tonic evolution is characterized by medium-pressure (MP) and medium-temperature (MT) metamorphic conditions associated with the development of main metamorphic foliation. The area west of the PSZ is characterized by low-pressure (LP) and high-temperature (HT) metamorphism associated with melting, intense post-metamorphic deformation and syntectonic intrusion of granitoids.

Structural investigations west of the PSZ revealed three phases of deformation. The D1 phase is associated with the development of the westward-dipping S1 foliation, and the $L_1$ stretching lineation plunging in the same direction. The $S_1$ foliation was later refolded into km-scale $F_2$ folds or completely reworked into NW–SE-striking, subvertical $S_2$ foliation. The $L_2$ stretching lineation is mostly subhorizontal, suggesting transpressional regime of deformation. Intrusion of the Amspoort-type granite seems to be coeval with the D2 deformation and its solid-state deformation (D3) indicates continuous deformation during decreasing temperature.

As suggested by structural data, the early stage of tectonic evolution in the area is characterized by oblique northwestward underthrusting of the western margin of the Congo craton, resulting in its MP–MT metamorphism. On the other hand, slow oblique exhumation caused LP–HT metamorphism and partial melting of the upper plate, and resulted in its strong weakening. The development of a substantial rheological contrast prevented further underthrusting of the western margin of the Congo craton, and allowed the formation of the HT Puros shearzone as a result of localized transpressional deformation along the contact with the weak LP–HT unit. Intense deformation associated with transcurrent movement is observed in the whole LP–HT unit where the former flat-lying metamorphic foliation is almost completely reworked into subvertical fabric. This subvertical fabric was later intruded by syntectonic Amspoort-type intrusion. Late tectonic evolution of the area is characterized by localization of transpressional deformation in the Amspoort-type intrusion, probably during cooling of the whole orogenic belt. Intense low-temperature deformation of the Amspoort granite and surrounding rocks suggests that this intrusion represented weak inhomogeneity which overtook the role of the PSZ in late stages of the evolution of the Kaoko belt. We suggest that differential movements along these first-order shearzones are responsible for the final pattern of the Kaoko orogenic belt.

# U-Pb Dating of Detrital Zircons by Laser Ablation ICPMS for Sedimentary Provenance Studies

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Age dating of detrital zircon has proven to be a useful tool for stratigraphic correlations, identification of sediment sources and transport and depositional histories. Laser ablation ICPMS and ion probe (SIMS) have been successfully used to resolve the provenance of sediments in a variety of geological settings worldwide. Comparison of results from dating the same samples of detrital zircons by SIMS and LA-ICPMS (Košler et al. 2002) has demonstrated that both techniques are equally accurate and suitable for U-Pb dating of zircon for provenance studies. The advantages of SIMS are slightly more precise ages, less damage to samples and better spatial resolution. LA-ICPMS is the more cost-effective technique with the potential to analyse 3–5 times as many samples in a given time compared to SIMS.

Elemental fractionation of Pb and U has always been an important source of error in U-Pb dating of zircon by LA-ICPMS. There is, however, a variety of sampling techniques that suppress this fractionation, and several correction methods that can be used, resulting in accuracy and precision of age data that are sufficient for sedimentary provenance studies. They include external calibration by matrix-matched standards, use of special cell design, short ablation time (large laser pit diameter/depth ratio), laser beam rastering and mathematical methods of correction for elemental fractionation.

The laser ablation ICPMS method of age dating has been successfully applied to study the provenance of Cretaceous to Paleocene sandstones from the Norwegian Sea (Fonneland 2002). It can be demonstrated that material derived from east Greenland contains both Archean (3800–2500 Ma) and early Proterozoic rocks (ca 2000 Ma) while sediments derived from the Norwegian landmass are significantly younger (1600–1000 Ma). The changes in detrital zircon age spectra interpreted as a result of progressive change of sedimentary sources has been documented from several places in the Norwegian Sea, where it can be correlated with elevation of the Baltic margin in Coniacian to Maastrichtian times.

## References

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