Distinguished Alumni Lecture

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A re-assessment of the timing of the late Miocene C3-C4 vegetation transition across the Indian subcontinent and the globe

Grasslands expanded on the Indian sub-continent in the late Miocene. Precise chronological control is critical to compare the timing of the expansion between regions and evaluate the possible causes (and consequences) of the ecological transformation. Here we take a new look at old records from around Pakistan, India and Nepal on land and update the age models to the current paleomagnetic timescale. These records are then compared to new records from the marine sediments obtained on IODP Expedition 355 to the Indus Fan. Based on microfossil appearance and paleomagnetic constraints, the timing of the C4 transition is found to be asynchronous across the globe, probably initiating in India and Pakistan around 7.1 Ma and reaching Nepal by about 6 Ma. Elsewhere in the world (Australia and Argentina) the transition happened much later, in the Pliocene. This grassland expansion is coincident with a collapse in CO2 levels (although there is not yet a consensus on pCO2 proxies). If true, the C4 grass expansion may have contributed to the collapse because that vegetation is much more efficient at sequestering carbon than the forests and shrubs that preceded them.