



The lively Aysén fjord, Chile: Records of multiple geological processes

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The Aysén fjord is a 65 km long, east-west oriented fjord in Chilean Patagonia, located approximately at 45.4°S and 73.2°W, with a maximum water depth of 345 m. The fjord receives at present the riverine input of Aysén, Pescado, Condor and Cuervo rivers, which drain the surrounding up to 2000 m high Patagonian Andes. The fjord is crossed by a number of faults associated to the seismically active Liquiñe-Ofqui Fault Zone, a major trench parallel intra-arc fault system.

After a four-month period of moderate seismicity, an Mw 6.2 earthquake on 21 April 2007 triggered dozens of subaerial landslides along the fjord flanks. Some of the landslides reached the fjord water mass, generating a series of tsunami-like displacement waves that impacted the adjacent coastlines with 3-12 m, locally over 50 m high run-ups, causing ten fatalities and severe damage to salmon farms. The research cruise DETSUFU on board BIO Hespérides in March 2013 mapped the submerged morphology of the fjord and gathered air-gun seismic profiles and sediment gravity cores in order to characterise the footprint of the landslides in the fjord floor.

Very-high resolution multibeam bathymetry (4 m cell size) clearly shows the deformation structures created by the landslides in the inner fjord. The landslides descended and accelerated down the submerged fjord flanks, and reached the fjord floor at approx. 200 m water depth generating large, 1 to 10 m deep impact depressions. Sediment removed from these depressions moved radially and piled up in deformation rings formed by compressional ridges 10-15 m in height, block fields and a narrow frontal depression. Up to six >1.5 square km of these structures can be identified in the fjord.

In addition, the DETSUFU survey extended beyond the SE-NW-oriented inner fjord past the Cuervo Ridge, located in front of the Cuervo river delta. The ridge, previously interpreted as a volcanic transverse structure, has most probably acted as a limit for grounding ice in the past, as suggested by the presence of melt-water channels lateral to the ridge. Beyond the ridge, the fjord smoothens and deepens to more than 330 m forming an enclosed basin before turning SW. There, it shallows back across a field of streamlined submerged hills of glacial origin. The external Aysén fjord, before joining to Canal Costa and Canal Moraleda, is characterized by three volcanic cones, one of them forming Isla Colorada – which also acted as a glacial limit – and the other two totally submerged and previously unknown. The largest one is 160 m high, 1.3 km in diameter and tops at 67 m water depth. This data set illustrates the complex interaction between fluvial, glacial, tectonic, volcanic and gravity processes and evidences the recent lively geological history of Aysén fjord.