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Multi-proxy evidence for the denudation of Taiwan at the start of the Pliocene

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Collision between the Philippine Sea Plate and the Eurasian Plate in the late Miocene-early Pliocene resulted in the uplift of Taiwan, and lithospheric flexure to the west formed the adjacent Western Foreland Basin (WFB). Petrographic studies of late Miocene to Recent sediment and sedimentary strata in the WFB indicate that Taiwan was the main sediment source to the WFB in the early- to mid-Pleistocene, and prior to this, sediments were assumed to be derived primarily from the Eurasian continent. However, uplift of Taiwan began significantly earlier, and sediment derived from the island should reflect the onset and acceleration of uplift and subsequent erosion.

To resolve the timing of changes in sediment sources in the WFB, we present clay mineralogy, carbon and nitrogen geochemistry, and magnetic susceptibility data from the late Miocene to late Pliocene Kueichulin Fm that outcrops along the Da'an River in western Taiwan. This formation is composed of the lower Kuantaoshan Member, the middle Shihliufen Shale, and the upper Yutengping Sandstone. Clay mineralogy shows an upward increase in illite and illite crystallinity, and a decrease in chlorite and kaolinite starting at the base of the Shihliufen Shale, and this suggests that rapid erosion of Taiwan became a major sediment source to the WFB between the late Miocene and early Pliocene (Shihliufen Shale). $\delta^{13}\text{C}_{\text{org}}$ and C/N ratios preserve the dominance of Taiwan-derived sediment in the early Pliocene where there is a marked change from dominantly marine- to dominantly terrestrially sourced carbon at the transition from the Shihliufen Shale to the overlying Yutengping Sandstone. Finally, a rapid decrease (>50%) in magnetic susceptibility across the Shihliufen/Yutengping boundary indicates a significant dilution of magnetic minerals deposited in the WFB by the high flux of non-magnetic minerals delivered from the Taiwan orogenic belt. Together, these datasets record a major shift in sediment source to the WFB during the late Miocene to early Pliocene, and that Taiwan became the dominant source of sediment supply to the WFB by the early Pliocene, approximately two million years earlier than previously thought.

