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Zircon Pb loss as a result of a metacratonization process. The case of Sangmelima high-K granitoid zircons, Archaean Ntem complex, Congo craton, southern Cameroon

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High-K granite zircons of the Sangmelima region, Archaean Ntem complex, are characterized by strong discordant ^{207}Pb/^{235}U and ^{206}Pb/^{238}U ages, up to 82 %. Even the evaporation technique, devoted to analyze separately the best preserved parts of the zircons, gives a wide range of ^{207}/Pb^{206}Pb ages, attributed to discordance. Cathodoluminescence study of the zircons shows that their structures represent melt resorption-dissolution features and no inherited cores have been evidenced. Fractured zircons with cracks and channels are quite abundant, demonstrating that the primary magmatic zircon has been affected by brittle deformation. This supports a Pb loss as explanation of the strong discordance, which has been demonstrated when high fluid activities exist in tectonically active zones (e.g. Mezger and Krogstad, 1997, J. Met. Geol. 15, 127-140). In addition, radiogenic Pb loss is enhanced in U-rich zircons due to radiation damage, which is observed in Sangmelima zircons. The loss of radiogenic Pb induced low ^{206}Pb/^{204}Pb ratios: 120-280 for isotope dilution data corresponding to 12 to 26 % common Pb, 1000-10000 (with very few high ones $>$40000) for evaporation data. We interpret this high common Pb content as a result of the important radiogenic Pb loss.

The best estimation of the crystallization age of the Sangmelima high-K granites (based on zircon evaporation $^{207}Pb/^{206}Pb$ age) is 2721 $\pm$ 4 Ma, agreeing with the upper intercept of the multi-grain conventional U-Pb dilution age of 2751 $\pm$ 32 Ma. The latter age is affected by a high MSWD and corresponds rather to a discordia band. In the total absence of Variscan events in the Sangmelima area, the 300 $\pm$ 29 Ma lower intercept of the latter suggests that this age is the mean of several events that affected the area between now and the symmetric age, 600 Ma, i.e. the Pan-African orogeny. Pan-African effects on the Ntem complex based on U-Pb zircon dating have been extensively reported (e.g. Toteu et al., 1994, Prec. R. 67, 321-347; Shang et al., 2004, Bull. Gscs. 79, 205-219). Globally, the Pan-African event in the area consists in the overthrusting of the Yaounde nappe, belonging to the North Equatorial Pan-African orogenic belt, towards the Ntem complex, a part of the Congo craton. The nearby presence of the Pan-African Yaounde nappes (Mvondo et al., 2003, J. Afr. Earth Scs. 36, 215-231) to the north suggests that the Ntem region has been subducted during the collision with the Pan-African orogenic belt before being exhumed together with the Yaounde nappes; such an event is susceptible to partly reactivate this subducted part of the Congo craton, which is corresponding to a metacratonization process (Liégeois et al., 2003, J. Earth Scs. 37, 161-190). This suggests that the Ntem region represents the northern metacratonic boundary of the Congo craton, a metacraton being defined as a partly destabilized craton that kept some cratonic characteristics but not all (Abdelsalam et al., 2001, J. Afr. Earth Scs. 34, 119-136). These rigid but fractured metacratonic areas are particularly susceptible to be reactivated when stress is applied elsewhere on the plate (Liégeois et al., 2005, Geol. Soc. Am. 388-400). This was the case for the northern boundary of the Congo craton during the Phanerozoic, with stress coming from the Benue trough formational process, the opening of the Atlantic and currently the active Cameroon volcanic line. All these events are able to reactivate a metacratonic zone such as the Ntem complex, favouring fluid or magma passage, which can chemically affect the basement rocks including the zircons that are losing radiogenic lead. The current metacratonic nature of the Ntem complex can be visualized with tomographic data (CUB model, Shapiro, 2004, http://ciei.colorado.edu/$\sim$nshapiro/MODEL/), the characteristic thick lithosphere of cratonic areas being only seen at the rear of the Ntem area. The complexity of the zircon U-Pb data obtained can be ascribed to this metacratonic nature of the Ntem complex generated during the Pan-African and reactivated several times during the Phanerozoic. This shows that relatively robust metacratonic domains are actually very active in terms of trace element mobility, even at microscales. This should be considered during evaluation of economic mineralization potential.