Petrography, structural geology, geochemistry and metamorphism of the rocks in the eastern Fitz Roy foothills in Patagonia, Argentina

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The subject of this work is the eastern fore land of the Chaltén Plutonic Complex (CHPC) in the Argentinean Patagonia. The study area encompasses the region between the Cerro Polo in the east and the intrusive contact of the Miocene CHPC in the west. The studied zone is situated in the back-arc region of the Andean Cordillera and is part of the inner Andean Fold and Thrust Belt.

Predominant are Jurassic volcanic rocks from the El Quemado Formation. They cover the sediments from the Paleozoic Bahía de la Lancha Formation in the Cerro Polo area. More to the west, they form the crests of the Loma de las Pizarras mountain chain. At the Loma de las Pizarras, the Jurassic volcanic rocks have been overthrusted on the black shales from the Cretaceous Rio Mayer Formation. In the Laguna Sucia, the Jurassic volcanic rocks mainly form the base outcrops on the southern slope, on which Cretaceous sediments overlay. But there are also large volumes of these rocks, which have been overthrusted on the Cretaceous sediments. Towards the CHPC intrusion in the Laguna Sucia, the Jurassic and Cretaceous rocks enter in contact with Miocene tonalites. Different generations of dykes are mainly present in the Cretaceous sediments of the Loma de las Pizarras. The large-scale structures in the Laguna Sucia and Loma de las Pizarras areas are mainly east vergent thrusts. They are linked to the eastward migration of the Patagonian Fold and Thrust Belt, which has affected this zone in Oligocene times. The lithological and structural observations have served to design a geological and tectonic map. This is the basic part of this work.

The second part consists of geochemical studies. Whole rock major and trace element and stable isotope measurements have been made. Most of the Jurassic volcanic rocks are highly siliceous with SiO_2 wt% above 72% and have been classified as rhyolites. Volcanic tuffs are mainly present in the eastern part of the study area, and have also rhyolitic compositions. High Al_2O_3 wt%, high incompatible trace element and low compatible trace element contents underline an important crustal melt input for these rocks. Rhyolites have extremely high $\delta^{18}O$ values around 12‰, which are linked to influence of metamorphic fluids. Higher values in altered volcanic tuffs are linked to low T hydrothermal fluid circulations. Another peculiarity is the presence of high CaO wt% in the volcanic rocks. However, this is mostly linked to low degree hydrothermal alteration. The Cretaceous sediments are mostly siliciclastic with SiO_2 wt% above 60% and locally contain organic material and marine fossil shells. Sediments usually have $\delta^{18}O$ values around 16‰. The composition of the sediments suggest, that they are mostly derived from the Jurassic volcanic rocks. This is coherent with the regional paleotectonic settings, where the formation of a back-arc basin with clastic infill derived from adjacent rocks has begun after ceasing of Jurassic syn-rift volcanism. Stable isotope compositions have also been measured on quartz and poly-phase veins, in order to establish geothermometers. However, only one geothermometer of a vein in Jurassic volcanic rocks could have been calculated, resulting in a temperature of 260°C ±38°C.

The third part of this work considers the metamorphic record in the Cretaceous sediments and Jurassic volcanic tuffs. Two types of metamorphism are recorded in the area: The area between the eastern Laguna Sucia and the Cerro Polo shows low-degree regional metamorphic features. In the Laguna Sucia, an approximately 1.5km large zone in the Cretaceous sediments (and veins in Jurassic rhyolites) contains contact-metamorphic minerals. For the evaluation of the regional metamorphism, studies on the illite crystallinity have been achieved. Measurements on the Scherrer width and numerical simulations with peak deconvolution have been made. The resulting metamorphic degrees reach from anchizone to anchizone-epizone in the area eastwards of the contactmetamorphic zone, with approximately 250°C/2.8kBar PT conditions. In the contact metamorphic zone, cordierites, followed by andalusites and finally garnets towards the intrusive contact indicate the metamorphic contact aureole.