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The Main Shear Zone in Sør Rondane: A key feature for reconstructing the geodynamic evolution of East Antarctica

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Structural investigations were carried out along the Main Shear Zone (MSZ) of western Sør Rondane (22°–25°E, 71.5°–72.5°S) to gain new information about the position of the East-/West-Gondwana suture and the ancient plate tectonic configuration during Gondwana amalgamation.
The WSW-ENE striking MSZ divides south-western Sør Rondane in a northern amphibolite-facies terrane and a southern tonalite–trondhjemite–granodiorite (TTG) terrane. The structure can be traced over a distance of ca. 100 km and reaches several hundred meters in width. It is characterized by a right-lateral sense of movement and marked by a transpressional and also transtensional regime.
Ductilely deformed granitoids (ca. 560 Ma: SHRIMP U-Pb of zircon) and ductile – brittle structures, which evolved in a transitional ductile to brittle regime in an undeformed syenite (ca. 499–459 Ma, Ar-Ar mica), provide a late Proterozoic/ early Paleozoic time limit for the activity of the shear zone (Shiraishi et al., 2008; Shiraishi et al., 1997).
Documentation of ductile and brittle deformation allows reconstructing up to eight deformation stages. Cross-cutting relationships of structural features mapped in the field complemented by published kinematic data reveal the following relative age succession: [i] Dn+1 - formation of the main foliation during peak metamorphism, [ii] Dn+2 - isoclinal, intrafolial folding of the main foliation, mostly foliation-parallel mylonitic shear zones (1-2 meter thick), [iii] Dn+3 - formation of tight to closed folds, [iv] Dn+4 - formation of relatively upright, large-scale open folds, [v] Dn+5 - granitoid intrusion (e.g. Vengen granite), [vi] Dn+6 - dextral shearing between amphibolite and TTG terranes, formation of the MSZ, [vii] Dn+7 - intrusion of late- to post-tectonic granitoids, first stage of brittle deformation (late shearing along MSZ), intrusion of post-kinematic mafic dykes, [viii] Dn+8 - second stage of brittle deformation including formation of conjugate fault systems. The latter point to a WNW-ESE respectively NW-SE oriented maximum paleostress direction and indicate the latest deformation event; they are possibly related to the break-up and fragmentation of Gondwana.
Two contrasting models describe the configuration of East Gondwana during the Neoproterozoic and the final amalgamation of Gondwana. The first model proposes the existence of a Pan-African Orogen (East African/ Antarctic Orogen). The Main Shear Zone could represent the eastern extension of this orogen and may be related to a NE-directed lateral-escape tectonic model. Both published structural data from Sør Rondane and adjacent regions and the outcome of this study agree with this model and propose a suture of East- and West Gondwana located between Mühlig-Hofmann-Gebirge and Sør Rondane.
The second model of an overlap of two orogens with different formation ages cannot be proved by structural data from the MSZ. Instead, tight test constraints of the second model may be provided by new magnetic anomaly maps based on a 2012/13 aerogeophysical survey.

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