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Neoproterozoic Structural Evolution of the NE-trending 620-540 Ma Ad-Damm Shear Zone, Arabian Shield, Saudi Arabia

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Ad-Damm Shear Zone (ASZ) is a NE-trending fault zone separating Jeddah and Asir tectonostratigraphic terranes in the Neoproterozoic juvenile Arabian Shield. ASZ extends ∼380 km, with an average width ∼2-3 km, from the eye-catching Ruwah Fault Zone in the eastern shield to the Red Sea Coastal plain. It was believed to be one of the conjugate shears of the NW- to NNW- trending sinistral Najd Shear System based on noteworthy dextral shear criteria recorded within the 620 Ma sheared granites of Numan Complex, as well as right-lateral offsets within quartz veins and dikes transected by the shear zone. The present study is an integrated field-based structural analysis and remote sensing. We utilized the ASTER data for lithologic discrimination and automatic structural lineament extraction and analysis of the Neoproterozoic basement lithologies encountered along and within the vicinity of ASZ. Various false color composite images were generated and evaluated for lithological mapping and structural lineaments. The obtained map was analyzed using GIS techniques to interpret the behavior of the existing lineaments and their spatial distribution. Based on the results of the ASTER data, two significant areas; around Bir Ad-Damm and to the south of Wadi Numan, are selected for detailed field investigation. Shear-sense indicators and overprinting relations clearly show a complicated Neoproterozoic history of ASZ, involving at least three deformations: (1) an early attenuated NE-SW sinistral shearing; followed by (2) a SE-directed thrusting phase resulted in the formation SE-verging thrusts and associated thrust-related folds; and (3) late NE-SW intensive dextral transcurrent shearing played a significant role in the creation of mesoscopic shear-zone related folds, particularly in the area near Bir Ad-Damm. Such deformation history demonstrates the same episode of Neoproterozoic deformation exhibited in the NE-trending shear zones in the Arabian-Nubian Shield (ANS).