
Stratigraphic Simulation of Late Paleozoic Coal Bearing Cycles in Gondwana Basins of Eastern India using Continuous Time Markov Model

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Abstract

The Early Permian Karharbari and Barakar coal bearing cyclothems of Giridih and Saharjuri Gondwana sub-basins of Peninsular India represent asymmetrical and symmetrical cycles of sandstone, shale and coal. Lithologic composition shows decrease of sandstone at the cost of shale and coal through time from Karharbari to Barakar. The two successions were respectively deposited by braided and moderately sinuous streams which flowed from southeast to northwest.

Application of continuous time Markov chain model suggests that transition probability of lithologic transitions attains 'equilibrium stage' after 19 iterations in Karharbari and 10 in the overlying Barakar Formation. These differences are due to difference in lithologic composition and cyclic orders; asymmetrical cycles in Karharbari abound in coarse grade member, whereas symmetrical in the Barakar exhibits the same amounts of coarse and fine members. Cumulative probabilities of individual lithology of sandstone, shale and coal are used to simulate the Karharbari and the Barakar stratigraphy by random selection. These simulated successions are closely comparable with those of actual stratigraphy from borehole logs.

It is suggested that simulated stratigraphic sections of coal bearing cyclothems can best be used to predict sub-surface stratigraphy and percentage and number of associated coal seams.

Keywords: Stratigraphic simulation, Markov Chain, Early Permian, Gondwana, Cyclothems