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Shear zones of the Verkhoyansk fold-and-thrust belt, Northeast Russia

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The Verkhoyansk fold-and-thrust belt is situated on the submerged eastern margin of the North Asian craton, and is largely composed of the Ediacaran - Middle Paleozoic carbonate and the Upper Paleozoic–Mesozoic terrigenous rocks. The Upper Carboniferous – Jurassic sediments constitute the Verkhoyansk terrigenous complex containing economically viable orogenic gold deposits. The structure of the belt is mainly controlled by thrusts and associated diagonal strike slips. Linear concentric folds are common all over the area of the belt. Shear zones with associated similar folds are confined to long narrow areas. Shear zones were formed during the early stages of the Oxfordian-Kimmeridgian collisional and accretionary events prior to the emplacement of large orogenic granitoid plutons. The main ore-controlling structures are shear zones associated with slaty cleavage, shear folds, mullion- and boudinage-structures, and transposition features. The shear zones are listric-type, and represent branches of a detachment structure, which is assumed to be present at the base of the Verkhoyansk fold-and-thrust belt. A vertical zonation of shear zones is correlated with the distance to the detachment. Changes in the dip angle of the shear zones (as indicated mainly by cleavage), structural paragenesis, the degree of microdeformation of the host rocks, and the type of ore-controlling structures can be clearly observed in the direction away from the detachment. Structural zoning is evidenced, among other things, by changing morphologic types of microstructures and by strain-indicators of the degree of rock metamorphism. Four morphologic types of microstructures are identified. The first platy-shear type is characterized by aggregate cleavage and the coefficient of deformation (Cd) of single grains from 1.0 to 2.0. Irregular angular fragments of variously oriented grains can be observed in thin sections. The second shear-cataclastic morphologic type (Cd from 2.0 to 3.0) exhibits combined aggregate and intergranular cleavage. The third cataclastic-segregation morphologic type (Cd from 3.0 to 4.5) is distinguished by a wide distribution of lentelliptical grains of rock-forming minerals in a finely-crystalline matrix and by intergranular cleavage. The rocks of the fourth segregation-striate morphologic type (Cd >5.0) contain lenticular segregations of quartz and feldspar in an intensely linearized mylonite groundmass.