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Editorial

Neotectonics in the Eastern and Northern Cape Provinces of South Africa, Implications for Environmental Related Issues

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Editorial

Our current research is based on the understanding of neotectonics activity in the Eastern and Northern Cape Provinces in particular, and some areas of the country of South Africa in general. The interest in neotectonics in these two provinces is linked to the exploration of groundwater in the fractured Karoo aquifers and to the location of suitable areas to store nuclear wastes. One of the aims of our research was to identify and characterize neotectonic zones in the Eastern Cape Province of South Africa. Three neotectonic zones were identified and characterized on the basis of literature review, remote sensing and field observations. The first neotectonics zone in the Eastern Cape Province is located in the southern part of the Province. This southern neotectonic zone is characterized by the Kango Baviaanskloof fault and Sauer fault that were reactivated during the Quaternary. Other neotectonics markers include abrupt change of the Sunday River, large slumps on the continental margin of South Africa, and neotectonic faults and joints in Quaternary kaolin deposits of the Grahamstown area.

The eastern neotectonics belt of the Eastern Cape Province is mostly dominated by the Amatole-Swaziland (formerly Ciskei-Swaziland) axis of uplift that almost strikes parallel to the east coast along the Indian Ocean. This uplift caused most of the rivers in the province to flow towards the Indian Ocean; it was accompanied by the occurrence of spas and springs, and has possibly generated some fractures in the Karoo aquifers. One of the prominent fractures believed to have formed during the uplift is the Fort Beaufort Fracture oriented in northwest-southeast direction; besides, evidence of the uplift was inferred by the occurrence of river incision near the town of Fort Beaufort.

The incised river has alluviums that were sectioned vertically. These alluviums overlay a dolerite sill. One might think that the incision of the river evidenced by a flat vertical wall of the alluviums was caused by the intrusion of the dolerite. This supposition was found not be coherent because of time discrepancies. The intrusion of dolerite could not cause the incision of the river because dolerites dykes and sills that intruded the Karoo rocks are of Jurassic on the one hand, and alluviums along the said river are very soft and thus very young of age, definitely of Quaternary. The river incision could only be related to the Amatole-Swaziland uplift that occurred during the Quaternary. This uplift has also made the Mbashe River to have more sinuous and asymmetric meanders. The Fort Beaufort Fracture can be further investigated for groundwater exploration. Besides, it is not easy to drill productive boreholes in the Karoo sedimentary rocks. The springs and spas that accompanied the Amatole-Swaziland uplift could be hosted along neotectonic faults, these faults can also be targeted for groundwater exploration. Neotectonics can reactivate old joints and faults, and create new ones. The northern neotectonic belt of the Eastern Cape Province is characterized by a big seismic belt (Senqu seismotectonic belt or Kokstad-Koffiefontein belt) that strikes east-west. This seismotectonic belt hosts seven hot springs.

Hot springs are indicative of the circulation of groundwater at great depths. As neotectonics is strongly related to earthquake geology, one can surmise that the true neotectonic zone of the Eastern Cape Province should be the one hosted within the Senqu seismotectonic belt. A forth belt in the Eastern Cape Province is located in the central part, this belt is inactive with no record of seismic activity. This forth belt should be, on the environmental point of view, ideal for the storage of nuclear wastes. Such inactive belt with an undisturbed crust cannot have faults or fractures along which the water carrying nuclear wastes would percolate and contaminate the groundwater.

Another remarkable finding includes the seismicity and neotectonics investigated around the Augrabies Falls in the Northen Cape Province. The Augrabies Falls are hosted in the Proterozoic metamorphic gneiss, and water from the falls flows along a fault that was generated by the Griqualand-Transvaal surface uplift. In the Augrabies Falls potholes were found at approximately 617 meters above sea level in a place where there is no flow of water. Potholes are formed in a river when the water encounters a protuberance and whirls around it until it starts digging the river bed to form a depression. All the potholes seen in the Augrabies Falls today are on a dry surface, this again is a concrete evidence of the Griqualand-Transvaal uplift that occurred during the Quaternary. Another fact to be reckoned with regarding the evidence of the surface uplift is the occurrence of the fault in the gneissic rocks. Gneisses are metamorphic rocks that are much indurated; the occurrence of a wide opening of approximately 10 meters separating the two surfaces of the fault can only be explained by the surface uplift. The region of the Augrabies Falls is also characterized by the recurrence of seismic activity and cannot be considered for the storage of nuclear waste because of crustal instability. More needs to be done in order to elucidate the cause of neotectonics activity in South Africa.

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