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Groundwater Hydrochemical Dynamics of the Crystalline Basement in the Volga-Ural Region

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The groundwater composition of deconsolidated zones in the Precambrian crystalline basement of the Volga-Ural anteclise's South Tatarstan Arch was monitored during the period from 1998 to 2003. Chemical and gas compositions of basement waters and fluid levels were monitored in five wells. Other monitoring parameters included total dissolved solids, density and acidity of water and the contents of methane, heavy hydrocarbon gases, hydrogen, helium, carbon dioxide, dissolved organic substances (bitumen carbon) and total nitrogen. Analysis has shown that the salt and microelement compositions of the waters changed throughout the monitoring period. Other varying parameters included salinity and chlorine, iron, boron, copper, and molybdenum contents of water. For instance, all the samples collected in August and September 1998 have been found to have decreased total dissolved solids and the chlorine content and a slightly increased amount of carbon dioxide. In some wells this phenomenon was accompanied by a decrease in water density, and in other wells the water density was constant due to the increased iron content. From June to September 2000, peaks of hydrogen, methane and, in some cases, helium contents were recorded in all the wells studied. Similar compositional changes have also been recorded for the water-dissolved organic matter. The analysis of time variations in the amount of gases and hydrochemical components of groundwaters of the crystalline basement has revealed their close relation to the seismic activity in the area. This relation is indicated by total nitrogen, hydrogen and methane and, to a smaller extent, by carbon dioxide and helium. Variations in hydrochemical properties indicate the following. The crystalline basement provides favourable conditions for active movement of fluids at

various depths that still takes place indicating the fluid-dynamic activity in loosely aggregated zones of the crystalline basement. The varying hydrogen, carbon dioxide, nitrogen and boron contents show the importance of the deep component of the heat and mass transfer, which in turn indicates that the fluidisation and heat and mass transfer presently take place in the upper (?) portion of the area under study. This is also confirmed by the results of the thermal field monitoring conducted in the form of long-term, high-precision temperature surveys.