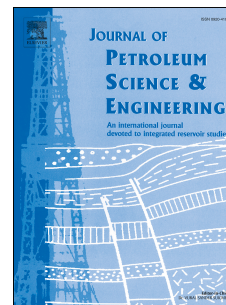


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Wave processes in relation to the tectono-sedimentary of the Tarim Basin: A new method for basin study

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Abstract: This study gives insights into the tectonic and sedimentary evolution of the Tarim basin, the largest petroleum-bearing basin in Western China, by analyzing sedimentary wave process using multi-scale decomposition of the wavelet transform method, and the mathematical defects of sliding-window method in the process of sedimentary wave analysis was discussed. The filtering analysis, in the time domain, was carried out on cores collected from 14 wells in the Tarim basin. The results show that the evolution of the Tarim basin was controlled by various wave processes. The periods of $212\pm$ Ma, $102\pm$ Ma and $33\pm$ Ma indicated a strong sedimentary rhythm, which displayed a spatial and temporal evolution of wave characteristics. The $33\pm$ Ma period represented a third-order sequence of the stratigraphic division, which identified with the unconformities of the Tarim basin; $102\pm$ Ma period corresponded to an important period of sedimentation and the plate collision around the Tarim basin, which marked a second-order period of the basin evolution. The centers of subsidence showed periodic shifts since the Cambrian, and the time for periodic migration (completing a circle) of the depocenters or the centers of subsidence is traced as $212\pm$ Ma, which corresponded to the first-order period of the basin evolution. The coupling relationships between the wave processes and the evolution and distribution of source, reservoir and cap rocks in the basin were given by three kinds of patterns, which were important in predicting the space-time distribution of source, reservoir and cap rocks. This study gives a new insight on predicting the formation and distribution of petroleum, which could be used for selecting petroleum exploration targets effectively.

Keywords: Geological rhythm; Wavelet transform; Wave analysis; Tectonic-sedimentation evolution; Tarim Basin

1 Introduction

Readily discoverable oil fields are going depleted gradually. As a result, it is urgent to study the existing petroliferous basin in detail to establish models that can be used to facilitate the selection of petroleum exploration targets. The information about crustal movement, eustatic sea level changes, sediment availability and provenances could be recorded during basin sedimentary process (Mitchum and Wagoner, 1991; Vail et al., 1991; 1997; Posamentier, 1992; Christie-Blick and Driscoll, 1995). Some geological events and phenomenon occurred in conspicuous periodicity, rhythm and cycle during the geological history, which could be studied to explain the geodynamic process (Zhang, 1983; Hirose and Lonngren, 1985). The cyclic sedimentation phenomena have been recognized in basins by various researchers (e.g. Vail et al., 1991; Decelles and Decelles,

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