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The Baklia Fault Zone – a regional strike-slip zone splitting Prins Karls Foreland (Svalbard)

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Prins Karls Foreland (PKF) is a westernmost island of Svalbard Archipelago belonging to the Southwestern Basement Province. The island consists of low-metamorphic facies probably Neoproterozoic metasediments, divided into two, northern and southern parts. Both parts are characterized by similar geological structures but different stratigraphy. New discoveries presented here result from joint, Norwegian Polar Institute and AGH UST Krakow expeditions in 2013 and 2014. Thorough characteristics of the location and character of a strike-slip fault splitting PKF (the Baklia Fault Zone) is presented here for the first time.

To date, one succession has been distinguished in the lithostratigraphy of PKF's basement. The northern part of the island consists of two groups: the Scotiafjellet Group and Grampianfjella Group (Dallmann et al. 2015). They comprise low-metamorphic metasediments (chlorite zone of greenschist facies), mostly slates, metapsamites and carbonates. Stratigraphic units of the southern part represent slightly higher, biotite metamorphic zone, and have been considered to be conformably underlying Scotiafjellet Group. The uppermost Peachflya Group and Geikiebreen Group (mostly phyllites with metavolcanics and carbonates) are in thrust contact with underlying Ferrierpiggen Group, comprising schistose diamictites. The Ferrierpiggen Group is a tectonic unit stratigraphically discontinuous at top and bottom. Isolated klippe of the Ferrierpiggen Group separated from Scotiafjellet Group by tectonic boundary is present in the northern part of PKF (Harland et al. 1979, 1993).

These complexes have undergone the Caledonian metamorphism followed by D_1 deformation producing SE directed folding and thrusts. D_2 deformation was coaxial, but not coplanar with D_1. D_2 deformation occurred probably in Mid-Cenozoic and resulted in refolding and thrusting, followed by formation of a dextral shear zone along Scotiadalen (Morris 1989). D_3 deformation is connected with transtensional formation of the Forlandsundet Graben along NNW-SSE faults finishing the West Spitsbergen Orogeny (WSO) (Manby 1986).

Distinct difference in the stratigraphy of southern and northern parts of PKF is apparent. The presence of the fault dividing the island was indicated before (Hjelle et al. 1979), but no single fault has been recognized during detailed mapping later on (Harland et al. 1979, Morris 1982, Manby 1986, Morris 1989).

Mapping and structural measurements conducted by the authors in the area of Selvågen led to the discovery of the major fault zone (the Baklia Fault Zone – BFZ) dividing PKF into two terrains. The BKF have N-S trend from Haukebukta in the west coast, through the slopes of Alasdairhornet (where it trapped few hundred meters long slab of the Ferrierpiggen Group rocks), to the southern Scotiadalen. Approaching Selvågen, the fault zone bends slightly to the NNE-SSW. The zone is filled with breccias and mixture of different lithologies with slabs of rocks derived from both limbs of the fault zone. The width of the zone measures approximately 100–250 meters. To the east, it is accompanied by at least three narrow subparallel faults. The age of the BFZ is

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unknown. A brittle character of deformation may suggest that it is Cenozoic in age. En échelon normal faults with a drop to the north, which associate BFZ may be considered as a Riedel shears R_1 formed at the beginning of a strike-slip movement. Structural measurements on slickensides as kinematic indicators revealed that normal faulting was associated with both, dextral and sinistral shear (not simultaneous). A main movement connected with dextral shearing occurred probably earlier, during late stages of the early Cenozoic crustal shortening. The extended width of the fault zone and the presence of a mixture of rock material from both terranes suggest the significant lateral displacement that might reach tens of kilometers. The BFZ cuts through the boundary faults of the Forlandsundet Graben displacing them sinistrally by approximately one kilometer. This suggests that sinistral movement was probably associated with rejuvenation of the fault during late stages or after the Forlandsundet Graben formation.

There are several regional implications of BFZ. The stratigraphic relationship of southern and northern terranes is unclear. The presence of BFZ at the boundary of the Scotiafjellet and Peachflya groups does not exclude their stratigraphic succession but makes it impossible to define. The field observations suggest that BFZ may be Cenozoic in age. It has similar tectonic style and orientation to other strike-slip zones present along western Svalbard coast. Strong tectonic deformation suggests displacement of the northern terrain of PKF by tens of kilometers. Even though southern terrain can be directly correlated with Oscar II Land, more research is needed to correlate more exotic northern terrain of PKF with the basement rocks in the southern parts of Spitsbergen. Ongoing research towards dating and detail structural characterization of this regional fault zone will allow for reconstruction of pre-Tertiary position of this part of Archipelago.

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