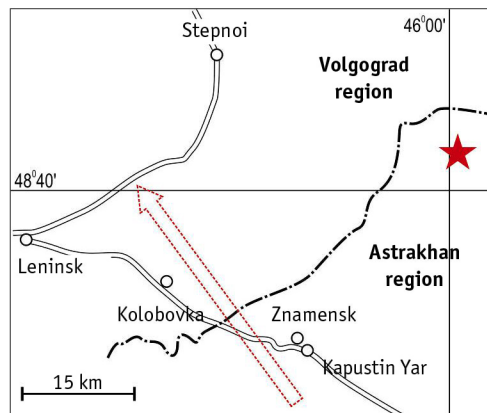


## KAPUSTIN YAR: A NEW LARGE CHONDRITE FOUND IN THE EUROPEAN PART OF RUSSIA

Victor V. Sharygin

V.S. Sobolev Institute of Geology and Mineralogy, Siberian Branch, RAS, Novosibirsk  
sharygin@igm.nsc.ru



1. Finding place of the Kapustin Yar meteorite (48.806°N, 46.062°E, marked with a small red star) in the Akhtubia district, Astrakhan region. The arrow indicates the trajectory of the Tsarev bolide that fell in 1922.

**K**apustin Yar is the third meteorite found in the territory of the Astrakhan region (48.806°N, 46.062°E). This meteorite was found in April 2021, in the vicinities of the Kapustin Yar Rocket Launch Complex in the Akhtubia district, northern Astrakhan region (Fig. 1). The meteorite was registered in September 2023, by the Meteoritical Society under the name of Kapustin Yar (ordinary chondrite L/LL6, mass 276.5 kg). The other meteorites previously found in the Astrakhan region are the Repeev Khutor iron meteorite (Iron IIF, 1933, mass 7 kg) and Kharabali ordinary chondrite (H5, 2001, mass 140 kg). The fourth meteorite found in the region (later than Kapustin Yar) is the Pirogovka chondrite (L6, 2023, mass 25 g).

The Kapustin Yar chondrite is one of the six largest (in their total mass) stony meteorites ever found in Russia, after the ordinary chondrites Chelyabinsk (LL5, 2013, >1000 kg), Kunashak (L6, 1949, >200 kg), Tsarev (L5, 1922, >1225 kg), Saratov (L4, 1918, >221 kg), and Okhansk (H4, 1887, >500 kg).

The history of finding this meteorite and its subsequent registration was quite long. In April, 2021, Sergey Kh. (he chose to remain anonymous), a resident of the Volgograd region, searched for artifacts in the steppe and found a large stone lump in the territory of former steppe khutor (farm) in Akhtubia district, Astrakhan region. This khutor was situated in the Akhtubia district of the Astrakhan region, not far from the boundary with the Volgograd region, 22 km southwest from the former settlement of Zhitkur in the Volgograd region. Only a small part of this stone raised above the earth surface. Sergey Kh. chipped a small fragment of this stone and later showed it to another scavenger, who suggested that the stone might be a meteorite. In early April 2023, they dug up the whole stone and simultaneously found its other nine fragments. Same time Igor V. Karlov (from Novosibirsk) with colleagues searched for fragments of the Tsarev meteorite in the vicinities of the Kolobovka village, Volgograd region, and Sergey Kh. showed them a fragment of the stone (a chip with sharp edges approximately 15 x 8 x 4 cm and about 500 g in mass). Visual examination of the stone led Igor Karlov to confirm that this is a meteorite indeed. He purchased one fragment for his own meteorite collection, and brought one sample to pass it for study in Novosibirsk. Later he handed the latter over to the author of this paper at V.S. Sobolev Institute of Geology and Mineralogy, Siberian Branch, Russian Academy of Sciences, in Novosibirsk.



2. Large fragment of the Kapustin Yar meteorite (275 kg). Photo: Sergey Kh. (Volgograd region)

The first ever data on the chemical composition of the minerals were obtained by microprobe analysis (EPMA) in May–June 2023. Simultaneously, characteristics of the meteorite were provisionally determined: this is an ordinary chondrite L/LL6 of shock grade S2 and weathering grade W2.

The following two tasks were faced by the researchers when studying this meteorite. First, the transitional status of this meteorite from chondrite L to LL. Regrettably, all main characteristics (the composition of the key silicates, Co concentration in the kamacite, and the modal concentration of metal in the chondrite) did not unambiguously classify the meteorite as either L or LL, and hence, the meteorite should be in transitional status. It should be mentioned that 29 ordinary chondrites with the L had been found by that time on the Earth. The other task calling for its solution was whether this meteorite is a fragment of the well known Tsarev meteorite (chondrite L5), whose fall site was the closest to that of Kapustin Yar. To solve the latter problem, we have studied a fragment of the Tsarev chondrite. The studies have shown that the compositions of the key minerals and other mineralogical and petrographic characteristics of the two meteorites are obviously different. Moreover, the bolide that resulted in the Tsarev meteorite flew from southeast to northwest, and its flight trajectory was located approximately 50 km southwest of the site where the Kapustin Yar meteorite was found (Fig. 1). All of the above mentioned problems emerged when the registration of the Kapustin Yar meteorite was in progress and somewhat slowed down this process.

An application for a new meteorite was sent on September 8, 2023, to the Meteoritical Society, and this meteorite was registered then by the Nomenclature Committee of the Meteoritical Society, and it was entered into the approved meteorite list (Meteoritical Bulletin Database) on September 29, 2023. The name of Kapustin Yar was given after the name of the nearby rocket launch complex in the Astrakhan region, because no population centers occur near the fall site of the meteorite and around the rocket launch complex.

The total mass of the meteorite, together with its nine fragments, amounts to 276.5 kg. The largest fragment is angular and slightly rounded, 48 x 60 x 50 cm. Its surface is partly covered by with a fusion crust, as is readily seen in a large sample (Fig. 2). The