

# NO MORE ICE IN PARADISE: AGES OF PLEISTOCENE GLACIATIONS ON MAUNA KEA, HAWAI'I

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Glacial deposits on Mauna Kea, the only location in the interior tropical Pacific known to have been glaciated, have been mapped and investigated for nearly a century, but the timing of glaciations has proven difficult to resolve. We have developed a new chronology of glacial events on Mauna Kea using *in-situ* cosmogenic <sup>36</sup>Cl dating of boulders and glacially abraded bedrock, and <sup>40</sup>Ar/<sup>39</sup>Ar dating of lava flows interstratified with glacial deposits. Using these chronometric systems in tandem, one of which dates the depositional event itself (cosmogenic <sup>36</sup>Cl) whereas the other yields bracketing ages for glaciations (<sup>40</sup>Ar/<sup>39</sup>Ar dating), can provide compelling evidence of the antiquity of events.

<sup>36</sup>Cl ages of samples from the Pohakuloa and Waihu, the oldest glacial deposits, exhibit bimodal distributions, which we interpret to represent the timing of deposition (older mode) and the subsequent exhumation (younger mode). The older modes are centered on 147±14 ka (all uncertainties, 2σ) for the Pohakuloa and 110±12 ka for the Waihu. <sup>40</sup>Ar/<sup>39</sup>Ar incremental heating analyses yield plateaus and isochron ages that place the Pohakuloa glaciation between 166±36 ka and 163±10 ka, and the Waihu glaciation between 122±30 and 97±29 ka. We conclude that the Pohakuloa was deposited during oxygen isotope stage (OIS) 6. But the results for the Waihu are less conclusive; this advance could have taken place either late in OIS 6 or early in OIS 5. If the mean <sup>36</sup>Cl ages hold true, the similar terminal positions of the Pohakuloa and Waihu deposits indicate that climatic conditions during early OIS 5 were as conducive for ice cap formation as those that prevailed during OIS 6. However, additional work must be conducted to reduce the uncertainties in both isotopic systems to levels that would permit a more definitive correlation with either of the two isotope stages. The last deglaciation sequence began at 20.6±1.2 ka with deposition of the Makaanaka moraine and terminated with the disappearance of the ice cap at 16.5±1.4 ka. The formation of a boulder-dominated fan at 13.2±1.5 ka suggests that significant high-elevation precipitation continued well after glacial ice had disappeared from the summit, consistent with a more southerly position of the North Pacific anticyclone during the late glacial.

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