

# Secular Change of Elastic Constants Estimated using Tidal Strains

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Amplitude and phase of each tidal component observed at the 800m-deep borehole showed secular change. Time change of tidal constant was caused by change of physical properties in the surrounding crust. In this study, we calculated elastic constants using the observed and predicted tidal strains. It is considered that changes of elastic constants around the borehole were caused by change of pore pressure and healing of fractures.

800m-deep borehole is located in 500m southeast of the Nojima fault. Three strainmeters (Str\_U: N21W-S21E, Str\_M: N81E-S81W, Str\_D: N39E-S39W) were installed at the bottom of the borehole. Continuous observation of strain change has been performed at the borehole since May 1996. We calculated tidal constants every year by applying the tidal analysis program 'BAYTAP-G' (Tamura et al., 1991) to the observational data of strain. Amplitude and phase of each tidal component showed gradual secular change in the period from 1997 to 2000. Particularly, tidal amplitudes of Str\_M increased by 20 - 50%, and tidal phases of Str\_U changed by 30 - 100degrees. Rapid change of tidal constants occurred in 2000. Tidal amplitude of Str\_U and Str\_M in 2000 showed ascendance by 100% or more and descent by 10 - 40% for a year, respectively.

Elastic constants were estimated by using the observational data of strain and the tidal strain predicted by GOTIC2 (Matsumoto et al., 2001). In the 2-dimensional elastic body, 3 components of strain ( $\epsilon_x$ ,  $\epsilon_y$ ,  $\epsilon_{xy}$ ) can be expressed by using 3 components of stress ( $\sigma_x$ ,  $\sigma_y$ ,  $\sigma_{xy}$ ) and a symmetric matrix  $[c_{ij}]$  with 6 independent elastic constants. When direction of x axis was NNW - SSE or WNW - ESE,  $c_{11}$  had the maximum value. It is considered that major part of fractures in the surrounding crust intersects the Nojima fault, which has the strike in the northeast-southwest direction, by about 45degrees. The  $c_{11}$  and  $c_{22}$  increased gradually in the period from 1997 to 2000. It is considered that healing of fractures reduced disturbance of tidal force due to fractures and caused ascendances of  $c_{11}$  and  $c_{22}$ . The  $c_{12}$  in 2000 was twice as large as the value in 1999. Sealing of the 800m-deep borehole caused ascendance of pore pressure and pore fluid filled in fractures. As a result, Poisson's ratio in the surrounding crust increased and  $c_{12}$  changed rapidly.