone, varve, shale	Palaeoice tranport was directed towards northwest and northeast, and locally towards east and west
---------- Unconformity ----------		
Late Archaeans / Middle to Late Proterozoics		

belts (Naqvi and Rogers, 1987). The resultant strongly anisotropic basement splitted in Late Paleozoic along the structural grains to provide initial depressions (Veevers and Tewari, 1995). Acharyya (2000) suggested half graben Gondwana basins as the result of extensional tectonics. Dutta (2001) postulated that isostatic readjustment of the lithosphere due to glacial load and subsequent glacial erosion possibly generated initial depressions.

Table I lists the stratigraphic relationships, depositional facies models and paleoslopes of Late Paleozoic - Mesozoic Gondwana sequence of Peninsular India. It has been summarised that Gondwana sedimentation began in Late Carboniferous in northwesterly sloping paleovalleys which were initially filled by glaciogenic sediments followed by braided and meandering alluvium through Permian and Triassic/Early Jurassic. The deposition ceased with break-up of greater India from rest of Gondwanaland in Late Jurassic and Early Cretaceous (Veevers and Tewari, 1995). Many field evidences suggest that initially narrow Gondwana paleovalleys floored by uneven basement during glaciogenic Talchir, were expanded areally and became unified and wider as sedimentation progressed through time (Casshyap, 1979). The present occurrences of Gondwana basins therefore represent remnants of originally much wider master basins.

An integrated account of stratigraphic relationships, lithofacies characters, depositional models and paleoslopes evidently favour three distinct and successive tectono-stratigraphic sedimentary events of Early, Main and Late Gondwana facies.

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