Three Dimensional Forward Gravity Analysis for the Basement Structure Characterized by a Reverse Fault

Kunihiro Ryoki[1]

[1] Industrial Chemistry, Kinki Polytech. Col.

1.Introduction

The sedimentary basin in Southwest Japan, for example, the Osaka sedimentary basin, has the basement structure often caracterized by the development of the reverse fault system. A powerful means to clarify the structure is seismic reflection methods, the gravity servey is done in shape to interpolate these, and somewhat wide-ranging underground structure is interpreted overall. Then, an easy expression method of a basement structure model, which considers the form of the reverse fault, is shown here, and some examples of forward analysis are reported in this paper.

2.Forward Analysis
2-1. Two dimensional structure

The theoritical curves of gravity anomalies is obtained by the inclination of the fault plane if an underground structure is assumed with two parallel layers cut in the reverse fault (for instance, GARLAND(1964) or SEGJ (1989)). The curvature of these theoretical curves are becoming small at a low-angle reverse fault, and the maximum or minimum position is away from the fault. This feature looks remarkable when the curve of the horizontal secondary derivative value is drown.

2-2. Three dimensional structure

Because the method of the frequent use, when the gravity value is calculated from three dimension structure model, is a method with a vertical square prism. The upper surface of the square prism is calculated as the horizontal, and so the basement structure which can be expressed is limited simple. GOHTZTE and LAHMEYER(1988) developed the method of computing the gravity value which a vertical triangle prism in which the upper surface was inclined. And, RYOKI(1996) designed the technique in which the method was appropriately used with grid data. When an upper triangle is calculated, the result reaches a negative value if the order of describing the top is reversed. Therefore, if the characteristic of this calculation is used, gravitational value of the reverse fault structure is calculated without changing the expression technique of grid data.

3.Example

Three dimensional analysis of the surrounding at the Uemachi fault in the central part of Osaka Plain was attempted. At first, it was considered the two dimensional structure, and the horizontal secondary derivative value distribution is requested from the gravity section to make the model. Next, it was presumed the fault position or the inclination of the fault plane. Moreover, three dimensional model which contained the reverse fault was made deciding basement depth around the fault referring to the reflection section, and forward analysis was done.

4.Discussion

When forward analysis result of the underground structure model approximated to the vertical fault considered the reverse fault are compared, it is understood that the latter looks like the distribution of the measurement value. The rise of the calculated gravitatinal value swerved to the upper side from the fault position (INOUE et al.(1995)). To correct, it was necessary to make the head of the basement large or to make a large swale to the upper side far from the fault position. But these inconveniences can be canceled by considering the reverse fault in this time.

References
SEGJ (1989) : Gravity and   Magnetic Survey, Illustration Geophysical Exploration, 187-191.
GARLAND (1969) : The Earth's Shape and Gravity, 67-86 (Japanese Translation).
GOHTZE and LAHMEYER (1988) : Application of Tree-Dimensional Interractive Modeling in Gravity and Magnetics, Geophysics, 53, 1096-1108.
INOUE et al. (1995) : Basement Structure of Osaka Sedimentary Basin Inferred from Gravity Anomaly, Ab. for Tech. Pro., IAMG 1995 Annual Conference, 245-247.
RYOKI (1996):Method of Dividing Underground Model into Trianglar Forms and its Application in Gravity Analysis, Geoinfor., 17, 117-127.