Geophysical aspects of underground fluid dynamics and mineral transformation process

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The description of processes of mass exchange between fluid and poly-minerals material in porous media from various kinds of rocks (primarily, sedimentary rocks) have been examined. It was shown that in some important cases there is a storage equation of non-linear diffusion equation type. In addition, process of filtration in un-swelling soils, swelling porous rocks and coupled process of consolidation and chemical interaction between fluid and particles material were considered. In the latter case equations of physical-chemical mechanics of conservation of mass for fluid and particles material were used.

As it is well known, the mechanics of porous media is theoretical basis of such branches of science as rock mechanics, soil physics and so on. But at the same moment some complex processes in the geosystems lacks full theoretical description. The example of such processes is metamorphosis of rocks and correspondent variations of stress-strain state. In such processes chemical transformation of solid and fluid components, heat release and absorption, phase transitions, rock destruction occurs. Extensive usage of computational resources in limits of traditional models of the mechanics of porous media cannot guarantee full correctness of obtained models and results. The process of rocks consolidation which happens due to filtration of underground fluids is described from the position of rock mechanics. As an additional impact, let us consider the porous media consolidating under the weight of overlying rock with coupled complex geological processes, as a continuous porous medium of variable mass.

Problems of obtaining of correct storage equations for coupled processes of consolidation and mass exchange between underground fluid and skeleton material are often met in catagenesi processes description. The example of such processes is metamorphosis of rocks and correspondent variations of stress-strain state. In such processes chemical transformation of solid and fluid components, heat release and absorption, phase transitions, rock destruction occurs. Extensive usage of computational resources in limits of traditional models of the mechanics of porous media cannot guarantee full correctness of obtained models and results. The present work is dedicated to the retrieval of new ways to formulate and construct such models. It was shown that in some important cases there is a governing equation of non-linear diffusion equation type (well-known Fisher equation). In addition, some geophysical aspects of filtration process in usual non-swelling soils, swelling porous rocks and coupled process of consolidation and chemical interaction between fluid and skeleton material, including earth quakes, are considered.