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A Commentary on Grenvillian Events in Sri Lanka

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Extensive studies including zircon geochronology and internal isochron datings published within several years around 1990 have generally settled the timing of metamorphic events in Sri Lanka. The major granulite facies metamorphism, which is regarded to be synchronous with the D1/D2 structures (e.g., Yoshida et al., 1990; Voll anf Kleinschrodt, 1991), is considered to have taken place sometime between ca 560 Ma to 610 Ma (Kröner and Williams, 1993). However, there are some inconsistencies among recent arguments as well as between the recent and classical ideas, which remain unresolved (e.g., Bauer et al., 1991; Yoshida, 1999; Yoshida et al., pers. comm.; Braun and Kriegsman, 2003). The major problem relates to the ca 1.0 – 1.1 Ga ages detected by Rb-Sr and Sm-Nd isochron, zircon SHRIMP and internal isochron methods as well.

Yoshida (1999) pointed out some of the problems that are inherent in the interpretation of radiometric ages in high-grade polymetamorphic terrains, which include the following. (1) Concordia-discordia method for U-Pb dating cannot negate the existence of older events, which is superimposed by later high-grade events. Likewise, U-Pb concordant ages of mineral fractions often include a possibility of mixture ages with younger or older minerals/micro domains. (2) Zircon ages do not necessarily indicate high-grade conditions; low temperature formation/rejuvenation of zircon has also commonly reported from both field studies and laboratory experiments. Also, the lower intercept ages of zircons in particular, should be examined with great care. (3) Sm-Nd internal isochron ages generally reflect the closure temperature of the system, and do not reflect the time of formation of the minerals. Furthermore, the closure temperature is not necessarily above ca 750°C, but may be further lower in many cases as demonstrated by several field and experimental studies.

If the above problems are seriously taken into account, then we may find that the current interpretation is not the sole possible resolution for the timing of tectonothermal events in Sri Lanka. The problems in the current interpretation are also realized, if we look into details of structural evidence within the Sri Lankan basement rocks (e.g., Yoshida, et al., 1990; Kröner et al., 2003). In combination of these two aspects, i.e., geochronology and structures, we propose here a possibility of the Grenvillian events in Sri Lanka as follows.

The time of the incipient charnockite formation in Sri Lanka of 535 Ma is considered reasonable, but is definitely later than D_3 of Berger and Jayasinghe (1976) (Yoshida et al., 1990; Kehelpannala, 1999). In considering this, the amphibolite to low-granulite facies metamorphism associated with D_3 tectonics (Yoshida, et al., 1990; Voll and Kleinschrodt, 1991) be older, possibly ca 550 Ma - 600 Ma as reflected in the prominent

Pb-loss event (mostly lower intercept ages) throughout the Sri Lankan basement rocks. Then, the major granulite facies metamorphism, which is associated with D_1/D_2 structures and distinctly earlier than the D_3 event (Yoshida et al., 1990; Voll and Kleinschrodt, 1991), may be ascribed to ca 1.0-1.1 Ga ages. It is pointed out that not only extensive magmatic activity but also deformation event of the Grenvillian age are well documented from all the amphibolite facies units of Sri Lanka (Kröner et al., 2003), suggesting a possibility of the same *Heimat*, and therefore, same tectonic transport, of all geologic units in Sri Lanka.

We point out that the data and discussions so far published are insufficient at the present stage to negate the Grenvillian high-grade event in Sri Lanka. We assert that the work of Kröner et al. (1987) who obtained ca 1.0-1.1 Ga ages for the major granulite facies metamorphism using zircon SHRIMP geochronology has neither been retreated nor rejected with reasonable discussions in subsequent studies.

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