

GL03396

UNIVERSITY OF UTAH  
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LOCAL GEOTHERMAL ANOMALIES IN THE DONETS BASIN AND  
THEIR RELATIONSHIP TO RECENT CRUSTAL MOVEMENTS<sup>1</sup>

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(Presented by Academician I. P. Gerasimov, September 14, 1971)

Using the extensive information now available on local geothermal anomalies in coal measures of the Donets basin, we have reinterpreted some patterns of their distribution and relationship to Holocene movements.

During the exploration and mining of coal fields in the Donbas more than 3000 rock-temperature measurements have been taken in prospecting drillholes with resistance thermometers (to within  $\pm 0.5^\circ$ ), and more than 750 in mine workings with mercury thermometers in 3- to 4-m long blastholes (to within  $\pm 0.2^\circ$ ).

Many of the temperature logs cannot be used to assess the temperature of coal measures in the Donbas because of the too low exposure time and the shallow depth of drillholes. To describe the geothermal conditions here, we chose 1253 thermograms recorded in prospecting drillholes and 690 temperature measurements made in mine workings.

Our comparison of the temperatures in drillholes and 93 nearby mines (no farther than 300 m away) showed that the measurements in drillholes were  $1.3^\circ$  lower than those in mine workings. This implies a systematic error in the rock-temperature measurements.

Geothermal maps generally are plotted on various datum levels in order to illustrate the regional variations of rock temperature. In this case, however, it is impossible to use, without extrapolation, the isolated temperature measurements taken in mine workings and drillholes at different depths. Accordingly, for the Donbas we have chosen a new geothermal indicator, the geothermal background [1].

The geothermal background can be defined as a  $1^\circ$  increase in temperature within the formation relative to an arbitrarily chosen standard, with the thermograms of the drillhole taken as the zero level. Given this new indicator we were able to utilize all rock-temperature measurements taken in mines. To calculate the geothermal background, we took the temperature measurements made at depths of 400 to 1000 m from the surface. For each drillhole used in the calculation and for each point of temperature measurement in mine workings we computed the geothermal background and prepared a geothermal background-contour map of the Donets basin (Fig. 1). For the Rostov part of this map we used some of the unpublished data of the late G. A. Kon'kov.

Analysis of our map partly confirms the general conclusions of other investigators on the regional distribution of temperatures in the Donbas and also reveals various new local features. In particular, we should note that against the background of a general regional increase in temperature from each to west and from central areas toward the Azov and the Voronezh blocks of crystalline rocks there are also numerous local anomalies, many of which were checked by rock-temperature measurements in mines. These local geothermal anomalies are associated with transverse faults and other structures — flexures, anticlines and synclines superposed on the general Donbas folding — which, presumably, are still evolving at the present time.

A special study of Holocene tectonic movements on the Donbas geodynamic test range [2] has shown that in zones of maximum velocity gradients of Holocene vertical movements the rock temperatures are also higher, whereas at points of Holocene relative uplift or subsidence of the ground surface the temperatures are  $3^\circ$  to  $5^\circ$  lower. We should note, too, that local geothermal anomalies coincide with areas of relatively high gas emission and sudden

<sup>1</sup>Translated from: O lokal'nykh geotermicheskikh anomal'yakh Donetskogo basseyna i ikh sootnoshenii s sovremennymi dvizheniyami zemnoy kory. Doklady Akademii Nauk SSSR, 1972, Vol. 207, No. 3, pp. 673-674.

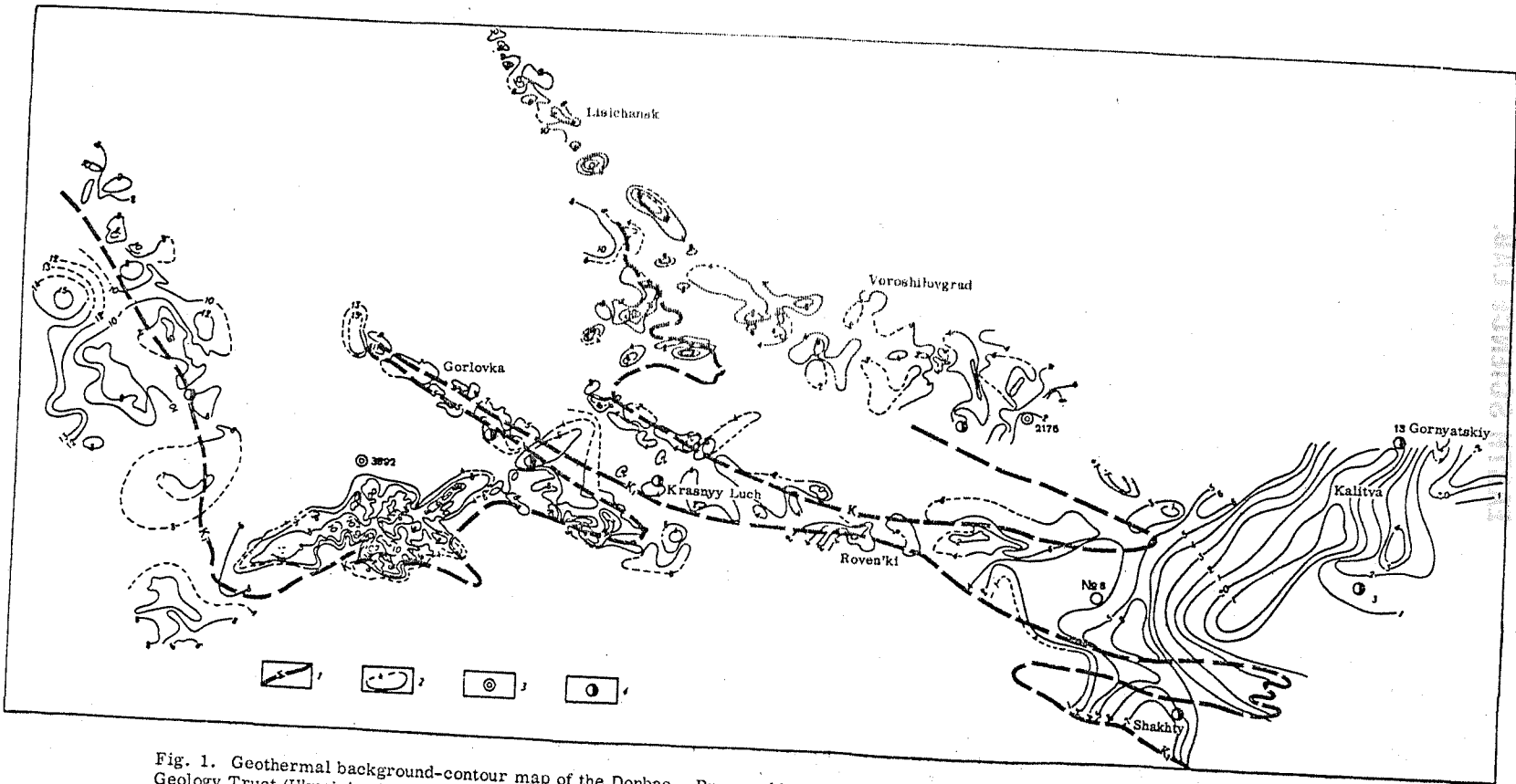


Fig. 1. Geothermal background-contour map of the Donbas. Prepared by V.S. Vereda and Ye.M. Chernokalova from data of the Mining Geology Trust (Ukrainian Ministry of Coal Mining), the Artemgeologiya and the Voroshilovgradgeologiya Trusts (Ukrainian Ministry of Geology), and the Novocherkassk Polytechnic Institute. 1) outcrop of the K<sub>1</sub> limestone unit; 2) geothermal background contours; 3) reference drillholes; 4) coal mines.

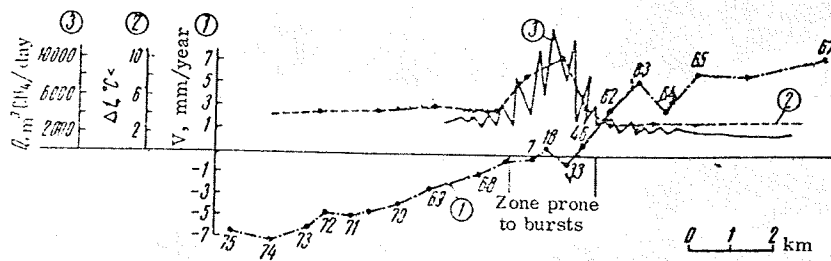


Fig. 2. Comparison of curves of Holocene tectonic movements, the geothermal background and gas emission, including the zone prone to bursts, on the south profile of the Donbas test range. 1) curve of rates of Holocene vertical movements and numbers of reference points (rates measured to within  $\pm 0.5$  mm/year; 2) curve of the geothermal background; 3) curve of absolute methane concentration in mined areas of coal seams.

coal, gas and rock bursts during mining operations (Fig. 2).

Received September 13, 1971

#### REFERENCES

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2. Vereda, V.S., F.M. Urmantsev et al. In: *Izucheniye sovremennykh dvizheniy zemnoy kory na statsionarnykh geofizicheskikh poligonakh* (Study of Holocene Crustal Movements on Fixed Geophysical Test Ranges), Ashkhabad, 1970.

It seems to be connected with the development of the geothermal field with the assumption of development of the field in the past three tectonic stages. Thus one would expect an increasingly complex geothermal background in post-Precambrian times, widespread, but not necessarily tectonic and magmatic.

From this study some new data on the geothermal field using the technique in conjunction with the controlled directivity line in the north of the Odessa-Brusilovskaya workers' station, laboratory of the Institute of Geology and Geophysics of the USSR Academy of Sciences.

Analysis of the geothermal potential fields and the picture of the tectonic structures of various potential fields in the bodies of the gravitational field took place during the interpretation of the magnetic field reception method in the Odessa-Brusilovskaya station of the previous into its elements only to identify

<sup>1</sup>Translated from *formirovaniya geotermicheskogo polya na primere Kievskogo poligona* Doklady Akademii Nauk SSSR, No. 3, pp. 675-

