Geodynamics Seminar

第301回ジオダイナミクスセミナー

Seismological and mineral physical joint modeling on seismic anisotropy above/below D” discontinuity beneath the Antarctic Ocean

Speaker : Yusuke　Usui

(Global COE Postdoctral Fellow, GRC)

主催：愛媛大学地球深部ダイナミクス研究センター
日時：7/15（金）午後 4時30分～
場所：総合研究棟4F　共通会議室

Abstract

Seismic anisotropy in the D” layer can provide a seismic signature to the lowermost mantle flow invisible to other methods such as tomographic studies. Shear wave splitting with a delay of the longitudinal component (SV) relative to the transverse component (SH) has been observed in various places of the D” layer. The anisotropy is considered to be the transverse isotropy with vertical axis of the symmetry. Lattice preferred orientation (LPO) of anisotropic minerals, which are subjected to shear stress, as expected to occur in the lowermost mantle, has been proposed as the explanation of the anisotropy.

$MgSiO_3$ post-perovskite (PPv) is thought to be the most abundant mineral component in the D” layer. The observed anisotropy as mentioned above, i.e., $V_{SV} < V_{SH}$, could be produced by vertical alignments mainly of [001]. PPv is likely to be the origin of the anisotropy. On the other hand, MgO, which is expected to be secondary abundant phase, is also very anisotropic. This phase could be another likely candidate for the origin of the anisotropy. For more understanding of the anisotropy, it is necessary to examine the elasticity not only single phase but also two phase mixture such as (PPv + MgO), under the lowermost mantle conditions.

Furthermore, the phase transition boundary may not be the same as the anisotropic boundary. MgO can produce the anisotropy even above the D” discontinuity. However the depth from which anisotropic region starts in the lowermost mantle is still unclear. It is necessary to investigate the depth distribution of the anisotropy carefully. Pv and MgO should be considered to explain the anisotropy above the D" layer.

In order to clarify the anisotropy, the seismological and mineral physical (in particular first principle calculations) joint modeling would be an important approach. Here, I first show the observations of the seismic anisotropy even above the D” layer and determine the anisotropic velocity structure based on the waveform modeling. Then I show the results of the mineral physics modeling using elastic properties of (Pv + MgO) and (PPv + MgO) polycrystalline aggregates. This modeling helps us to know likely LPO directions and predictions about the degree of LPO.

詳細は当センターホームページ: http://www.ehime-u.ac.jp/~grc/をご覧ください
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Geodynamics Seminar

第301回ジオダイナミクスセミナー

Developments of large 6-6 type compression for high-pressure neutron diffraction

Speaker :Akihiro Yamada
(Global COE Postdoctral Fellow, GRC)

主催：愛媛大学地球深部ダイナミクス研究センター
日時：7/15（金）午後 4時30分～
場所：総合研究棟4F　共通会議室

Abstract

Japan Proton Accelerator Research Complex (J-PARC) is a newly constructed institute which provides the most intense neutron beam in the world (still not got to maximum intensity). Neutron diffraction provides us different information from x-ray diffraction because the scattering and absorption cross section are fairly different from each other. Specifically, the information about hydrogen can be directly obtained from neutron diffraction, which is almost impossible to be seen by x-ray diffraction. The interest for the field of Earth science is how hydrogen (water) behaves in the mantle minerals and the melted phases at high pressure and temperature such as deep Earth's interior. In order to investigate it *in situ*, high-pressure and temperature technique with neutron source must be developed. To cover the Earth's mantle P-T condition, the 6-6 type compression, which has been originally developed by Chicago University and GRC groups, is a promising technique for the high-pressure experiment using a cubic-anvil apparatus in terms of switching of anvils, the alignment and cost for the anvils. In the high-pressure neutron diffraction experiment at J-PARC, the present technique will be one of the most powerful tool as well as 6-8 type compression. Although the use of the 6-6 type technique for the synchrotron x-ray diffraction is spreading to many users, it can not be used for the experiment using neutron source with no modifications of the assembly because of the large difference in the property of the sources such as the beam intensity, interaction with samples, radioactivaion of the materials and so on. In particular, large-volume sample (~f3 × 3 mm) is essential for the achievement of high-quality neutron diffraction due to the weak scattering intensity of the sample. In order to make the sample volume larger, large 6-6 type assembly (anvils and the guide) has been developed. So far, we have achieved the generation of P-T condition up to < ~10 GPa and 1500 K with adequate volume sample. Further details on the technical developments of large 6-6 type compression for high-pressure neutron diffraction will be introduced.

詳細は当センターホームページ: http://www.ehime-u.ac.jp/~grc/をご覧ください
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