Experimental presentation of plate tectonics using paraffin wax

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Although “plate tectonics” is commonly taught in Earth Science and Geochemistry, the physical entity of a plate, its motion and driving forces still remain unresolved. To assist students’ comprehension of tectonic plates and plate dynamics, we have developed a tank apparatus and performed experiments using paraffin wax to simulate the subduction of a plate as a well-developed thermo-mechanical boundary layer on top of a vigorously convecting mantle. We constructed a glass tank with an inner size of 120x23x4cm. The walls were made from double-pane glass, and reinforced with aluminum plates and bars. The paraffin was melted from below by a copper heat-sink. To prevent the paraffin wax sticking at the boundary layer as it cooled down we attached a wire heater to the inner walls. The top layer of the wax was cooled with a flow of liquid nitrogen. A clear “plate” could be observed forming. In a plate of moderate thickness, after artificial fracturing or weakening of the boundary layer, subduction was initiated. Colder and thicker plates did not subduct even after an external force was applied, forming a stagnant lid. Hotter and thinner plates did not show continuous subduction. In every case where subduction was initiated plate motion soon stopped, possibly because the slab pull force was too weak. Controlling plate behaviour by adjusting the cooling-heating balance may provide a useful perspective in understanding tectonic plate formation and motion.

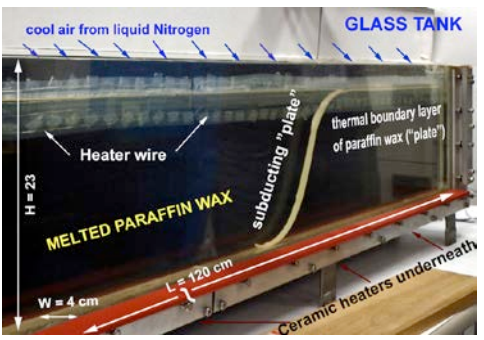

Figure 1: The tank apparatus used to model “plate subduction” with molten paraffin wax.