THE USING OF GEOTHERMAL ENERGY IN THE DEEP SEDIMENTARY BASINS IN THE USSR

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Geothermal energetics in the USSR is a young branch of science and economy. The industrial exploitation of the depth heat was begun in the USSR in 1966 with the establishing of the Caucasian (in Makhachkala) and the Kamchatka (in Petropavlovsk-Kamchatski) Departments for using the depth heat of the Earth and with the putting unto operation of the Pauzhet Heat Power Plant of 11 MW in the same 1966. In the 1967 the Paratun Geothermal Heat-power Plant working on thermal water having temperatures 80°C was put into operation.It used freon 12 as a low-boiling working body.

More than 20 years have elapsed. Over 70 deposits with the hot water capacity of about 400 mln m^3 a year have been discovered. Great thermoanomalies, making the creation of geothermal power plants possible,have been found both in the regions of high energy consumption (the Carpathians,the Crimea,the Caucasus,the Central Asia,Kazakhstan) and in the regions with expensive fuel which is transportes there (Kamchatka,Chukotka). Out of 300mln tons of conventional fuel about one third falls on geothermally active regions with thermal resources. Their heat power potential has reached 200 mln gigacalories a year,or 30 mln tons of conventional fuel.

By now about 65 mln m^3 of water a year is extracted for supplying heat to little towns and settlements and for the needs of agriculture,which is equivalent to no more than 600,000 tons of coventional fuel. The quantity of electric power produced by geothermal sources has not grown up. This is accounted for by the lack in the USSR of volcanic regions of the Kamchatka type, the presence of competing sources of power and by a number of scientific and technical problems.

In a number of cases thermal water is not just a heat carrier. Quite often it contains industrial consentrations of the most valuable elements. As is known,the developed countries get out of thermal waters up to 30% of lithium,as well as boron,rubidium,bromine,iodine,magnesium and sodium chloride. As a rule such rare- metal hydrotherms are of balneological importance That is why it is more logical to speak not only of geothermal energetics,geothermal raw materials and balneology,but also of a complex exploitation of geothermal resources,of "geothermics" as an interdepartment scientific and technical field.

It is hardly probable that geothermics will achieve new spectacular results if we remain within the framework of monotechnological thinking.

It goes without saying not all the geothermal activity area is of interest from the point of view of energetics or,moreover, of integral geothermal technology. Zones suitable for exploiting geothermal resources we shall call geothermal objects. Geothermal objects can be easily subdiviced into three groups,

- Convective magmatic systems (CMS)
- Convective hydrothermal systems (CHS)
- Petrothermal systems (hot impermeable rocks (PTS).

A great deal of papers cover convective magmatic systems. Here we shall dwell only on convective hydrothermal systems,i.e.objects with magmatic reservoirs (CHS-systems).

In deep sedimentary basins a CHS-like geothermal object is attached to a fault,this being one of their peculiarities.

The conditions of heat-and mass transfer within and without a disjunctive differ greatly. Of principal interest is the area of the dynamic influence of the disjunctive (ADID) in which deformations caused by the disjunctive development are manifested.Physical modelling has show that the ADID is always a higher permeability zone. The form and the spatial layout of this zone depends on the type of the relative motion of blocks (Fig.3).In all the cases a powerful zone of fracturing A is formed which is situated either vertically (normal fault) or obliquely (thrust fault). In the case of a normal fault or a thrust fault it is complicated with small sites B and C of near-surface destruction. A and B zones can unite into a single-linkage field,C cite remains a detached element. In natural conditions,disjunctives are covered with a practically undisturbed layed of modern sediments, and the ADID body is saturated with fluid (water,gas,oil).

Stable spatial periodic structures appearing in a level layer of a viscous fluid which is heated from beneath are known well enough. We have proved that similar phenomena are given rise to in geothermal seams and faults.

Mean yields of the Miocene complex in Daghestan are 1,500m^3 a day, reaching 75,000m^3 a day. The yields of thermal waters of the Mesozoic sediments vary from tens and hundreds m^3 a day up to 70,000m^3 a day (Berikay),120,000m^3 a day (Adzhinaur).

Thus in the case of CHS the canal of the extraction can be calculated for quick upraise of great volumes of hot brines from the depths of 3 to 6 km. In this case geothermal energetics is really a "non-traditional" branch ofenergetics in which energy is not produced but extracted. Geothermal energetics is in fact a mining production. Or,the other way round, the extraction of depth heat is part of energetics. This dualism necessarily gives rise to specific problems of other mining productions. We are not going to dwell on such problems as the sinking down of mountain rocks massives or an induced seismic activity. We shall refer only to biospheric disturbances.

Thermal waters contain strontium,arsenic,naphthenic acids phenols. It is known that naphthenic acids lessen the salting of hard soils. Naphthenates possess surface-active properties. The natrium salt of the naphthenic acid is biologically active,it gives rise to disorderly development of plants and their deformity.

Quite typical are in thermal waters hydrogen sulphide,iodine and boron compounds,mechanichal impurities. Biosphere reacts to changes in temperature and air humidity. The study of the complex and ambiguous process of geothermal activity influence on ecogenesis may give rise to a new branch of science.

The complex deep reprocessing of geothermal resources with back pumping is capable of solving the problem,but back pumping to the dephs of 3-4 km raises anumber of scientific and technical problems itself.

The problems mentioned here are just specimen problems but they are enough to show how rich,multiple and wide science is,how promising and complicated practice.