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The volcanology of the White Mfolozi inlier of the c. 3.0 Ga Pongola Supergroup, South Africa: an example of repeated transgressive shallow water to subaerial volcanism on a stable continental margin

A.H. Wilson

School of Geosciences, University of the Witwatersrand, Johannesburg, South Africa
allan.wilson@wits.ac.za

The White Mfolozi inlier in KwaZulu-Natal, South Africa, is one of the best-preserved mid-Archean supracrustal sequences in the world. The 1000 m thick sequence has almost continuous exposure along 10 km of the White Mfolozi River gorge. Two volcanic sequences, the lower Nhlebela Formation (120 – 150 m thick), and the upper Agatha Formation (150 – 180 m thick) are interlain with units of clastic and chemical sediments. The strata dips gently to the east at 8 - 30˚ and are essentially undeformed.

Both volcanic sequences exhibit beautifully preserved lavas which indicate a transition from shallow water subaqueous to subaerial environments. The andesitic lavas of the lower Nhlebela Formation erupted as pillows, sheet flows and hydroclastic breccias. Flow lobes are perfectly preserved and chills are surrounded by hyaloclastite breccias. The upper basalt – basaltic andesite Agatha Formation commenced with the development of a Mg-hydroclastic tuff and is overlain by aa lava and well preserved pahoehoe lava flows. Features include beautifully preserved ropy lava surfaces, jointed crusts, tumuli, a wide variety of vesicle types, interacting lava lobes and toes, and lava breakouts. These provide evidence for the inflation mechanism of subaerial lava emplacement as is known in recent volcanic fields. The compositions of the lavas strongly influenced the style of the pahoehoe lava and the vesicle development. The various styles of volcanism that are observed can be related to both the environment of deposition and the compositions of the lavas.