Werk

Jahr: 1975
Kollektion: fid.geo
Signatur: 8 Z NAT 2148:41
Digitalisiert: Niedersächsische Staats- und Universitätsbibliothek Göttingen
Werk Id: PPN1015067948_0041
PURL: http://resolver.sub.uni-goettingen.de/purl?PPN1015067948_0041

LOG Id: LOG_0082
LOG Titel: Paleogravity - A possible chance for determination of paleo-geographic north
LOG Typ: article

Übergeordnetes Werk

Werk Id: PPN1015067948
PURL: http://resolver.sub.uni-goettingen.de/purl?PPN1015067948
OPAC: http://opac.sub.uni-goettingen.de/DB=1/PPN?PPN=1015067948

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J. Geophys. 41, 535–536, 1975

Short Communications

Paleogravity—A Possible Chance for Determination of Paleo-Geographic North

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Key words: Paleogravity – Paleogeographic north.

As we know since the activities of Eötvös (1848–1919, cf. Eötvös 1953) a Cavendish pendulum with a suspension wire of infinitely small torsion will turn towards and assume its equilibrium along the direction of the minimum curvature of the earth. This direction is, of course, equal to the direction of maximum radius, and is dependent upon the location of the pendulum. In a normal case on the earth (*i.e.* in the absence of an anomaly) this direction is the East-West-direction since

$$\rho_{WE}=\frac{a^2}{(a^2\cos^2\varphi+c^2\sin^2\varphi)^{1/2}} \quad \rho_{NS}=\frac{a^2c^2}{(a^2\cos^2\rho+c^2\sin^2\varphi)^{3/2}}$$

(see *e.g.* Egyed 1969) with ρ being the radius of curvature of the earth, a the equatorial radius, c the polar radius, and φ the geographical latitude.

The R curvature of the gravitational acceleration which is proportional to the driving momentum is very small.

As it is known,

$$R=\sqrt{U_\Delta^2+4U_{xy}^2}$$

where $U_\Delta=U_{yy}-U_{xx}$, being the Northern, y the Eastern direction; and the indices indicating the derivatives of the proper gravitational potential. On the normal Earth:

$$U_{yy}=U_{xx}=0$$

and

$$R=10{,}26\cos^2\varphi \quad \text{eötvös.}$$

If needlelike sediments deposit in the sea water then they – as gravitational compases – during the sedimentation are regulated into in Eastern-Western direction by the driving moment of the curvature of the gravitational acceleration. Therefore the direction-statistics of the needlelike elements of the old sea sediments afford a possibility to the determination of the paleogeographic directions.

However, as it is known from the many Eötvös balance measurements, the earth, on its many points, possesses a considerable local curvature anomaly,

these anomalies being many times greater than the normal value of the curvature. This difficulty perhaps can be solved by many samples obtained from a larger area.

On the other hand it is probable that the magnetic, electrostatic, surface and other forces, besides waterstreams, and subsequent geological recrystallization processes often sweep away the directing effect of the normal curvature. Direction statistics of calcit or silica needles of recent sea sediments perhaps would show how useful the proposed paleogravitational method might be.

References

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Received April 3, 1975