Appendix 6.1

Locations of sampling sites for the Kamativi dyke dyke,Guruve dyke dykes, Mutare dykes and Umkondo sills. Baddeleyite grains were obtained only in samples JM0104, JM0109 and JM0125, and some metamict zircons in JM0138. Samples shown in italics were not processed due to time constraints.

Sample No.	**Dyke/Sill**	**District**	**LOCATION: UTM Co-ordinates**		**Grains recovered**
			East	**North**	
JM0101	Umkondo sill	Chipinge	464922	7737071	Nil
JM0102	Umkondo sill	Chipinge	466943	7742258	Nil
JM0103	Umkondo sill	Chimanimani	464923	7787195	Nil
JM0104	Mutare dyke	Chimanimani	490120	7794842	Baddeleyite
JM0108	Mutare dyke	Chipinge	441193	7780169	Nil
JM0109	Umkondo sill	Chipinge	444620	7781753	Baddeleyite
JM0110	Mutare dyke	Mutare dyke	436702	7800301	Nil
JM0119	Mutare dyke	Mutare dyke	454114	7849641	Nil
JM0120	Mutare dyke	Mutare dyke	468741	7879022	Nil
JM0121	Mutare dyke	Mutare dyke	485452	7890016	Nil
JM0122	*Mutare dyke*	*Mutare dyke*	*475796*	*7891247*	*Not processed*
JM0123	Umkondo sill	Nyanga	474007	8056058	Nil.
JM0125	Umkondo sill	Chimanimani	480387	7832272	Baddeleyite
JM0137	Umkondo sill	Nyanga	462471	7837362	Metamict zircons
JM0138	Umkondo sill	Nyanga	482155	7997149	Nil
JM0139	Umkondo sill	Nyanga	489269	8010575	Nil
JM0140	Umkondo sill	Nyanga	488082	8007067	*Not processed*
JM0142	Umkondo sill	Nyanga	475659	8009436	*Not processed*
JM0160	Deweras dyke	Chinhoyi	212566	8078341	No zir./bad.
JM0161	Guruve dyke	Chinhoyi	212933	8099187	No zir./bad.
JM0162	*Guruve dyke*	*Chinhoyi*	*221685*	*8117002*	*Not processed*
JM0163	*Guruve dyke*	*Chinhoyi*	*214069*	*8113113*	*Not processed*
JM0165	*Kamativi dyke*	*Hwange*	*500744*	*7949385*	*Not processed*
JM0166	Kamativi dyke	Hwange	494079	7963970	Nil
JM0168	*Kamativi dyke*	*Hwange*	*484188*	*7962091*	*Not processed*
JM0169	Kamativi dyke	Hwange	461212	7948852	No zir./bad.

Appendix 6.2.

Umkondo igneous province and mesoproterozoic Umkondo basin in eastern Zimbabwe: Possible relevance to Rodinia.

Venue: Hynes Convention Center, Boston, USA (Presented by Joshua Mukwakwami)
Occasion: Annual General Meeting of the Geological Society of America (2001)
Date: 06 November 2001

Mukwakwami, Joshua[1], Blenkinsop, Tom G.[1], Hanson, Richard[2], and Munyanyiwa, Hubbert[1], (1) Department of Geology, Univ of Zimbabwe, P.O. Box MP 167, Mount Pleasant, Harare, Zimbabwe, joshua@science.uz.ac.zw, (2) Geology, Texas Christian Univ, Box 298830, Fort Worth, TX TX 76129

The Umkondo igneous province in southern Africa may record impact of a mantle plume on the Kalahari craton during Rodinia assembly at 1.1 Ga, coinciding with widespread intraplate magmatism in Laurentia. In the Umkondo type area, eastern Zimbabwe, dolerite dykes and extensive sills (>=100 m thick) intrude metasedimentary rocks of the Umkondo Group, which forms a sequence up to 800 m thick of basal arkoses, stromatolitic limestones, cherts, mudrocks and quartzose sandstones. The metasedimentary rocks are locally folded about N-S axes and thrust towards the west, and have been metamorphosed with the dolerites at low grade. This tectonism probably occurred during Pan-African orogenesis. The age and tectonic setting of the Umkondo basin are not well established, but it may have linked with a Mesoproterozoic continental margin to the east.

The Umkondo strata rest non-conformably on the Archean basement. Dolerite sills are continuous from the basement into the Umkondo Group; some sills were intruded along the nonconformity. Probable felsic tuffs and mafic lapilli tuffs occur in the middle Umkondo Group, which is conformably overlain by basalt lavas geochemically similar to the dolerites. Together with the presence of peperite along one sill margin, these observations suggest that deposition of the Umkondo Group directly preceded widespread Umkondo mafic magmatism.
The Umkondo Group appears to have been deposited in fluvial to shallow-water environments with episodic input of distal bimodal pyroclastic debris. Lateral continuity of the main stratigraphic units suggests a single depositional basin with a N-S dimension >=390 km. These preliminary observations may have paleogeographic implications for Rodinia reconstructions.

Appendix 6.3

Correlation of 1.1 Ga large igneous provinces on the Laurentian and Kalahari cratons: Implications for Rodinia reconstructions

Venue: Mile High City Denver, USA (Presented by Richard Hanson)
Occasion: Annual General Meeting of the Geological Society of America (2002)
Date: 29 October 2001

Hanson, R., Pancake, J., Geol. Dept., TCU, Fort Worth, TX 76129, r.hanson@tcu.edu; Bowring, S., RAMEZANI, J., Dept. Earth, Atmos. & Planet. Sci., MIT, Cambridge, MA 02139; Dalziel, I., Gose, W., Geosci. Dept. & Inst. for Geophysics, Univ. of Texas, Austin, TX 78759; Blenkinsop, T., Mukwakwami, J., Geol. Dept., Univ. Zimbabwe, Harare.

Synchronous emplacement of large igneous provinces on the Laurentia and Kalahari cratons at 1.1 Ga provides an important constraint on relative positions of these major cratons within the Rodinia supercontinent. The Laurentian province is best represented by the Midcontinent rift (MCR), where published data (including high-precision U-Pb geochronology) indicate that 75% of the total volume of basaltic magma was emplaced at 1108-1105 Ma, during a superchron characterized by generally uniform magnetic polarity but with sporadic, brief reversals. Workers in the MCR arbitrarily assign a reversed polarity to this superchron, to distinguish it from a succeeding long interval of "normal" polarity.

In southern Africa, the Umkondo igneous province on the Kalahari craton is primarily represented by widespread mafic intrusions in eastern Botswana, Zimbabwe, and South Africa. Eleven separate intrusions have now yielded conventional U-Pb zircon or baddeleyite ages of 1111 +/-2 to 1105 +/-2 Ma; work is in progress on additional samples. Bimodal magmatic rocks within the province in western Botswana and Namibia have zircon ages of 1109-1106 Ma. Based on published paleomagnetic data and our new work, 45 sites from Umkondo intrusions in southern Africa have yielded consistent magnetization directions corresponding to a well-defined Umkondo pole. 38 of these sites have identical polarity; the other sites have opposite polarity. We infer that the majority of the Umkondo province was emplaced in a narrow time frame during the "reversed" superchron documented from the MCR. The close similarity in timing of these major magmatic events makes it highly unlikely that they developed on unrelated cratons. Correlation of the Umkondo igneous event with 1108-1105 Ma magmatism in the MCR removes the ambiguity in polarity assignment inherent in Precambrian paleomagnetic studies and supports a Rodinia reconstruction in which Kalahari is located south of Laurentia, aligning the two igneous provinces behind a single convergent margin defined by the Grenville and Namaqua-Natal orogenic belts. However, this configuration does not align the Umkondo and MCR poles, and further work is required to produce a Rodinia model that can resolve this discrepancy.

Appendix 6.4

Coeval Large-Scale Magmatism in the Kalahari and Laurentian Cratons During Rodinia Assembly

Hanson, R., Crowley, J.L., Bowring, S.A., Ramezani, J., Gose, W.A., Dalziel, I.W.D., Pancake, J., Geol. Seidel, E.K., Blenkinsop, T. and Mukwakwami, J., 2004. Science 304, 1126-1128.

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