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Program and Abstracts

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volcanic centers in the Southern Andean volcanic zone. We present preliminary results of a comprehensive GIS-based analysis of the alignment of volcanic centers and their correlation with upper crustal structures. Volcanic centers used for this purpose were compiled from published sources and satellite imagery in combination with topographic maps. Our systematic assessment shows a number of linear spatial assemblages of mostly monogenetic cones of basaltic composition trending NE-SW in the Loncopué trough, a pronounced topographic depression of the back arc. NE-SW-trending volcanic lineaments are at variance to the strike of prominent faults observed in the study area, but correspond to the principle shortening direction in the Southern Andes imposed by oblique plate convergence. This observation suggests that monogenetic volcanic centers, which are generally thought to have been fed from the mantle, formed by local NW-SE dilation of faulted crust under overall NE-SW compression. Consequently, maximum principal compression during basaltic volcanism in the Loncopué trough was horizontal rather than vertical, as is commonly believed. This calls into question the popular back-arc extension hypothesis for the Southern Andean volcanic zone.

3D seismic tomography and seismotectonics of the Ecuadorian margin inferred from the 2016 Mw 7.8 Pedernales aftershock sequence

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Based on seismicity recorded by the permanent Ecuadorian seismic network and our large emergency array installed shortly after the 2016 Mw 7.8 Pedernales earthquake, we derived a 3D velocity model of central coastal Ecuador using a local earthquake tomography. We manually analysed the seismic waveform recorded on the amphibious array to determine high quality P- and S-wave arrival times. Joined inversions for earthquake locations, velocity structure and, if applicable, station correction terms were carried out with increasing complexity from 1D to 3D.

From the tomography we imaged the subducting oceanic Nazca plate down to 50 km depth inferred by a high Vp feature dipping eastward. The distribution of the relocated seismicity is mostly distributed along the plate interface and allow us to identify the boundaries between the subducting and overriding plate. Changes consistent with the north-south transition from an accretionary to erosive regime were found. To the north, in the marine forearc section we image areas with high Vp/Vs contrast where seismicity close to the trench is located. This finding might suggest the presence of eroded or fractured wedge capable to trigger seismicity after a large megathrust earthquake. Also, we observe a low Vp region which might co-locate to areas where slow slip events have been identified. The southern section shows a wider zone of seismicity suggesting a thicker crust subducting beneath the continental plate that can be associated with the influence of the incoming Carnegie Ridge. The presence of this large bathymetric feature also adds buoyancy to the incoming oceanic crust and might affect the way how stress is released in this area. In the overlying continental crust, we observed clustered shallow seismicity in both northern and southern profiles which is located at the limits of high Vp/Vs bodies. Moreover, our results show how the Bahia Caraquez and Manta cluster, both registered after the Pedernales earthquake, surround a body that might correspond to a less consolidated area in the marine forearc. Finally, we can co-locate a high Vp/Vs body located in the east part of the southern section to areas that recorded high PGA during the Pedernales earthquake. Our results presented here highlight the heterogeneities of the subduction zone that might influence different stress release behavior over time and can coexist and interact even in a local to regional scale along the central coastal Ecuadorian margin.

Miocene volcaniclastic foreland basin infill next to the exhumed North Patagonian Andean Batholith: a record of collapse-caldera eruptions?

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The nature of Andean magmatism and their tectonic regimes results from variations in the angle of subduction of the Nazca and Antartic oceanic plates beneath South American plate. For the North Patagonian Andes, a flat slab type subduction was proposed to the middle Miocene. At one time, foreland basins were filled with tens of volcaniclastic materials that were distributed for more than 30.000 km2. In order to understand the relationship between tectonics and magmatic–volcanic system interactions, we analysis the Miocene volcaniclastic infill succession of a basin located next to the exhumed Andean Batholith.

The Collón Cura basin was configured between 16 and 14.4 Ma due to the uplift of the north Patagonian Andes towards the west and the Sañicó Massif towards the east, whereas the uplift of the North Patagonian Andes continues up to 4.8Ma. At the same time, a volcaniclastic succession of tuffs and lapilli tuffs were deposited into the basin with up to 150 m-thick that reach an estimated volume of ~1800 km3. The succession is limited below by an angular unconformity and above by a regional erosional unconformity and is characterized by three sections. The lower and upper sections are composed of ~50 - 70 m-thick of massive to roughly stratified and moderate-sorted vitric-rich lapilli tuffs. The middle section is characterized by 10 to 30 m thick of lenticular beds composed of massive, vitric-rich and moderately sorted lapilli-tuffs. Geochronological and magnetostratigraphic analysis constrain the volcaniclastic succession between 15.160 and 12.049 Ma and reveals that the whole succession has a normal polarity paleopole dated between 15.160 and 15.032 Ma, determining a maximum depositional time process of 128.000 years. Nevertheless, sedimentological features of the succession indicate that deposits were probably deposited even in a much shorter time span.

The deposition of the volcaniclastic succession was interpreted as short-term processes associated with PDC´s occurred during the main structural configuration of the basin that matches with the contractional flat slab regime. The volcaniclastic succession of the Collón Cura basin would record a huge volcanic eruption deposited by catastrophic events in a many or nested collapse-caldera scenario. The origin of the calderas would be genetically associated with Miocene igneous rocks of the North Patagonian Batholith, that was exhumed in the North Patagonian Andean axis after the flat slab regime.

Seismic processing strategy and crustal structure of the April 1, 2014 Mw 8.2 rupture area offshore Northern Chile from seismic reflection data

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The northern Chilean margin has long been recognized as an erosive margin, which has been active since the Jurassic. Along the Chilean trench system, material transfer changes from accretionary south of the Juan Fernandez Ridge (~33°S) to erosive in the north offshore Antofagasta (~23°S) and Iquique (~22°S). Because of its rich earthquake history and the systematic spatial variation in geologic factors that potentially affect megathrust rupture, the Chile subduction zone is arguably one of the best places on Earth to understand the effect of crustal structure and megathrust geometry on the behavior of continent-ocean subduction plate boundaries. On April 1, 2014, a magnitude Mw 8.2 earthquake ruptured the marine forearc offshore Iquique and Pisagua between 18.5°S to 21°S, covering an area spanning about 20% of the region previously referred to as a seismic gap. This event did not compensate the entire slip deficit and hence the continuous potential for a large rupture makes a close investigation of the fault slip zone timely.

In 2016 RV Marcus G. Langseth set out to acquire deep-penetrating, high-resolution seismic data in the 2014 rupture area during cruise MGL1610 under the framework of the PICTURES (Pisagua-Iquique Crustal Tomography to Understand the Earthquake Source) project. A grid of seismic reflection and refraction profiles were acquired to document the geologic structure of the upper and lower plates and the rheological properties of the boundary zone between them. Here we present first results from processing of line MC25, which is located in the southern part of the 2014 rupture area. Due to the starved sediment and strong signal, the seafloor multiple is quite strong in the shallow part. The shot interval of the raw data is 125 m, which leads to prominent aliasing in the original gather. To dismiss these aliased data, shot interpolation is applied in the raw data, leading the shot interval from 125m to 15.625m. As the result is not a multiple for the receiver interval, an irregular interpolator module was used to interpolate it to 12.5 m. After that, the shot gathers have no aliased components associated with them and meet the standard coordinate system. Several processing techniques are introduced with the aim to increase the signal/noise ratio. Focusing on the multiples, we utilize enhanced multiple suppression techniques, e.g., wave equation multiple attenuator, deterministic water-layer demultiple, interbed multiple predictor, anomalous amplitude noise attenuation, adaptive filter and multichannel dip filter to improve the imaging quality at greater depth.

Crustal deformation and loading effects in southern Patagonia

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GNSS observations well distributed over the Southern Patagonian Icefield (SPI) region have revealed rapid uplift with rates of up to 4 cm/a (Richter et al. 2016; Dietrich et al. 2010). The magnitudes and patterns of vertical and