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DIPARTIMENTO DI GEOSCIENZE

Seminario

Structural evolution of the Atacama Fault System: Deformation in a magmatic arc during oblique convergence

Martedì, 4 giugno – ore 16:30
Aula Arduino

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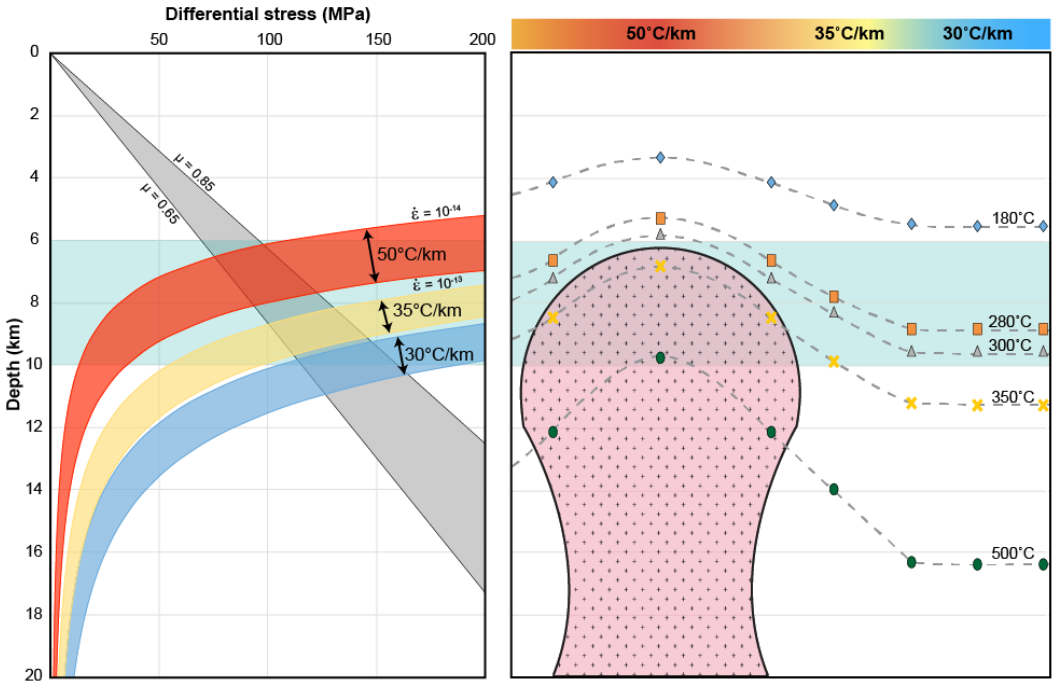

Abstract

The Atacama fault system (AFS) is a major Andean forearc structure that occurs within the Mesozoic Coastal Cordillera arc. Several authors have suggested AFS deformation is related to arc magmatism, however the specifics of that proposed relationship have not been clearly defined. Here we seek to establish the slip history of the AFS and understand how it relates to the fault system's position within the arc. We mapped along the northern ~70 km^2 of the El Salado segment of the AFS, documenting the distribution of arc plutons and style of deformation. Petrology, geochemistry, and geo/thermochronology were used to characterize and correlate plutons, and structural data were analyzed to understand progressive changes in the style of deformation.

New zircon U-Pb ages document a major pulse of magmatism from 150–120 Ma, with the most important plutons intruding between 135–124 Ma. Mylonitic fabrics are uniquely associated with the margins of Early Cretaceous plutons, and are cut by late kinematic intrusions at 120–107 Ma. A systematic ~12–8° counterclockwise angle between mylonitic foliation and brittle fault orientations indicate deformation occurred during progressive ductile to brittle sinistral strain. The distinctive syn-kinematic Cerro del Pingo tonalite was mapped on both sides of the El Salado segment. Petrography, geochemistry, and geochronology all overlap within error, and therefore this pluton is an offset marker along the AFS. The slip magnitude along the El Salado segment is ~49–60 km and occurred almost entirely between ~134 and ~110 Ma, for a slip rate of ~1.6–2.1 km/Myr. We postulate that thermal softening as a result of Early Cretaceous pluton intrusion into the shallow crust locally elevated geothermal gradients to ~50°C/km, allowing for ductile deformation at ~5–7 km. Zircon (U-Th)/He ages record cooling through ~180°C by 116–99 Ma and relaxation of elevated gradients coeval with the end of slip along the El Salado segment. Together, these data document the development of the AFS as a highly segmented fault system that slipped at a slow rate over ~20 Myr, and was abandoned as plate motion vectors shifted in the middle Cretaceous and arc magmatism migrated eastward.

Proponente: **Giulio Di Toro - Rodrigo Gomila**