Shear wave splitting measurements in South Kamchatka during 9-year period (1993-2002) are used to determine anisotropic properties of the subduction zone and variation of fast S-wave polarization azimuths ($\phi$) in time. The local small seismic events recorded at the Petropavlovskaya IRIS station (PET) were analyzed. Seismic records of events with $K < 10.5$, depths up to 310 km and epicenter distances less than 100 km from PET are used. Since crustal seismicity beneath PET is comparatively low, the earthquakes associated with the submerging Pacific Plate prevail in seismic records. All large events ($K \geq 12$) are located at the distances greater than 100 km from the station. The largest Kronotsky Earthquake (12.05.1997; $M = 7.7$; 54.95°N, 163.23°E) is located at a distance of 340 km from PET.

The results of study show that anisotropic properties of medium vary with depth (Fig.1). The dominant azimuths of the fast shear wave polarizations for 9-year period are defined within N90°E±20°, which are consistent with the direction of the general motion of the Pacific Plate. Maximum values of normalized time delays are observed for the events within 50-60 km and 90-150 km depth intervals, and also for the events with back-azimuths of eastern directions. Time delay for events deeper than 200 km reveals the smallest values. Modeling of fast shear wave polarizations shows that HTI model with the symmetry axis oriented northward fit well the observed data of events within upper 80 km in depth. For events within the 80-~120-km depth interval, HTI model and orthorhombic (ORM-1) model with axis [100] oriented along azimuth of 295° with dip angle of 67°, axes [010] and [001] are directed to east (86°) and south and dip of 20° and 10°, respectively, satisfy the data. Analysis of fast azimuths reveals their temporal variation. The most regular variations in $\phi$ are observed for the deep events (80-~120 km) with a period of about 400-~600 days over 9-year period. The fast polarizations of crustal events behave comparatively stable. For the deepest events (120-~310 km) dominant fast azimuths vary with time (Fig.2): $\phi$ is oriented north during 1993-1995, east during 1999-2000, along N and E during 1996-1998, and along NE and SE during 2001-2002. It is observed uniform scattering of $\phi$ with back azimuths within back-azimuth intervals 0~50° and 200~230°, whereas, out the intervals, the direct dependence between $\phi$ with back azimuths is detected. Anisotropy of the medium is approximated by TI model with symmetry axis directed along azimuth of 280° and dip angle of 60°, and orthorhombic model (ORM-2) with axis [100] oriented along azimuth of 135° and dip angle of 76°, axes [010] and [001] are directed westward (268°) and northward and dip of 10° and 10°, respectively. It is assumed that temporal variations of $\phi$ are connected with stress regime changes (principal stress component ratio changes) which may lead to the symmetry axes swinging.
Fig. 1 Distributions of observed fast $S$-wave azimuths for all events and events of four depth intervals over the 9-year period. Gaussian approximation of the fast azimuths is plotted by the solid line on the histograms.

Fig. 2 Distributions of observed fast $S$-wave azimuths of deepest events for different time intervals (a), and observed fast azimuth projected onto the horizontal plane following their ray azimuths and incidence angles (b). The circle in (b) corresponds to the contour of ray incident angles of 45°.