

Ice core drilling on the Hofsjökull ice cap

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Abstract – In August 2001, an ice coring program was carried out on Hofsjökull, a temperate ice cap in Central Iceland. A shallow drill designed and built at the Alfred Wegener Institute in Bremerhaven, Germany, and intended for use in dry holes on polar ice sheets, was used in this effort. The drilling took place near the summit of the ice cap, at an altitude of 1790m, above the eastern rim of a subglacial volcanic caldera. The local ice thickness at the drill site is close to 300m. The drilling was smooth and problem-free down to a depth of 35m, where the water table in the ice cap was encountered. Beyond this depth, the average core length dropped rapidly from 1m to 0.3m. The main problem encountered in drilling through water-saturated ice seemed to be related to transport of ice chips, since the chips produced during cutting did not move easily into a collection chamber in the top part of the core barrel. Compaction of chips occurred when the spiral section on the outside of the barrel had been filled. Freezing onto the cutters did not seem to be a significant problem during drilling. Below the water table, water tended to leak into the drill motor, which nevertheless continued to operate. In total, a 100.2m long ice core was drilled in 263 runs, in 9 days. The core was logged on-site and a preliminary study of visual stratigraphy was carried out, revealing an abundance of bubble-free layers, up to 30 cm in thickness. Density measurements reveal that glacier ice ($\rho = 830\text{ kg/m}^3$) has formed at a depth of 35m. Tephra layers from the Hekla eruptions in 1991 and 1980 were found at 40.8m and 69.7m depths, respectively. Experience gained during the drilling may be used to improve the drill so that it becomes better suited for drilling in temperate ice.