

AN OVERVIEW OF 1000 YEARS OF TROPICAL CLIMATIC VARIABILITY FROM  
ICE CORES FROM THE ANDES OF SOUTHERN PERU

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ABSTRACT

Over the last 20 years ice cores extending to bedrock have been obtained from the Greenland and Antarctic ice sheets and from other glaciers in high latitudes. Studies of these cores, especially of the ratios of the stable isotopes of oxygen and hydrogen and the concentration of microparticles, have produced extra ordinary records for the high latitudes (AGU, 1985). The numerous paleoclimatic reconstructions for high latitudes contrast sharply with the information gap for the tropics. Therefore, applying the ice core paleoclimatic technique in the low latitude, high altitude glaciers merits particular attention.

Each summer between 1976 and 1984 research was conducted on the Quelccaya Ice Cap with one central objective, to recover an ice core to bedrock from which an approximate 1000 year climatic history for tropical South America could be reconstructed. In 1983 that central objective was accomplished by recovering one core 155 meters in length containing 1350 years and a second core of 163.6 meters containing more than 1500 years of climatic history (Thompson et al., 1985, Thompson et al. submitted Science).

Historical records for the Southern Hemisphere are almost nonexistent and this has been a particularly troublesome aspect of the attempt to describe global changes in climate from the historical record. This is especially true in South America.

The very accurate dating of the Quelccaya ice cap cores results directly from having several stratigraphic features which exhibit seasonal variability. Age estimates for the bottom of the ice cap were derived initially from flow-model calculations (Thompson et al., 1982) depending heavily upon initial assumptions and boundary conditions. Fortunately, stratigraphic dating of the core in the field was possible using the visible annual dust layers. The thickness of the annual layers ranged from 1.24m (ice equivalent) at the surface to 0.01m at the base. The visible stratigraphy was complimented by the preservation of annual variations in microparticle concentrations, conductivity levels and oxygen isotope ratios. The Quelccaya cores have been dated to 1500 A.D. with an estimated uncertainty of plus or minus two years and an absolute date of 1600 A.D. where the Huayna Putiva eruption ash has been identified.

The most significant climatic event in tropical South America over the last 1500 years was the "Little Ice Age" which is recorded between 1490 to 1880 A.D. in these ice core records. Records from the summit of the Quelccaya Ice Cap show that during the "Little Ice Age" period there was (1) a general increase in particulates (both insoluble and soluble, starting around 1490 A.D. and ending abruptly in 1880 A.D.); (2) an initial increase in net accumulation (1500-1720 A.D.) followed by a period of decreased net accumulation (1720-1860 A.D.); (3) more negative  $\delta^{18}O$  values beginning in the 1520's and ending around 1880 A.D. The "Little Ice Age" event is evident as a perturbation in all five ice core parameters.

#### REFERENCES

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