Striation process at subduction zones of terrestrial planets

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We consider the basic nature of dynamics at zonal convergence boundaries between separate lithospheres on the terrestrial planets.
In this study the surface of the terrestrial planet considered is covered with several spherical rigid lithospheres having non-negligible individual horizontal motions relative to the deeper planetary structure.
We can analyze the basic aspects of various features at lithosphere boundary zones using the classical concept of plate tectonics.
Smaller-scaled convex topography and/or irregular shallow structure of the underthrusting-side lithosphere at the contacting interface of the consuming boundaries would cause a sort of striation (or wear-related) process with the elastic and inelastic deformation.
The continuous striation process should record the direction of the relative lithosphere motions on the planer interface.
However, in the case of tightly coupled boundaries with the intermittent history of greater seismic events, the striation process may not be a steady state problem.
On the earth, a large number of marine surveys have been unveiling the detailed characteristics of both the topography and sub-surface structure of oceanic lithospheres around subduction zones.
Recent studies of sophisticated multichannel seismic prospecting identified fine-scaled non-uniform topography of the plate-interface just beneath the fore-arc overriding lithosphere at the Japan trench and Nankai trough subduction zones, etc.
Using engineering methods and survey results, we can decode the details of the strain-rate dependent (seismic/aseismic) striation process on the lithospheric-interface with the local convex topography etc. at the terrestrial subduction zones.
For the striation process, we should incorporate the effect of both the spherical bending and subsequent buckling of the downgoing-side lithosphere with the age-dependent EET (effective elastic thickness).
Although the spherical buckling at the consuming boundary requests a specific geometry of surface curvature mainly depending on the EET, the past tectonic history including the deeper material flow regime etc. would also influence the three dimensional morphology of the downgoing lithosphere.
Furthermore, the difference of the elastic constants between the overriding and underthrusting lithospheres may affect dynamically on the striation and on the other seismological phenomena.
We then discuss mathematically the strain-rate dependent striation process using a simplified mechanical model for the larger inter-lithosphere seismic events.

Keywords: striation process, wear, inelastic deformation, spherical buckling, subduction zone

