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Anomalous subsidence history of the West Siberian Basin as an indicator for episodes of mantle induced dynamic topography

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Vertical intraplate motions are not easily related to plate tectonics. Understanding their underlying mechanism is further complicated by poor constraints on the magnitude and timing of these motions. Western Siberia is a prominent intraplate area affected by vertical tectonics. Shortly after the assemblage of Pangaea, the region experienced substantial uplift followed by a long period of subsidence that led to formation of the world's largest sedimentary basin–the West Siberian Basin. Its sedimentary cover has been extensively explored and described in the Soviet literature. Here we digitise compilations of stratigraphic data to calculate the basin's subsidence history by backstripping analysis. Our results confirm the prolonged and high amplitude regional subsidence that has been noted before and constitutes the basin's first-order vertical motion. However, our backstripping results also reveal a secondary mode of shorter spatial and temporal scales induced by the migration of the maximum subsidence across the basin. Importantly, the generally slow subsidence of the basin was interrupted by uplift events in the early and late Cretaceous and in the Middle Oligocene. While the secondary mode of vertical motion is not easily understood in terms of traditional subsidence models restricted to lithospheric cooling after stretching, it is consistent with rapid uplift events that have been reported for other locations, such as elevated passive continental margins. We discuss the geodynamic implications and conclude that the basin may hold important constraints on dynamic topography induced by sublithospheric mantle flow processes.