

Depositional ages and provenance of Paleoproterozoic sequence of Lesser Himalaya in Nepal based on U-Pb zircon dating

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Proterozoic Lesser Himalayan sediments (PLHS) is a thick sequence attaining 10,000 m deposited on a passive continental margin of the Supercontinent Columbia, which started its rifting at around 2.0 Ga. The PLHS could be correlated to the Chancheng Group on the North China craton and the Coronation Supergroup on the Slave craton in Northwestern Territory of Canada (Sakai et al., 2013), therefore the PLHS is important to understand tectonics and sedimentation in the rifting process of the supercontinent Columbia. In addition, it has also important key to solve the exhumation process of the Himalayan metamorphic belt, so called the Higher Himalayan Crystallines (HHC), which thrusts onto the PLHS and caused inverted metamorphism. However, age data of the PLHS are very limited except the lower group and granitic intrusives (augen gneiss) into the lowest Kuncha Formation. Then, we performed detrital zircon U-Pb dating of the three groups comprising the PLHS and granitic rocks intruded into the Kuncha. As the results, depositional age of the Lower Group was estimated from 1.9 to 1.75 Ga, and those of the Middle and the Upper Group are from 1.75 to 1.7 Ga and from 1.7 to about 1.6 Ga, respectively. Furthermore, we recognized two peaks of granitic activity at around 1.85 and 1.75 Ga. In this paper, we report the results of dating and discuss on the depositional age, provenance and tectonic meaning of unconformity between the groups.

The PLHS is divided into three groups: the Lower Group, the Middle Group, and the Upper Group. The Middle and Upper Group are separated by an unconformity. The uppermost part of the Kuncha Formation of the lowest unit of the PLHS yielded the youngest detrital zircon age of 1869 ± 24 Ma. The basal part and the uppermost part of the Naudanda Quartzite of the Lower Group yielded the youngest detrital zircon U-Pb ages of 1773 ± 55 Ma and 1755 ± 45 Ma, respectively. Then, the depositional age of the Lower Group is estimated to range 1870-1750 Ma. The youngest detrital zircon of the Nourpul Formation of the Middle Group yielded U-Pb age of 1650 ± 43 Ma. The youngest detrital zircon of the Benighat Slates of the lower part of the Upper Group yielded U-Pb age of 1586 ± 53 Ma. The Riri Limestone of the Upper Group yielded Pb-Pb age of 1683 ± 68 Ma (Watanabe, 2001MS). Then, the depositional age of the Middle Group is estimated to range 1750-1640 Ma, and that of the basal part of the Kerabari Formation at the uppermost stratigraphic unit of the PLHS is estimated to range 1640-1610 Ma. The Dunga Quartzite in the Robang Formation of the uppermost unit of the Nawakot Complex yielded the youngest detrital zircon age of 1800 ± 63 Ma, which is assigned to the age of the Lower Group. Thus, it is no doubt that this overturning of age was caused by thrusting of the Kuncha nappe over the Malekhu Limestone of the Upper Group.

A mylonitic granite intruded into the sediments of the MCT zone, which is the uppermost part of the Kuncha nappe, was dated as 1769 ± 15 Ma, and an augen gneiss intruded into the basal part of the MCT zone was dated as 1730.4 ± 9.7 Ma. They show younger ages than previously reported ages of granites intruding into the Kuncha Formation (1.9-1.8 Ga). It suggests that igneous activity occurred intermittently within the sedimentary basin of the PLHS. Age distribution histogram of detrital zircons from the Lower Group commonly have two peaks at around ~ 1850 Ma and ~ 2450 Ma. On the other hand, age distributions of detrital zircons from the Upper and Middle Group have a unique peak around ~ 1750 Ma. This indicates that tectonic event occurred in between the Lower and Middle Group, and caused a change of the provenance of detritus.

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