Aleutian

Interpretation (based on geologic data, plate reconstructions, seismic tomography, geodynamic modelling)

The Aleutian subduction zone initiation event formed today's active Aleutian trench. The onset of the subduction zone likely occurred at around **53 Ma** (Davis et al., 1989; Jicha et al., 2006) when the Pacific and Kula plates began to subduct northward, and at some point, under the overriding continental plates of northeast Siberia and North America.

The Aleutian SZI event was possibly instigated as a **subduction polarity reversal** associated with the arrival of an intraoceanic arc (Olutorsky arc) to the Okhotsk-Chukotka-Beringian margin of northeastern Asia and northwestern North America (Scholl, 2007; Domeier et al., 2017; Vaes et al., 2019), and therefore may have formed close to (i.e., at a distance of around 300 km) a pre-existing convergent plate boundary. Vaes et al. (2019) have speculated that the Aleutian trench may have exploited a pre-existing transform boundary in a possible backarc behind the Olutorsky arc. Those authors have furthermore pointed out that arc volcanics with ages of 54.4 Ma to 50.2 Ma have been dredged from the Beringian margin (Davis et al., 1989), and note that the Aleutian SZI event could also be seen as the outboard jump of that Beringian subduction zone.

Direct evidence (based on direct measurements)

The oldest rocks in the Aleutian arc are andesites dredged from Murray Canyon (Jicha et al., 2006) and primitive basaltic rocks from Medny Island, both of which are 46 Ma (Minyuk and Stone, 2009).

Reconstruction (based on reference model by Müller et al., 2016, AREPS)

In the model of Müller et al. (2016), the Aleutian SZI event occurs at 55 Ma, by the outboard (southward) jump of a pre-existing Kamchatka-Alaska subduction zone; this jump ranges from less than 100 km in the east to ~500 km in the west. The Olutorsky arc is not implemented in this model (nor is any other intra-oceanic arc in this region at this time), but instead a regional plate reorganisation event is temporally paired to subduction of the Izanagi ridge. This plate reorganisation occurs at 55 Ma, and includes both a re-direction of the Pacific plate (from NW-directed to N-directed) and an acceleration of the Kula plate's northward drift.

Seismic tomography (based on Vote Maps of 10 seismic tomography models and the Atlas of the Underworld)

Seismic tomography reveals a slab attached to the trench and reaching a maximum depth of around 700 km (van der Meer et al. 2018).

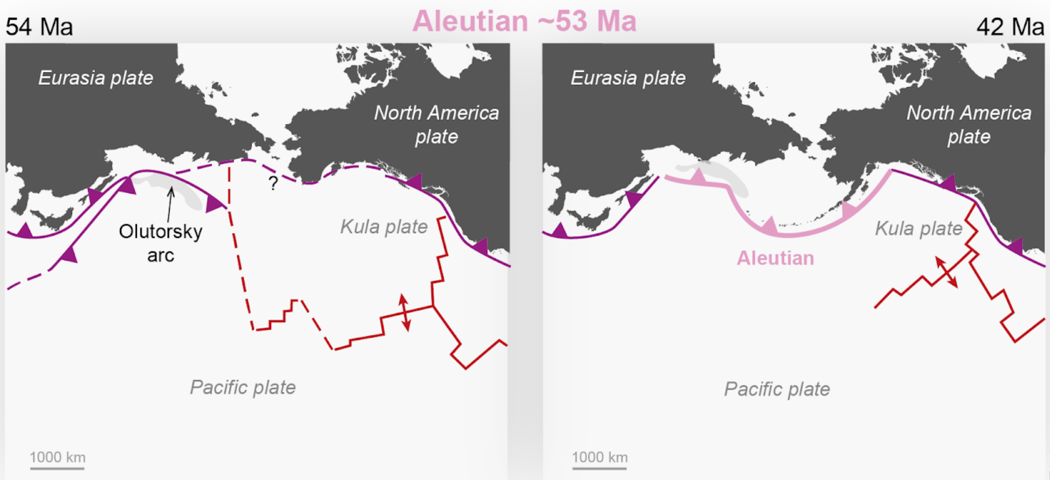

Figure. Schematic tectonic reconstruction of the Aleutian SZI event (modified from Domeier et al., 2017). The collision of the Olutorsky arc with the trench of the south-dipping subduction of the Eurasia plate below the Pacific Plate is suggested to have caused a flip in subduction polarity, initiating the new Aleutian subduction zone. Shown are the new subduction zone (pink line), other active (solid purple lines) and inactive (dashed purple lines) subduction zones, spreading ridges (solid red lines), and transform faults (red dashed lines).

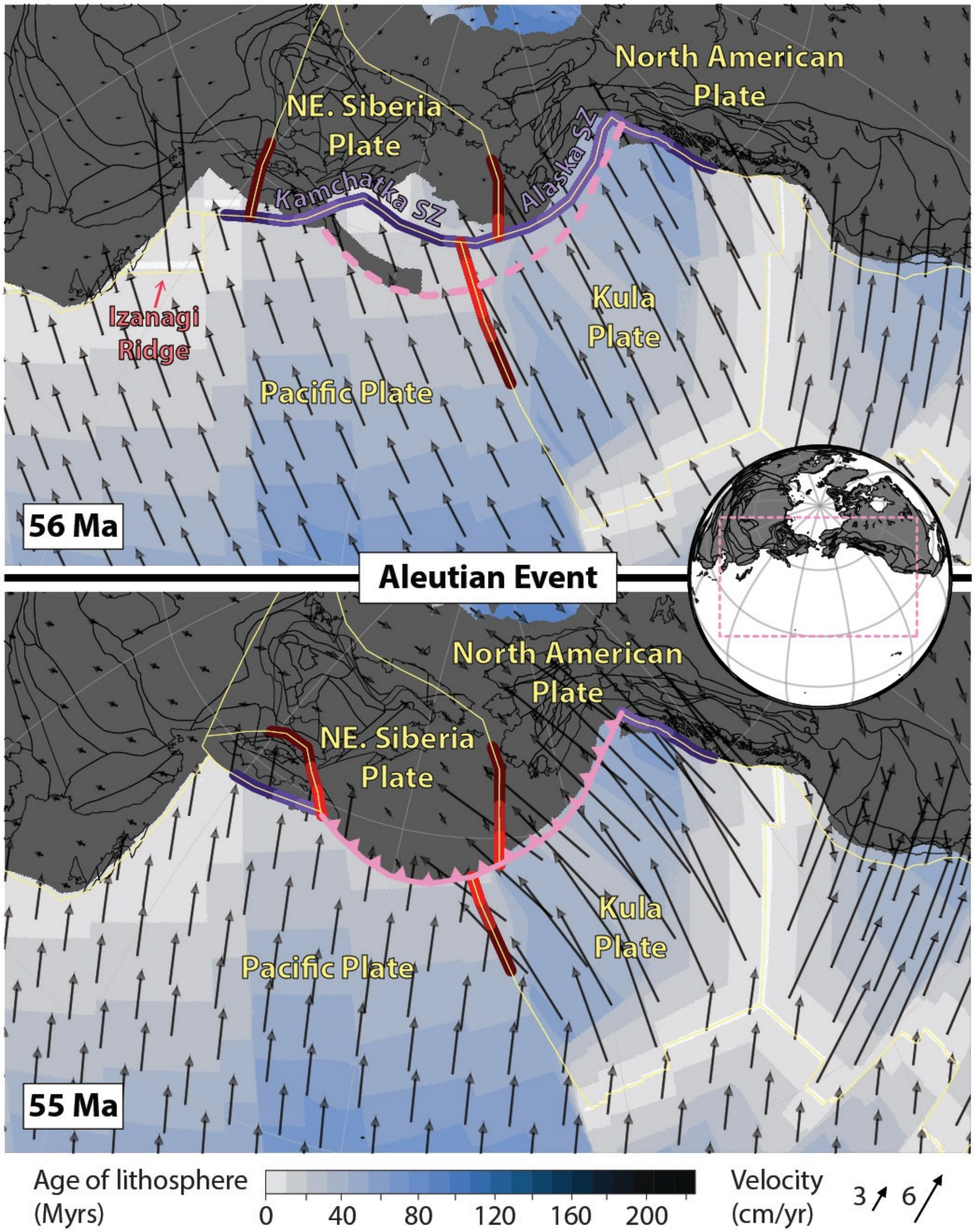

Figure. Aleutian SZI event as reconstructed in the model of Müller et al. (2016). Pink dashed (solid with teeth) line shows the Aleutian trench 1 Myr before (at) SZI time in the model. Purple (red) lines show segments of neighbouring subduction zones (ridges and transforms) that lie within some radius of the Aleutian trench (pink line); the brightness of the colours reflects 3 different distance thresholds of 250, 500 and 1000 km.

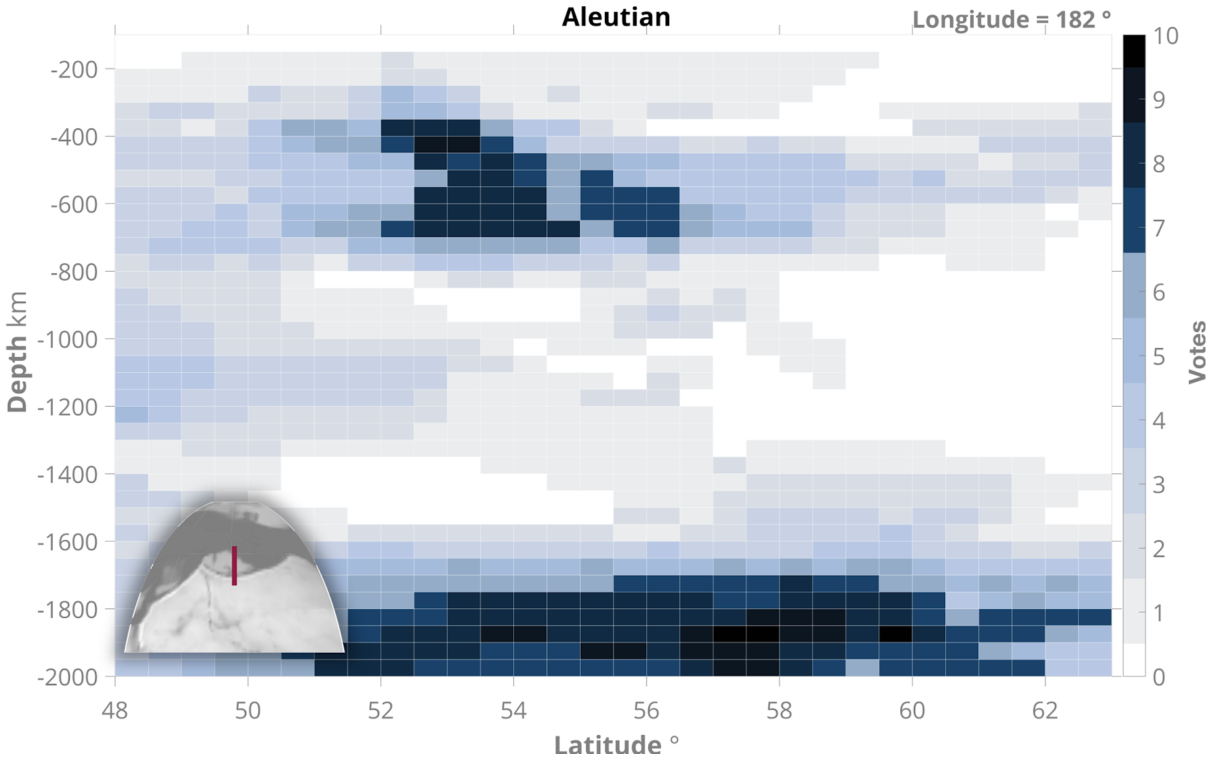

Figure. Seismic tomography VoteMap (Shephard et al., 2017) analysis of the Aleutian SZI event.

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