Appendix I

Analytical Techniques

1.1 Fieldwork

Profiles and drill core intersections investigated during this study included:

Sekororo Formation, Wolkberg Group, on the farm Rietfontein 34KS, S24°09’19.8’’; E29°14’32.9’’

Duitschland Formation, Pretoria Group, on the farm De Hoop 53KS, S24°10’30.5’’; E28°10’10.7’’

Timeball Hill Formation, Pretoria Group, in drill core EBA1 near Potchefstroom

Hekpoort Formation, Pretoria Group, in drill core EBA1 near Potchefstroom

Ongeluk Formation, Postmasburg Group in a road cut between Groblershoop and Griquatown on the Farm Bosch Aar, S28°54’’; E 22°47’’

Daspoort Formation, Pretoria Group, at Strubenskop, Pretoria, S25°45.277’; E28°15.555’

Magaliesberg Formation, Pretoria Group, in the Magaliesberg, S25°51.674’; E27°29.99’

Swaershoek Formation, Waterberg Group on the farms Rhenosterpoort 402 and Zuurvlei 403, S24°39’32’’; E28°10’58.4’’

Rust de Winter Formation, on the farm Rust de Winter 180, S25°15’30.1’’E28°39’09.3’’

Entabeni Granite, sampled in a fresh road cut near the Timbadola saw mill at 23°02’11.9’’; 30°13’02.4’’E

Sandriviersberg Formation, Waterberg Group, in the road cut between Nylstroom and Vaalwater, S24°24’29’’; E28°07’09.2’’

Selika Formation, Palapye Group in the Tswapong Hills, S22°41.35’; E27°24.54.3’, in the Tsweneng Hills, S22°54’22’’; E27°31’41.1’’, in the Tshweneng Hills

Tswapong Formation, Palapye Group in the Tsweneng Hills, S22°59’58.3’’E27°29’29.4’’

Roodeberg Formation, on the farm Bronkhorstfontein, at S23°05’02.6’’; E28°27’20.1’’

Wylliespoort Formation, Sand river gorge at S22°58'14''; E29°37'23.8''

Ngwanedsi Formation, close to the Nzhelele River at S22°48'15.1''; E30°03'56''

1.2 Sample Collection

Depositional units predominantly constituted of coarse- to medium-grained quartzite/sandstone were sampled for detrital zircon analyses. Small hand samples were collected systematically through the entire unit in order to obtain a composite sample representative of the whole formation. Volcanic rocks and granites were sampled at fresh outcrop localities.

1.3 Sample Preparation

Sample preparation was done in the sample preparation facility at the Department of Geology, RAU. The following successive steps were applied to separate zircons from whole rock samples.

A)Hand samples were cut by diamond saw to remove weathered surfaces. The samples were then washed and dried.

B)Samples were crushed in a jaw crusher and then milled in a Siebtechnik swing mill, using a Cr-steel set of rings. Samples were milled until particles would pass through a 400µm sieve.

C)Crushed powder samples were then split in order to obtain a representative sample of approximately 7kg weight.

D)The first step in the heavy mineral separation process was the separation of fines and light minerals from the heavy mineral fraction on a Wilfley table. The heavy mineral concentrate was washed with acetone and dried in an oven in order to prevent that metal pieces (derived from crushing and milling) would rust.

E)Further concentration of the heavy mineral fraction by heavy liquid separation using Bromoform.

F)Removal of magnetite and chips of iron (derived from the crushing and milling process) by hand magnet.

G)Magnetic separation in five different steps (0.3A, 0.6A, 0.9A, 1.2A, 1.5A) on the Frantz isodynamic magnetic separator. Visual control of the remaining non-magnetic fraction after each separation step.

H)In the presence of abundant pyrite in the non-magnetic separate, dissolution of the latter in 3N HNO_3.

I)In the presence of abundant apatite in the non-magnetic separate, use of Methylene iodite to separate apatite from zircon.

J)Zircons were then hand picked and mounted in epoxy for SHRIMP analyses.

1.4 SHRIMP Analyses

Mounts were polished and photomicrographs of the zircons were taken in order to evaluate, which zircons would be best suited for analyses (crack-free clear zircons were mostly selected for analyses). Mounts were then carbon-coated, after which cathodoluminescence images of zircons were obtained on a scanning electron microscope. Cathodoluminescence images were used in order to determine, if zircons were oscillatory zoned, or if they contained rounded detrital cores and metamorphic rims. Based on the photomicrographs and cathodoluminescence images, zircons for SHRIMP analyses were selected for analyses.

Selected zircons were analysed by SHRIMP using the analytical procedure described by Compston et al., (1984). In Perth, the CZ3 zircon standard (564Myr; $^{206}Pb/^{238}U$=0.0914), with precision (1s) better than 1% was used for calibration purposes. Initial Pb correction for the total Pb in each analyses was done by removing initial ^{206}Pb, ^{207}Pb and ^{208}Pb, using the observed ^{204}Pb and assuming Pb of Broken Hill isotopic composition. Errors are expressed at a 95% confidence level and ages in million years (My) are marked on the isochrone curves.

In Canberra, zircon grains were mounted in epoxy disks with chips of SL13 zircon standard. The Pb/U ratios have been normalized to a value of 0.0928 for the $^{206*}Pb/^{238}U$ ratio for the SL13 standard, equivalent to an age of 572Ma. Zircon analysis was conducted using SHRIMP mass spectrometry. Analytical data was reduced in a manner similar to that described by Compston et al. (1992), and Williams and Claesson (1987).

Discordant data were excluded from the calculation of ages for igneous zircon populations. Ages of detrital zircons were only used in discussions, if data were no more than 10% discordant.

References

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