Continental Crustal Growth and Consolidation of Crust in Accretionary and Collisional Orogens: Trans-Euroasian Paleozoic System

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Both accretionary and collisional orogenic systems contribute to the growth of continents by contrasting mechanisms: Accretionary orogens are characterized by long-lasting additions of oceanic crustal fragments and scrapped ocean floor stratigraphy to the continental nuclei. In contrast, the collisional orogens result from closure of small oceanic basins and amalgamation of continental blocks. Magmatism and metamorphism related to ongoing oceanic and continental subduction are key processes forming lower crust by recycling of both old continental and freshly accreted juvenile crust. Thus, understanding mechanisms of vertical differentiation and lateral homogenization of accreted and collided blocks is a first order challenge of modern geodynamics. To fill the gap we compare geophysical and geological data from the Palaeozoic European Variscan and the Central Asian Orogenic belts, which contributed significantly to the final construction of the Pangea supercontinent. We show that in both cases the key process of continent construction is rélamination of orogenic lower crust derived from deeply subducted lower plate in the case of collisional Variscan belt. In contrast, in the accretionary Central Asian Orogenic Belt, it is the buried and re-molten arc and accretionary prism material, which are redistributed beneath upper plate crust. Both mechanisms are responsible for blurring of geophysical signal of originally accreted/amalgamated blocks by redistributing homogeneous layer of intermediate to felsic lower crust beneath heterogeneous upper crust. This anomalous lower crust is subsequently exhumed in form of giant granulite-migmatite domes which is the main structural feature of both types of orogenic systems. We discuss the contribution of these processes to the building of mature continental crust and continental growth in general.