PUCHEZH-KATUNKI IMPACT CRATER: PRELIMINARY DATA ON RECOVERED CORE BLOCK STRUCTURE; B.A.Ivanov (1), G.G.Kocharyan (1), V.N.Kostuchenko (1), A.F.Kirjakov (2), and L.A.Pevzner (2); (1) Institute for Dynamics of Geospheres, Russian Academy of Sciences, Moscow, Russia 117939, (2) Nedra State Scientific Industrial Enterprise, Yaroslavl, Russia 150000.

Vorotilov Deep Borehole (maximum depth is 5374 m) has been drilled at the central uplift at the Puchezh-Katunki impact crater. The estimated rim crater diameter is about 40 km. Core recovery is about 70 % of penetration with coring. The recovery core investigation allows to estimate the blocky structure of hard rocks inside the central uplift. Up to depth of 3 km the block size along the borehole is about 100 m. Such blocks survived with a minor or medium damage the passage of a shock wave with an amplitude 20 to 40 GPa, the downward displacement at 6 to 10 km during the transient crater growth and the consequent upward displacement to the final position inside the central uplift. The proper model of large scale crater formation should take into account the discrete character of rock deformations. With measured block size, the deformation seems to be highly localized at inter-block boundaries.

Previous investigations of the impact crater formation mechanics show that the late stage - a transient cavity collapse in a gravity field - may be modeled with a traditional rock mechanics if one ascribes very specific mechanical properties of rock in the vicinity of a crater: an effective strength of rock needs is around 30 bar [1], an effective angle of internal friction is below 5 degrees [2]. The rock media with such properties may be named as "temporary fluidized". The nature of this "fluidization" is now poorly understood (see the review of hypotheses by Melosh,[3]). Melosh [4,5] suggests an acoustic (vibration) nature of this fluidization. This model now seems to be the best approach to the problem. However other hypotheses need to be taken in mind. To make the next step we need to study more relevant models of mechanical behavior of rocks during cratering. The specific of rock deformation is that the rock media deforms not as a plastic metal-like continuum, but as a system of discrete rock blocks. This approach allows to take into account an important phenomenon of localization of deformations at block boundaries.

One of the main questions for modeling is the structure of a rock media under the crater. Is this a "rubble pile" or a solid uplifted "plug" of basement rocks? Recently the investigation of a central peak formation has been included in the project to analyze results of the deep (5 km) drill hole in the center of a 40-km terrestrial crater in Russia [6]. Numerical simulation [7] demonstrates shock waves passage and the transient cavity growth and collapse in the gravity field. T

The recovery core from the Vorotilov Deep Borehole was investigated to estimate the possible size range of rock blocks constructed the central uplift. The set of petrographical and petrochemical evidences was used to recognize possible "blocks" - fragments of rock which were shocked and moved with a crater-forming flow with minor internal relative displacement. This set includes gneiss foliation angle, the level of shock and post-shock thermal metamorphism and the level of mechanical damage. Despite the relatively high percentage of recovery (about 70 %), approximately 1/3 of the borehole was not presented at the recovered core. So the current preliminary data on the recovered core should be improved in close future with the data of geophysical logging along the borehole. Fig. 1. demonstrates preliminary data on the recovered core discretization into a system of possible blocks and inter-block gaps of breccia.

Conclusion. The preliminary analysis of the recovered core from the borehole at the summit of the central mound reveals the blocky structure of subsurface uplifted basement rocks. At depths from 1.8 to 3 km possible block sizes vary from 50 m to 200 m with an average size about 100 m .Below 3 km we see larger blocks of 200 to 400 m. Below 4.2 km up to the final depth of 5.4 km the drill hole run inside one block or uniform basement. The average ratio of the total breccia sections length to the total block sections length is about 1:3.

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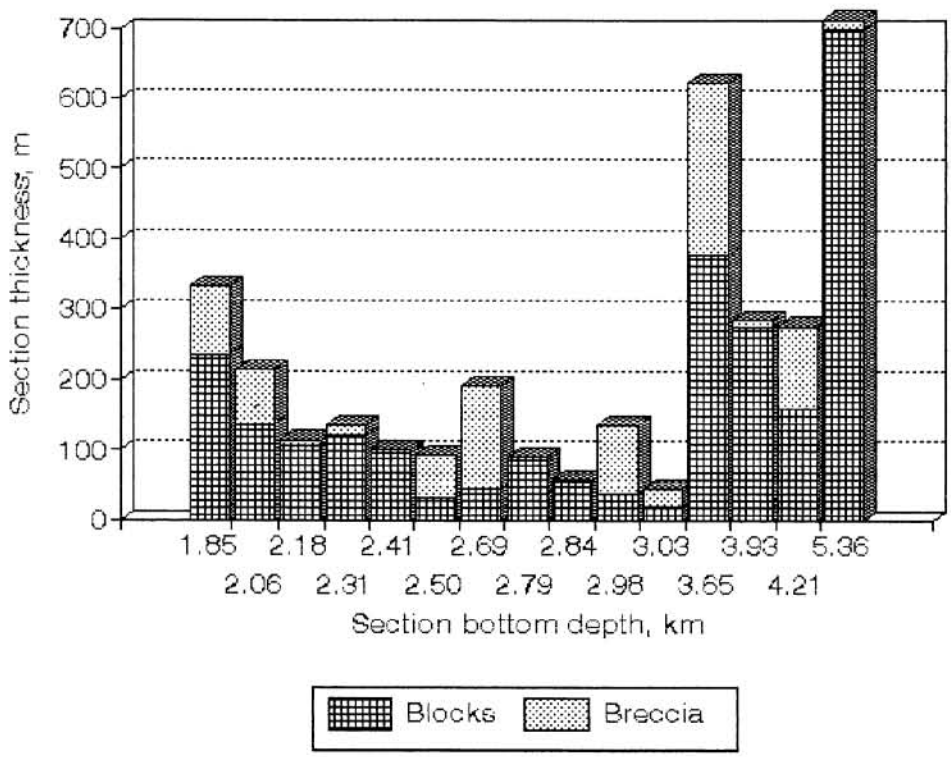

Fig.1 Preliminary data on the block structure under the Puchezh-Katunki impact crater. Each column at the diagram is a section of the recovered core described as "breccia" or "block". The bottom of each column corresponds to the top of the next (to the right) column. Below 4.21 km the borehole run inside a single block.