THE CASE FOR CONSIDERING THE ENTIRE ALEUTIAN SYSTEM

John C. Eichelberger[1], Evgeny I. Gordeev[2], Stephen H. Kirby[1]
1. U.S. Geological Survey
2. Institute of Volcanology and Seismology, Far East Division, Russian Academy of Sciences
Email: jeichelberger@usgs.gov, gordeev@kscnet.ru, skirby@usgs.gov
Sites: Commander Islands, Kamchatka Pass, Kamchatka Cape
Themes: #5: Subduction initiation and evolution; Also: Generation of magma, earthquakes and tsunamis in relation to subduction geometry and dynamics; Accretion; Subduction-subduction collision
Discovery Corridor: Aleutian-Kamchatka collision zone

The Draft Implementation Plan for GeoPRISMs' Subduction Cycle and Deformation program observes that one of the scientific attractions of the Aleutian subduction zone, in addition to intense seismic, deformational, and volcanic activity, is the along-strike systematic variation of

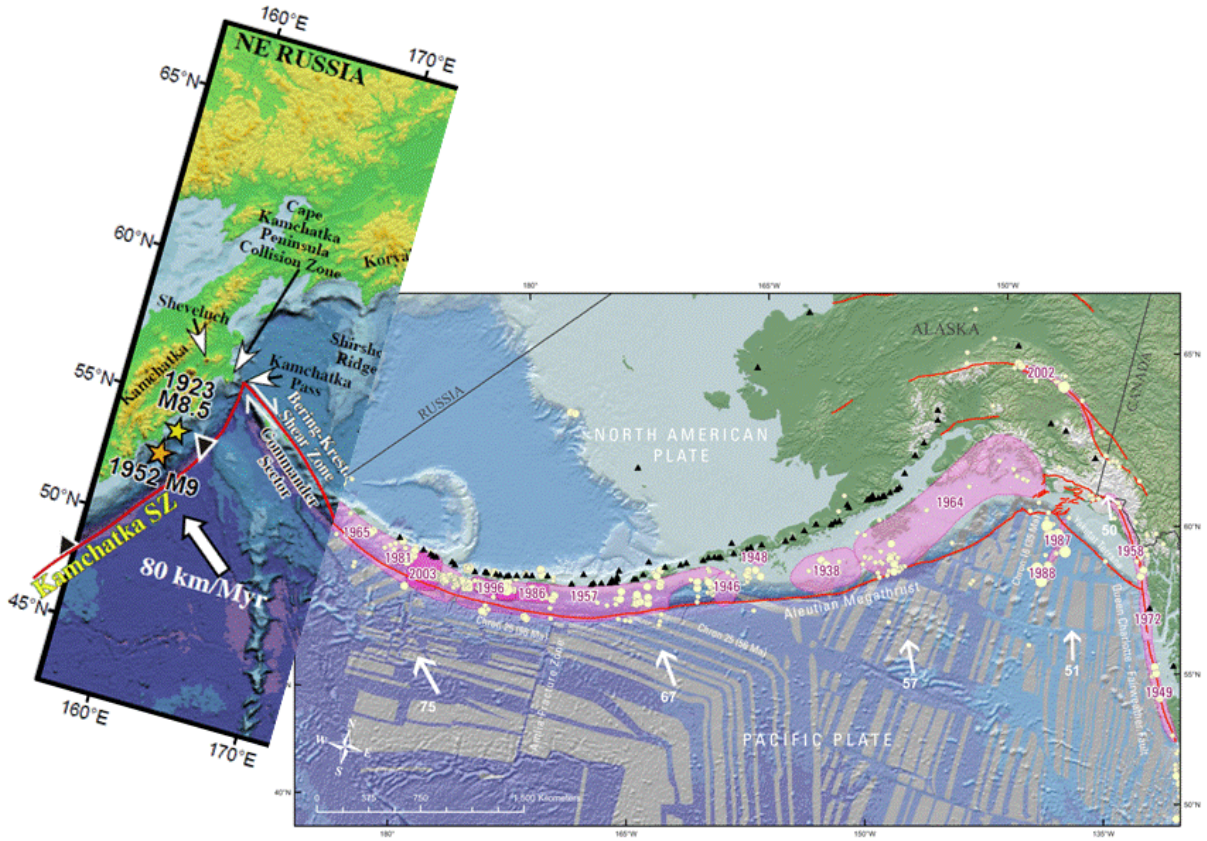

Figure 1: The American portion of the Aleutian subduction zone (from GeoPRISMS Draft Implementation Plan: 2. Subduction Cycles and Deformation) with the Russian portion superimposed (after Scholl, 2007). The latter segment includes the final transition from a convergent to predominately strike-slip plate boundary, and the collision of the Aleutian volcanic arc, here coupled to the Pacific plate, with the Kamchatka Peninsula.

parameters of subduction. These parameters include the angle between convergence and the plate boundary, transfer of arc coupling from one plate to the other, width of the arc-trench gap, the composition and thickness of the overriding plate, and the amount of sediment load in the trench.

The consequences of these characteristics for intensity and frequency of large earthquakes, the likelihood of great tsunamis, and the composition and flux of magma can thus be evaluated. These variations do not, however, stop at the international border of the United States with the Russian Federation. The subduction zone continues through the Commander Islands to its orthogonal collision with the Kamchatka subduction zone. There, the consequences of collision appear to include accretion of Aleutian arc material as capes, prodigious volcanism, and back-arc rifting of the Kamchatka Peninsula.

There are two issues pertaining to the Russian portion of the Aleutians, the Commander Sector, that are especially relevant to answering outstanding problems posed in the Draft Implementation Plan. One is the relationship of subduction structure to the composition of magmas being generated. The plan suggests that unusual composition of magmas in the west arise because of oblique convergence (and perhaps also an exposed, torn slab edge). An evaluation of this hypothesis should include the Commander Islands, as well as submarine Piip volcano and other submarine activity that may yet be discovered.

A second problem, one that represents Theme 5 of SCD, is the initiation of subduction. If the arc massif is forming in the dominantly convergent portion of the arc and then being torn and rafted by the Pacific plate towards Kamchatka, then the earliest record of Aleutian subduction lies in the Commander Islands and perhaps the Kamchatka Cape. It would seem difficult to develop a comprehensive view of the evolution of this subduction zone without including these features in the research.

From a hazard assessment, monitoring, and risk mitigation perspective, there is much to be gained by considering the entire system through bilateral collaboration, and much to be lost by not doing so. This is important for the relatively small but valued communities of the northern Pacific and for the much broader Pacific basin subject to Aleutian-launched tsunamis as well. One goal of bilateral collaboration should be the real-time exchange of seismic and deformation data, thereby improving early detection and characterization of hazard events.

The Russian Academy of Sciences, NSF, and USGS have a two-decade long history of highly productive collaborations in the Kamchatka region, encompassing both basic science and hazard monitoring. There also exists a wealth of information from the Soviet era, when Kamchatka was viewed as a natural laboratory for the study of volcanoes and earthquakes.

Without exception, tasks proposed in the Draft Implementation plan for Alaska should be extended to the entire Aleutian system: A) Data synthesis; B) Mapping, paleoseismology, seafloor sampling; C) Geochemistry and geochronology; D) Geophysical studies; E) Geodetic field campaigns; and F) Geodynamic modeling. In some cases, for example tephra and tsunami geochronology, such work is more advanced in the Russian portion of the system than the American. It would also be beneficial to target the Aleutian-Kamchatka collision zone as a Discovery Corridor, where ongoing accretion, deformation, and eruption are dramatically displayed.

Some territorial and political sensitivities in relations between our two countries remain, particularly in the area of ship-based observations. But if we work together and acquire the endorsement of our respective leaders at a sufficiently high level (this has already occurred in the area of disaster response and a dialog is beginning for geological hazards), there is reason to

believe that the result can be a collaborative bilateral effort to understand the entire Aleutian system and the hazards associated with it. This will be an important contribution to subduction science and ultimately to the resilience of northern Pacific communities.

References

Scholl, D. W., Viewing the tectonic evolution of the Kamchatka-Aleutian (KAT) connection with an Alaska crustal extrusion perspective, in Volcanism and subduction the Kamchatka region, J. C. Eichelberger , E. Gordeev, P. Izbekov, M. Kasahara, and J. Lees, eds., Amer. Geophys. Union, Monogr. 172, 3-35, 2007.

Eichelberger, J.C., D.W. Scholl, E.I. Gordeev, Aleutian subduction: A scientific opportunity whose time has returned, MARGINS Newsletter, 22, 9-12, 2009.