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Can ice loading explain the only dacitic explosive eruption in an andesitic volcano? Implications for future explosive eruptions in the Southern Andes

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Hudson volcano, located in the Southern Andes (45°54'S; 72°58'W), has had four large plinian eruptions in the last 18 ka. Three of them, named as H0 (18 ka), H1 (7 ka BP) and H3 (1991 AD), have been basaltic-andesitic to andesitic in composition. The only dacitic eruption, known as H2 (4 ka), erupted ≤4 km3 DRE. The latter silicic composition is unique in the post-glacial history of the volcano and it would have been erupted at final stage or after an intra-Holocene glacial period, which started ca. ~6 ka worldwide, and has been recognized in the area to have occurred ca. 4.7 - 4.2 ka. In this study we analyse the relationship between the volcano's magmatic system and the overlying intra-caldera glacier to evaluate the role of glacial load in producing dacitic magmas in an andesitic-dominant volcano. We model the compositional evolution of the Hudson's magmatic surficial reservoir (1-3 km depth) using MELTs, starting with a basaltic parental magma, attempting to know the pressure and temperature conditions required to produce dacitic magma. Additionally, we generate a finite elements model to evaluate the effect of the glacial load on the probability to trigger an eruption during progressing and retreating glacial periods. In this model we consider a homogenous upper-crust; except for ring faults that form the caldera in have a lower tensile strength. The reservoir is initially at its neutral buoyancy level, and its internal pressure increases with time as more magma is injected into the camera. We consider the load of a central, disc-shaped glacier with 5-km radius and 2 km-high, and a perimeter (toroidal) load with a 5-km internal and 10-km external radius. Our results let us test the hypothesis of glacial influence on the generation of voluminous and more silicic magmas and hazards implications in ice-covered volcanoes.