PRELIMINARY MINERALOGICAL DATA FROM THE SARATOV (L4) PRIMITIVE ORDINARY CHONDRITE. R.K. Herd[1], P.A. Hunt[1], K.E. Venance[1] and M.B. Killgore[2], [1]Geological Survey of Canada, Natural Resources Canada, 601 Booth Street, Ottawa, ON K1A 0E8: herd@nrcan.gc.ca , pahunt@nrcan.gc.ca , kvenance@nrcan.gc.ca ; [2]Southwest Meteorite Laboratory, P.O. Box 95, Payson, AZ 85547, U.S.A: meteoritelab@cybertrails.com .

Introduction: Saratov fell September 6, 1918, total known weight (TKW) 328 kilograms [1]. A detailed description of its mineralogy and texture is not available, although it has been analyzed in some important studies and is widely available in collections and from dealers. Research on Saratov has been undertaken in conjunction with research on another primitive ordinary chondrite [2,3] to compare textures and petrologic grade.

Sample Character: Saratov contains an abundance of chondrules, ranging in size from less than a mm. to over a cm., easily detached from samples. It consists of chondrules and chondrule fragments or agglomerations, matrix, and metal (mainly troilite and FeNi phases) and shows a low shock stage (S1- S2). It appears to be unweathered.

Polished Thin Section (PTS) Studies:

Methodology: One thin section and one PTS were available. The PTS was systematically documented by mapping in back-scattered electron (BSE) mode with a scanning-electron microscope (SEM). All images were digitized. A mosaic of BSE images, all at the same magnification, was compiled into a single large photomosaic map of the section. Adjustment of the contrast among adjacent BSE images resulted in a virtually seamless photo-map that shows the section in great detail, and serves to locate areas of investigation at higher magnification.. The mineralogy and texture of chondrules and matrix were investigated at magnifications up to 1700X. All detailed BSE images were digitized. Energy-dispersive spectrometry (EDS) spot data using the SEM allowed grains of different mineral phases to be distinguished, based on elements present and relative peak heights of each element. The BSE images, annotated as to the qualitative identification of the minerals, were then used to identify sites for quantitative electron-microprobe analyses of olivine, pyroxenes, plagioclase and minor accessory minerals.

Results, photomosaics: Distinct textural components become visible when the PTS map is examined. Recognizable are: intact chondrules consistent with their petrologic grade; intact chondrules inconsistent with their petrologic grade; primary matrix; chondrule fragments resulting from crushing during lithification; secondary matrix resulting from recrystallization of fragments and primary matrix. It is obvious that radiating pyroxene chondrules and their fragments in particular have resisted crushing during lithification, and have sharp boundaries. Perfectly round chondrules of all types are easily seen.

Textural results, Saratov: The BSE mapping and higher magnification SEM studies of Saratov show that it contains a range of textural types typical of primitive ordinary chondrites, essentially interchangeable from one meteorite to another, and possibly derived by similar processes from a similar chondrule reservoir [2]. It may be possible to derive a useful descriptive classification scheme, that conveys essential texture and mineralogy, to describe and compare these chondrules [3].

Results, chondrules: At least six groups of chondrules, with subtypes, occur in Saratov, based on the presence/absence of pyroxene and olivine, whether the major phases are porphyritic, radiating, or not, and considering reaction textures, including obvious replacement and zonation. From the thousands of chondrules in the single PTS, nineteen were chosen as archetypical, or atypical, and identified for electron-microprobe analysis.

Mineralogical Data:

Olivine: Prior to this study the composition of Saratov olivine was recorded as Fa_{24} [4]. It has been previously noted that no obvious relict olivine zonation can be detected in BSE mode [2]. Fourteen new olivine analyses from eleven different chondrules yield an average of Fa_{23} with a range of Fa_{22-26} . There is no significant minor element content, and no relict zonation.

Low-Ca pyroxene: Varieties of orthopyroxene constitute major phases in the Saratov chondrules. Ten analyses from seven chondrules show $Wo_{0.2-4.0}$ with $Fs_{5.9-35.7}$ and $En_{90.1-63.7}$. No low-Ca pyroxenes are aluminous.

Ca-rich pyroxenes: Non-aluminous varieties (four analyses from three chondrules) contain $Wo_{7.8-38.6}$, $Fs_{11.3-20.6}$, $En_{46.8-71.7}$. Aluminous pyroxenes (five analyses from four chondrules) contain up to 17.9 wt. % Al_2O_3 with $Wo_{16.8-47.9}$, $Fs_{2.1-22.4}$, $En_{46.1-60.7}$.

Plagioclase: Analyzed compositions span the range Ab_{92} to Ab_{32} , all with very minor K_2O and FeO contents (nine analyses from six chondrules).

Other minerals: A probable pre-solar grain of Mg-Fe-Al spinel has been analyzed in the core of a chondrule containing olivine Fa_{23} and calcic-aluminous pyroxene. This chondrule is atypical and may have the composition of a CAI.

Summary and Conclusions: New mineralogical data from chondrules in the Saratov (L4) primitive ordinary chondrite confirm its classification, based on an average equilibrated olivine composition of Fa_{23} and recrystallization of chondrule matrices. Both orthopyroxene (low-Ca pyroxene) and calcic pyroxenes have more variable and less equilibrated compositions, and some calcic pyroxenes are rich in alumina.

References: [1] Grady M. M. (2000) *Catalogue of Meteorites.*[2] Herd et al. (2003) *LPS XXXIV,* Abstract # 2058. [3] Herd et al. (2003) *Meteoritics & Planet. Sci., 38,* A145. [4] Rubin A.E. (1990) *Geochim. Cosmochim. Acta, 54,* 1217-1232.