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Modeling Formation Process of Jura-Type Folds in Eastern Sichuan: New Experimental Models

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Abstract: Jura-type folds are well-developed in the Eastern Sichuan fold-thrust belt, which is separated into two areas with different structural styles by the northeast-trending Qiyueshan fault, ejective folds to the northwest and trough-like folds to the southeast. The tectonic deformation of the Mesozoic intra-continental structural belt is progressive from southeast to northwest in the period from ~165 Ma to ~75 Ma and controlled by multiple detachment layers which are the basement decollement horizon, lower-Cambrian shale, Silurian shale and Triassic mudstone, respectively. In this study, the formation process and main controlling factors of the Jura-type folds were addressed based on in-depth geological analysis and corresponding structural physical simulation and discrete element numerical simulation. The result shows that the pre-existing Huayingshan fault (~40º) and Qiyueshan fault (~45º) play a crucial role in the development of Jura-type folds. The basement decollement horizon (deeper detachment layer at a depth of ~14km) result in trough-like folds, while the Silurian shale (shallower detachment layer) lead to ejective folds. The lower-Cambrian shale is the most important tectonic dividing layer, which separates the shallow complex fold-thrust deformation and the deep weak deformation. The shortening rate caused by tectonic extrusion in the eastern Sichuan has been 25%-30% since the Jurassic. The Qiyueshan anticline is a fault-related fold controlled by multi-period tectonics and the Fangdoushan anticline is formed by the gradual westward thrusting of the early Qiyueshan fault fold. The inclination and space of Qiyueshan fault and Huayingshan fault are the main controlling factors determining the tectonic deformation characteristics.

Key words: Jura-type folds; Eastern Sichuan fold belt; formation mechanism; structural physical simulation; discrete element numerical simulation