Diachronous and progressive deformation in intracontinental tectonic system: A case study from Mesozoic Thrusting in the Xuefengshan, China

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Temporal-spatial distribution of many Triassic to Cretaceous angular disconformities in the Xuefengshan intracontinental tectonic system is very important constrains to structural evolution of the South China Block. The boundary line between high-angle disconformity and low-angle disconformity during Early Triassic to Middle Triassic is identified along the Cili-Baojing fault. The deformation range in Triassic is east of Longshan-Hefen fault. All these indicate that the deformation intensity in the intracontinental tectonic system decreases from east to west during this period. Since Late Triassic, it is obvious that the diachronously progressive deformation propagates westward. Four deformation belts formed in the diachronous and progressive deformation can be subdivided. Their propagation rates of the corresponding four stages are calculated respectively in Table 1. Finally, the aspects to control these propagation rates resulted from detachment layers and coeval magmatism in the South China which played an important role to westward propagation of thrusting. The most dramatic magmatism in the region is east to Xuefengshan. Relate to the highest propagation rate in the region west to Xuefengshan. The more detachment layers are, the faster propagation rate are. Therefore, Mesozoic lithosphere thinning of South China may be related to its deformation.

	J_1	J_2	J_3	K_1
Propagation rate (Km/ma)	3.46	7.14	17.63	5
Magmatism	quiet	strong	violent	strong

Table 1: Relation between propagation rates with magmatism of South China.

How pores grow in shale during rock-water interaction: A SANS/USANS study

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Transformation of bedrock into regolith is initiated by the dissolution of the most reactive mineral phases, accompanied by subtle but critical changes in porosity and surface area. Here, we use small angle and ultra-small angle neutron scattering analysis (NS) along with mineralogical and geochemical observations to characterize shale weathering in the Susquehanna/Shale Hills Observatory. NS can characterize connected and unconnected pores or fractures ranging from 10 nm to several μm in dimension that develop as bedrock transforms into regolith.

The primary pores in unweathered shale bedrock interrogated by neutron scattering are isolated, intraparticle pores that comprise ~5-6% of the total rock volume. As the bedrock fragments and alters, secondary pores grow by dissolution of carbonate (at 22 m depth) followed by feldspar (at 6 m depth) and partly due to physical processes related to peri-glacial conditions 15 ky before present. As shale fragments weather in the regolith, chlorite and illite dissolution causes further increases in porosity and surface area. Intraparticle pores progressively connect to form interparticle pores, changing the mineral-pore interface from a mass fractal to a surface fractal. As clay minerals become more depleted, relatively smooth quartz surfaces are exposed, causing the total mineral-pore interfacial area to decrease. The clay minerals could also be closer to equilibrium with infiltrating fluids, leading to smoother surfaces. In the shallowest regolith, rock fragments show an increase in concentration of unconnected pores, especially at 10 cm below ground surface. These are attributed to the precipitation of kaolinite and Fe oxyhyroxides which effectively clog the pores. Physical stress of annual freeze-thaw cycles may also contribute by creating new pores.

We infer that bedrock-regolith conversion at Shale Hills is controlled by chemical reactions and the advance rate of the interface is most likely limited by the rate of diffusion of reactants and water into the rock. This noval NS study provides new insights in how and why microscopic pores and mineral surface features vary through the entire weathering zone.