# Discovery of glacial activity from an arid Chinese region

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A unique discovery of three distinct layers of Ice Rafted Debris (IRD), drop stones and surface microtextures of quartz grains supporting glacial activity is reported for the first time from a 20.7m sediment drill core retrieved from Wuliangsuhai Lake (altitude 1,017 m), an arid to semi-arid region in Inner Mongolia. With medium high mountains, deserts and no major glacial activity around, this finding is amazing. This lake, freezes in winter, has an annual mean temperature of 7.3$^{o}$C with seven times higher evaporation against a mean annual precipitation of 224 mm. The Yellow River was feeding this lake until recently. The core is investigated for magnetic susceptibility (MS), relative brightness index (RBI), particle size as well as major and trace elements. The IRD layers have high 1) MS in the bulk as well in separated size fraction (>150-<1000 μm, 27-105 and 55-191x$10^{-6}$, SI units) and 2) mean grain size (38 and 984 μm) with drop stones (Fig. 1). The IRD layers contain light (felsic) colored quartz and feldspars as indicated by RBI measurements and confirmed by elemental analysis. The study of 180 μm sand fraction of IRD layers by scanning electron microscope (SEM) show surface microfeatures such as angular to sub-angular grains, parallel to sub-parallel striations, conchoidal and arc step fractures and adhering particles reconfirming glacial activity. Moderate relief, sub-angular shapes and few crushing planes of glacial grains as seen in SEM indicate low shear stress and mechanical abrasion under thinner mountain glaciers. The timing of these IRD layers corresponds to Heinrich Events 1 and 2 in the North Atlantic Ocean.

The moraine material might be originated from the nearby Qilian Mountains which is ~1,000 kms from the core site, and transported by the Yellow River that flows by these mountains. The dissolution/precipitation features on glacial grains reveal transportation under low energy subaqueous conditions. Significant height difference between highs and the basins due to neotectonic activity and interlocking of mountains and basins favor the advancing glaciers to flow out of the mountains and spread as piedmont glaciers at the base. Thermoluminescence/$Be^{10}$ dating work is in progress to confirm the timings of the dropstone activity.

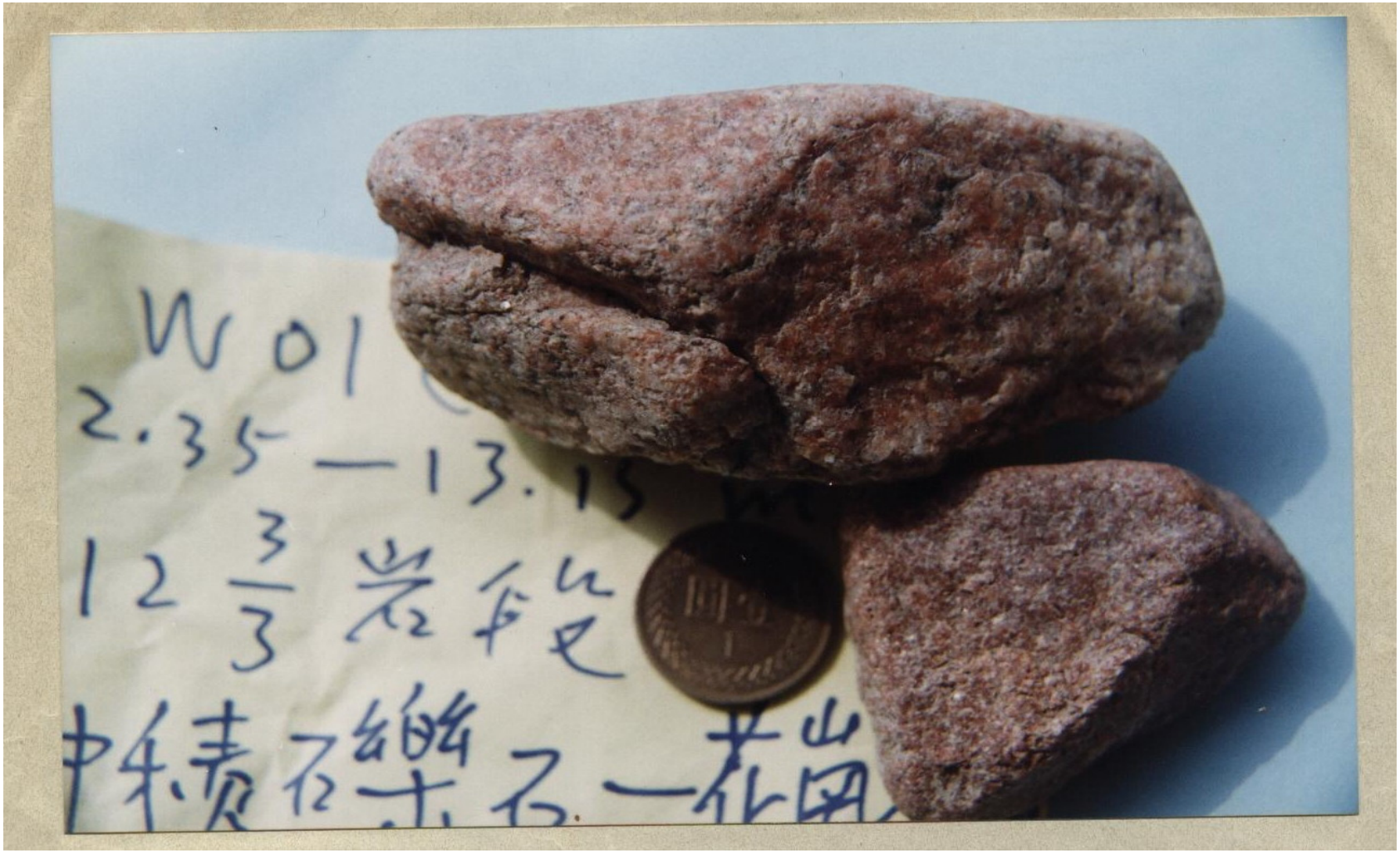


Figure 1 One of the Ice Rafted Debris layer (Heinrich Event 2) containing the largest drop stone measuring 8.2L x 4.6 W x 4 H cms in an arid region lake from the western Inner Mongolia