# Partitioning and transformation of phosphorus between dissolved, colloidal and particulate phases in the Bay of Saint Louis

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Field studies and laboratory mixing experiments were conducted to examine the dynamic partitioning and transformation between organic and inorganic P in dissolved, colloidal and particulate phases and key processes and mechanisms that control their distribution, variation and mixing behavior in the Bay of Saint Louis estuary in the northern Gulf of Mexico. A highly dynamic variability in P concentration and a non-conservative mixing behavior was observed within the estuary for all P species: dissolved inorganic P (DIP), dissolved organic P (DOP), particulate inorganic P (PIP) and particulate organic P (POP). The concentration of total dissolved P (TDP) first increased with increasing salinity, but decreased with increasing salinity in the lower estuary (S >21). In contrast, the concentration of total particulate P (TPP) decreased in general with increasing salinity with an elevated concentration in coastal waters. DOP was the dominant species in the TDP pool in both lower salinity (S<10) and higher salinity (S>25) regions, while DIP was the dominant species in mid-salinity regions (S of 10~20) comprising up to 75% of the TDP. Results of short-term laboratory mixing experiments resembled those of field observations in the distribution, variation, partitioning, and mixing behavior of P species, suggesting that physico-chemical processes are the predominant control on the biogeochemical cycling of P in the Bay of Saint Louis estuary. The partitioning coefficient of P between dissolved and particulate phases ranged from 4.0 to 5.5 (in terms of $\log K_d$), indicating its particle reactive nature and potential contol of soluble P concentration by TPP. Within the DIP pool, colloidal inorganic P decreased rapidly from ~60% near the river mouth to negligible in waters of salinity >18. Colloidal organic P was more abundant, decreasing from over 90% of the DOP pool at low salinity stations to <30% at middle salinity stations but increasing again to over 80% at coastal stations, further indicating dynamic partitioning, transformation and source change within the estuary.

# U-Pb zircon ages and Hf isotopic compositions of the magmatic and metamorphic rocks from Nyingchi group in Eastern Himalayan syntaxis and their geological implications

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Syn-collisional tectonothermal history of southern Lhasa terrane is critical to understand collsional process of India and Asian continents. In the eastern Himalayan syntaxis, the southern Lhasa terrane is mainly composed of middle-high-grade metamorphic rocks and anatectic rocks. This assemblage was termed as Nyingchi Group. Detrital zircons from a paragneiss of Nyingchi group yield U-Pb ages from 333 to 2965 Ma, with four major populations at 330-362 Ma, 440-625 Ma, 1057-1283 Ma, 1500-1850 Ma. Their $\varepsilon_{Hf}$ (t) values range from -28.9 to +3.6. A granodioritic orthogneiss has magma crystallization age of 84.3±0.6 Ma, with metamorphic ages of 64.5~56.0 Ma. This granodioritic orthogneiss is characterized by positive $\varepsilon_{Hf}$ (t) values of +7.4 to +10.7. Zircons from a gneissic leucogranite exhibit core-rim structures. The cores yield ages ranging from 347 to 2690 Ma, with age populations at 347-400 Ma, 450-650 Ma and 1000-1200 Ma. Their $\varepsilon_{Hf}$ (t) values range from -33.2 to +6.9, consistent with those of detrital zircons in the paragneiss, indicating that the protolith magma was derived from partial melting of the Nyingchi group. The zircon rims show that the protolith of the gneissic leucogranite crystallized at 64.9±1.4 Ma, but suffered subsequently metamorphisms at 55.4±1.0 and 41.4±2.3 Ma. Zirocns from a diorite yield magma crystallization age of 63.1±0.5 Ma, with $\varepsilon_{Hf}$ (t) values of -8.3 to -2.7, indicating the diorite sourced from partial melting of ancient crustal materials.

These results indicate that the late Cretaceous magmatism in southern Lhasa resulted from the Neo-Tethys oceanic slab subduction towards the Asian plate and the early Paleocene magmatism resulted from partial melting of ancient crustal materials and anatexis of the Nyingchi Group. Meanwhile, the southern Lhasa terrane had experinced a protracted metamorphism from early Paleocene to Eocene. We suggest that the crustal melting, anatexis and metamorphism were related to crustal thickening of southern Lhasa terrane due to the collision between the India and Asian continents. This implies that the collision of India-Asian continent took place probably prior to 65 Ma.