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# Evaluating the role of the upper-plate tectonics on the position of arc volcanism.

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## Résumé

The position of arc volcanism in subduction zones is thought to be primarily controlled by deep thermal processes, but these alone hardly explain the position of the arc at the surface. For instance, various arcs are aligned along major geological structures, such as the Great Sumatra Fault in Indonesia, which suggests a first-order tectonic and structural control. To date, no study has evaluated, at a global scale, the role of the tectonic regime of the overriding plate in controlling the arc position.

In this study, we propose to test this relationship for present-day subduction zones by building two global datasets. First, we accurately characterize the position of the Holocene arc relative to the trench and to the subducting plate using Slab 2.0 (Hayes et al., 2017). Second, we estimate the state of stress in the vicinity of the arc based on the inversion of focal mechanisms compiled from global and regional catalogs. Based, on the direction of the principal stresses, we develop a strategy to classify the arcs into 7 tectonic regimes with compressive, extensive, and strike-slip settings, as well as intermediate regimes. This new global database provides a finer update of tectonic regimes at volcanic arcs than previous studies.

In regions such as those from the Mariana Islands to the southern Kuriles and the Tonga-Kermadec subduction zones, we show that slab-top depth beneath the volcanic front (i.e., the volcanoes closest to the trench,  $H_{arc}$ ) increases with slab age and decreases with increasing subduction velocity. These correlations suggest a deep-thermal control for these regions. On the contrary, the lack of correlation in other subduction zones, such as Indonesia, or their inconsistency suggests additional controlling factors. For instance, in some regions such as Mexico-Central America and the Ryukyu-Nankai arcs,  $H_{arc}$  values behave differently depending on the tectonic regime, which may suggest a tectonic control:  $H_{arc}$  values tend to be slightly lower in extensional settings compared to compressional ones.

**Mots-Clés:** subduction, arc volcanism, tectonics

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