Computer model of underthrusting and subduction under conditions of the gabbro-eclogite transition

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Within the frame of mechanics of deformed solid body the mathematical models of underthrusting and subduction have been developed. The underthrusting/subduction of oceanic plate under absolutely rigid body (continental lithosphere) was modeled in approximation of the 2D plane strain state. It was assumed that the oceanic lithosphere is a uniform slab, which was subjected to lateral convergence with a rate of 1.375 cm/yr. The domain simulating a detachment was bounded by the contact between the converging blocks, one of which was set as a rigid immobile buttress with a given slope of the contact.

The principal difficulties in mathematical modeling of subduction processes are related to considering the substantial nonlinearity of equations for the mechanics of deformed solids (MDS) for an adequate description of real geological processes. One can recognize three main (physical, contact, and geometric) types of nonlinearity of MDS equations. The mathematical modeling was carried out with a MSC.Marc 2005 software that takes into consideration the required types of nonlinearity of MDS equations. The geometric modeling and stepwise integrations were performed with the MSC.Patran 2005 and MSC.Marc 2005 software packages, respectively.

The different models developed with elastic-plastic rheology allow to describe the realistic behaviour of lithospheric plates pushing together. The computer models enabled to establish that the gently pitching subduction or underthrusting were performed under different regimes depending on initial heterogeneity at the crust-mantle boundary. The subduction with consideration for eclogitization has no need of an arbitrary assigned speed of "sucking" plate into the mantle, as it was done in other models. As evident from the modeling, the plate downsinking into the mantle occurs even if assigned speed of moving plates is the order of 1 cm/year. The model results of underthrusting and subduction dynamics allows us to compare the design position of plate/sublithosphere mantle contact with the seismotomographic images of the lithosphere structure in collision regions.

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Diel biogeochemical processes in the cyanobacterial-impacted Klamath River, Oregon, USA

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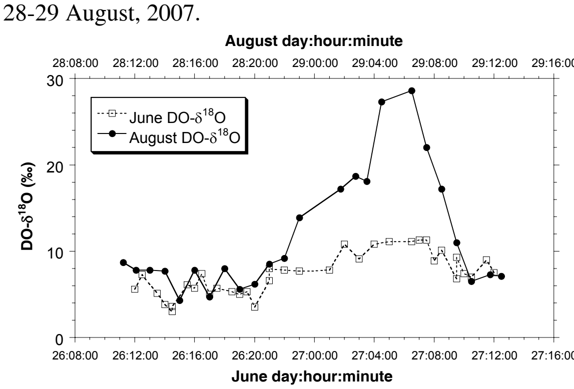
Poor water quality (e.g. dissolved O_2, ammonia, pH, chlorophyll *a;* Mrazik [1]) occurs in the Klamath River (http://or.water.usgs.gov/proj/keno_reach/), especially during the summer when cyanobacterial algae (*Aphanizomenon flos aquae*, AFA) proliferate. To investigate the factors and processes responsible for the poor water quality, this study has examined in-stream biogeochemical processes by measuring nutrient concentrations and stable isotope compositions of dissolved O_2 gas (DO-δ^{18}O) and dissolved inorganic carbon (DIC-δ^{13}C) on a diel time scale during 26-27 June, 2007, and 28-29 August, 2007.



DO-δ^{18}O shows a weak diel cycle in June, and a strong diel cycle in August. DIC-δ^{13}C (August only) shows little or no diel cycle, but has light values (-17.5 to -14.2‰). Dissolved nutrients show a morning peak in June, but little or no diel variation in August.

Diel cycles of DO-δ^{18}O and nutrients are predominantly controlled by varying rates of gas exchange vs. photosynthesis vs. respiration, as described by previous studies e.g. Parker *et al.* [2]. Other factors include the presence of high concentrations of AFA, the ability of AFA to migrate vertically and to aggregate/disaggregate, and the slow-moving nature of the river, which inhibits gas exchange with the atmosphere, resulting in possible small-scale chemical and isotope heterogeneity.

[1] Mrazik (2007) *OR Dpt. Env. Qual.*, DEQ07-LAB-004-TR, 13p. [2] Parker *et al.* (2005) *Env. Sci. Tech.* **39**, 7134-7140.