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Preliminary constraints on rheology of the deep crust beneath central Tibet from Late Pleistocene - Early Holocene shorelines

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Although the rheology of crustal materials is known to exert a fundamental control on the evolution of orogens, recent propositions that lateral flow of the lower crust is an active participant in the growth of the Tibetan Plateau demands scrutiny of whether the crust is capable of such behavior. Unfortunately, despite intensive geologic and geophysical investigation, direct tests of the rheology of deep crust beneath Tibet are challenging. Here, we exploit the flexural response of the lithosphere to climatically-driven changes in lake level of the Siling Co (Lake), in central Tibet. Extensive flights of well-preserved paleoshorelines are distributed around the lake, and extend up to 60m above present day lake level. In this study, we studied the highstand shoreline ($\sim$4595 m a.s.l.) in an effort to ascertain whether it is deflected in response to lake recession. This highstand shoreline is characterized by obvious constructional features (beach ridges, benches, spits, bars and cuspates) that continuously connect to wave-cut scarps which define a clear geomorphic boundary between an older landscape characterized by dissected alluvial channels/gullies and a lower one characterized by younger, recessional shorelines.

We surveyed eighty-seven constructional shoreline features along the highstand level. The results show that marginal highstand shorelines are $\sim$ 4594 m in elevation with $\sim$2 m of variation; seven radial transects from the paleolake center to the margin reveal a range of 4592 $\sim$ 4596 m in elevation for most shorelines, except a prominent spit ($\sim$ 4602 m) nearest the center. We have collected 5 individual depth profiles for surface exposure dating (36Cl and 10Be) and 27 samples for OSL from shoreline deposits. Preliminary results from OSL dating suggest that the highstand level dates to the Early Holocene (7 – 9.3 ka). The deflection of shorelines, however, is at present consistent with two scenarios: either, 1) the elastic strength of the crust central Tibet is extremely weak (Te = $\sim$ 5 km) or 2) moderately strong (Te $\geq$ 20 km). Our results appear to preclude intermediate values between these end members. Detailed chronologic data from these shoreline features will test shoreline correlations, refine loading histories and allow us to discriminate between these scenarios.