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In situ formation of greenstone belts on weak continental crust with reference to the Belingwe greenstone belt, Zimbabwe

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Archaean greenstone belts may form as a consequence of loading of weak continental crust by dense lavas. Initially a volcanic edifice grows, but as it builds the load causes the edifice to spread and the basement to subside. If the base of the lava pile denser is than the compensating layer in the crust, subsidence becomes unstable. Unstable subsidence can be represented by a model in which the top of the basement acts initially as a membrane and later by viscous flow. This model gives a sense of shear that is downward in the centre of the basin rather than unidirectional as would be the case if the greenstone succession had been emplaced as a thrust sheet.

We apply this mechanism to the 2.7 Ga Belingwe belt, Zimbabwe. In explaining the geology of the belt, the model implies that early volcanism which erupted through continental crust was in part subaerial, but as voluminous volcanism continued volcanism became subaqueous in a shallow depression as the base of the lava pile subsided. The belt narrowed and deepened with time as the dense greenstone belt sunk into the ductile crust. Finally, convergence of the lava pile as it sunk halted the volcanism and sediments filled the basin that formed when the greenstone sank into the crust. The model has attractive features that are not shared by alternative models, which invoke later folding of a continuous series of lava beds, or involve emplacement of the greenstone succession as a large thrust sheet. In particular, the basal sediments of the Belingwe belt, which are extremely well preserved and only subject to very low-grade regional metamorphism, were deposited as a shallow-water clastic succession unconformable on continental crust. At the distal position of outcrop, the model suggests the

peripheral sediments were never buried by the full $\sim$6 km stratigraphic thickness of the belt. Rather, they represent the flanks of the edifice that subsided to form a basin.