Tectonics and metamorphism in central and eastern Nepal

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The Himalaya is a fold-and-thrust belt in the northern margin of the Indian continent with a foreland propagating thrust system. Among these thrusts the Main Central Thrust (MCT) zone is the most important thrust in the Himalayan tectonics. The high-grade metamorphic rocks of the Higher Himalaya are thrust southward along the MCT for more than 100km and cover the non- to less metamorphosed rocks of the Lesser Himalaya. In western Nepal a thrust sheet consisting of kyanite-sillimanite gneisses of over 8km thickness with the Tethyan sedimentary cover makes a klippe (Karnali klippe) in the Lesser Himalayan zone. In central to eastern Nepal there are two huge nappes. The Ilam Nappe in the far-eastern part is compose of of kyanite-sillimanite gneisses and granitic gneisses with no the Tethyan sedimentary cover. On the other hand, the Kathmandu Nappe consists of a thick pile of the Tethyan sediments in the upper part and metamorophic rocks in the lower part, the metamorphic grade of which looks to be lower than the rocks of other nappe and klippe. Therefore, it is proposed that the Kathmandu Nappe is another thrust sheet which underlies the Higher Himalayan rocks in the north (Rai et al., 1998: Upreti and Le Fort, 1999). But this idea is unacceptable, because the MCT zone, which is different from the overlying Higher Himalayan rocks in lithofacies, metamorphism and manner of deformation, occurs everywhere below these nappe and klippe (Arita et al., 2001).

In the Ilam Nappe the pelitic gneisses bear garnet including kyanite, sillimanite replacing kyanite and cordierite including sillimanite. These suggest that these rocks were formed by a barrovian-type metamorphism (Eo-Himalayan stage of early Eocene) with decomposition process in the later stage. Furthermore, the foliation of the rocks is cut by shear bands with fibrolite, and it suggest a shear movement in sillimanite field (Neo-Himalayan stage of early Miocene). Such an occurrence is observed for at least 80km from the root zone (total thickness of over 25km) to southern marginal zone (5 km thick) of the Nappe. Metamorphic conditions of the Higher Himalayan rocks above the MCT are 650 to 750 C and 10 to 12 kbar, and those of the underlying MCT are 500 to 600 C and 6to 7 kbar.The metamorphic condition of the Higher Himalayan rocks is almost the same from the root zone to the southern margine of the Nappe.

The Kathmandu Nappe is cut by a out-of-sequence thrust and separated from the northern root zone. The northern root zone is made by kyanite-sillimanite gneisses and granitic gneisses which show the same occurrence as the Ilam Nappe. The southern nappe part consits of the Tethyan sediments with c.5 km thickness in the upper part and the underlying various gneisses with c. 9 km thickness and forms a synclinorium with an axis in E-W direction. The lower metamorphic rocks of the Kathmandu Nappe represent the metamorphic conditions of 500 to 600 C and c.8 kbar and bear no kyanite with an exception. The metamorphic grade of the underlying MCT looks almost same from the root zone to narginal zone as the same as the Ilam Nappe.

The difference in the metamorphic conditions mentioned above between the Higher Himalayan and MCT zones represent that their metamorphic stages are different each other. The MCT zone characterized by the occurrence of garnet with snow-ball texture was metamorphosed by thrusting of the overlying Higher Himlayan rocks. The difference in metamorphic grade of the basal rocks of Kathmandu and Ilam Nappes suggest that the MCT cut them at different depth (lithostratigraphic horizon) in places.