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Plate tectonics is based on the assumption that the plates have behaved rigidly for long periods of geological time. While plate rigidity has allowed the kinematics of the major plates to be described and plate motion models to be constructed, we still lack a full understanding of the physical properties of the plates, their long-term strength and how they respond to geological load shifts on their surface and convective tractions on their base. Evgenii Burov (1963-2015) was a pioneer in the application of geological observations such as plate flexure to better understand the structure, rheology and stress state of continental lithosphere. By comparing observations in compressional and extensional settings to multi-layered models that incorporated realistic rheologies based on data from experimental rock mechanics he showed that the response of the lithosphere varied with thermal and load age. We review here some of Evgenii's contributions to plate mechanics and mantle dynamics and the enduring impact that his studies have had on our understanding of lithosphere behavior on short and long time-scales and the link between surface crust and deep mantle processes.