Analysis of long–term deformations of the ultimately stressed samples of rocks

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Abstract The results of ongoing laboratory observations of long-term plastic deformations of an extremely stressed sample of rocks, which have been carried out from September 2009 to September 2022, are presented. A sample in the form of a cube with sides of 7 cm, made in the form of a cement-sand conglomerate, is subjected to a constant uniaxial pressure of 7 MPa. With the use of rubber suspension dampers, the press installation was isolated from the influence of microseisms and other mechanical vibrations from external sources. The laboratory ensured regular temperature stabilization of the environment within daily temperatures of the order of 1°C, and hermetic conditions were observed with minimal influence of humidity. For the measurement, a special method was used to register impulses of deformation jumps, which are converted into electromagnetic signals by virtue of a highly sensitive installation. The trend components of the creep rate, its annual periodicities and four stages, reflecting the features of changes in the state of the sample, are identified. It is shown that the magnitude of the large-scale, positive trend over the entire observation period is at least an order of magnitude greater than the standard one. At a qualitative level, a correlation was found between the amplitudes of diurnal variations in the creep rate and the distinguished stages of the ultimate deformed state. Estimates are made for the seasonal temperature influence of the surrounding laboratory environment on the annual periodicity of the creep in comparison with seasonal changes in atmospheric pressure.

Keywords Ultimate stressed sample, creep, kinetic theory of strength, LNT model, polynomial approximation, thermal stresses.

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