THE NIPR ANTARCTIC METEORITE THIN SECTION EDUCATIONAL SET. ***Bérczi Sz.[1], Lukács B.[2], Holba A.[2], Józsa S.[1], Kubovics I.[1], Puskás Z.[1], Szakmány Gy.[1],*** [1]Eötvös University, Dept. Petrology, H-1088 Budapest, Múzeum krt 4/a., Hunagry, [2]Centr. Res. Inst. Physics, RMKI, H-1525 Budapest-114. P.O.Box 49. Hungary, (bercziszani@ludens.elte.hu)

ABSTRACT

In 1993, after 20 years of successful meteorite collecting expeditions on Antarctica, a Meteorite Thin Section Educational Set was made - in 20 copies - by the National Institute of Polar Research (NIPR), Tokyo, Japan (Department of Antarctic Meteorites). The collection gives cross section about the rocky materials of the Solar System available today in the form of meteorites.

INTRODUCTION: THE NEW SOURCE OF METEORITES: ANTARCTICA

Till the 60 years of our century meteorites were collected from random events (falls or finds). Since that time first Japanese, then American expeditions started to collect meteorites from the icefields of Antarctica [1]. Meteorite search expeditions became annual events in Japan and United States during the last quarter of our century. This work resulted in ca. 20000 pieces of ANTARCTIC METEORITES. About half of this quantity is stored at the National Institute of Polar Research, Tokyo, [2-4] Japan, and half at the Planetary Materials Laboratory, NASA Johnson Space Center, Houston, Texas, U.S.A. There are collections in the European Community, this is the EUROMET program, also with hundreds of meteorites [5].

BENEFITS: ANTARCTIC SYSTEMATIC SEARCH

The Antarctic Meteorite Collections have many benefits over the traditional ones. Antarctic collections are free of the traditional selection effects of random falls and chance finds. (distinction from soil, fragility, recognition effects, etc.). Ice cover is a good preserver. Availability of meteorites in the Antarctic Collections is the best for investigations, and because of intensive studies they are "in hands", and are continuously the samples for comparison.

METEORITE COLLECTIONS FOR EDUCATION

The great number of source material was an excellent basis to make a systematic meteorite thin section collection for education. Using it students could get acquainted with meteorite textural types, classifications and systematic by their own work. The NIPR program made it possible to prepare an almost full set of representative class-types of meteorites. After using in Japan, the first foreign loan was for Hungarian universities, from June, 1994.

CLASSIFICATION OF METEORITES

The meteorite classification has a well known long path since the works of Chladny, Prior, Tschermak, Rose, Howard, Urey, Craig, Mason, Wiik, Van Schmus, Wood, Anders, Ringwood, and others. Another way was the theoretical one which based on the chemical condensation models of the Solar System (Larimer, Grossman, Lewis, and Barshay). The mineral sequence (mineral belts around the Sun) represents the whole known Solar System materials. The NIPR collection gives available background to understand all kind of material evolution processes in the Solar system.

A SHORT DESCRIPTION OF THE THIN SECTIONS

The set contains the following 30 samples: No. numbering is according to the set, photographs in [2] are given.

N° 1. Pallasite - Yamato 8451. Large spherulic olivine grains are embedded in the opaque metal phase (nickel-iron) ([2], p. 196.).

N° 2. Mesosiderite - Allan Hills 77219. The sample comprises of large orthopyroxene grains, opaque metal phase and smaller orthopyroxenes and olivines in the groundmass of the texture ([2] p. 53.)

N° 3. Aubrite (Enstatite achondrite) - Allan Hills 78113. The slightly brecciated texture mainly consists of large enstatite grains. Some regions contain olivine, too ([2] p. 55.)

N° 4. Ureilite - Allan Hills 77257. The texture consists of large, clear olivine, pyroxene and less plagioclase grains and opaque phase. All mineral grains have opaque edges, very characteristic to the ureilitic texture (by carbon diffusion, iron reduction) ([2] p. 54.)

N° 5. Diogenite A - Yamato 74097. Monomineralic crystalline texture consisting of orthopyroxene.

N° 6. Diogenite B - Allan Hills 77256. Monomineralic brecciated texture consisting of orthopyroxene.

N° 7. Howardite - Yamato 7308. Brecciated basaltic achondrite with plagioclase, orthopyroxene and less olivine, and clinopyroxene in the texture ([2] p. 34.)

N° 8. Eucrite A - Yamato 791195. This basaltic achondritic meteorite has crystalline texture similar to a microgabbro with clinopyroxene (also occurs with twin-lamellae) and plagioclase (in subhedral grains) ([2] p. 80.)

N° 9. Eucrite B - Yamato 74450. This basaltic achondrite has brecciated (polymict) texture and consists of plagioclase+pyroxene basaltic clasts, and mineral clasts of these two minerals, too ([2] p. 45.)

N° 10. Shergottite - Allan Hills 77005. Brown pyroxene and mainly glassy plagioclase (maskelynite) plus some plagioclase minerals and opaque component (chromite?) comprise this basaltic achondritic texture which is suggested to have been originated from Mars. At the edge of one plagioclase grain fine grained plagioclase crystals with glass between them have been formed with variolitic texture. Both diaplectic glass (maskelynite) and this region of melting and recrystallization refers to the impact event which delivered the sample to Earth ([2] p. 52.).

N° 11. Lunar Meteorite A (regolith breccia) - Yamato 86032.

Large plagioclase rich clasts are embedded in a darker matrix. It contain small olivine grains, too ([2] p. 197-198.).

N° 12. Lunar Meteorite B (norite) - Asuka 881757

The gabbroic texture of this lunar meteorite sample consists of orthopyroxene and glassy plagioclase (maskelynite). In many respects the sample is very similar to the NASA Lunar Sample N° 78235, which has similar mineral components except that there brown glass veins can also be found in the texture. Considering maskelynite, the Lunar Meteorite B - Asuka 881757 is also similar to the N° 10. Shergottite - Allan Hills 77005 sample, and similarity might have resulted from their excavation from the surface of a planetary body with greater mass than an asteroidal mass.

N° l3. Primitive achondrite - Yamato 794046.
The texture is equigranular and consists of olivines, pale brown pyroxenes embedded into a large, long plagioclase grain. It contains a few opaque minerals (troilite) and brown, almost isotropic glass, interstitially ([2] p. 158.).

N° 14. EH3 chondrite - Yamato 691. Well developed chondrules mainly consisting of olivine and pyroxene. It contains opaque phases (metal + troilite) too ([2] p. 33.).

N° 15. H3 chondrite - Yamato 791428. Well developed chondritic texture. The chondrules are both from olivine, plagioclase and pyroxene + opaque component. There are chondrules mixed from these three main mineral phases, too ([2] p. 95.).

N° 16. H4 chondrite - Allan Hills 77233. The chondrules of this rather well defined chondritic texture are mainly from clinopyroxenes, and in less number from olivine.

N° 17. H5 chondrite - Yamato 74079. Less well developed chondritic texture with chondrules consisting of olivine and pyroxene ([2] p. 36.)..

N° 18. H6 chondrite - Yamato 74014. Slightly discernible chondrules. There are chondrules consisting of skeletal olivine. By this chondrule there are also olivine crystals.

N° 19. L3 chondrite - Yamato 74191. Well developed chondritic texture. It contains mainly chondrules from olivine and pyroxene, and a devitrified brown glass also occurs ([2] p. 41.).

N° 20. L4 chondrite - Yamato 74355. Chondritic texture with well developed chondrules of olivine and pyroxene.

N° 21. L5 chondrite - Yamato 790957. Less well defined chondrules, mainly from pyroxenes.

N° 22. L6 chondrite - Allan Hills 769. Chondritic texture, poorly defined chondrules. In a large pyroxene grain olivine inclusions can be found, and the pyroxene grain itself is also surrounded by olivine grains.

N° 23. LL3 chondrite - Yamato 790448. Densely populated with chondrules and chondrule fragments mainly from clinopyroxenes (some are twinned). There is a cellular olivine which contains fine fiber of glass. Lamellar clinopyroxene also occurs with fine devitrifying glass fibers. Between chondrules sulfide type opaque patches occur ([2] p. 63.).

N° 24. LL4 chondrite - Yamato 74442. A rather well defined chondritic texture with a little bit brecciated character where olivine and pyroxene grains also occur, together with the chondrules.

N° 25. LL5 chondrite - Allan Hills 78109. Poorly defined chondrules. There are chondrules consisting of barred olivines grown together with lamellae with different directions. Olivine chondrules+opaque minerals+olivine crystals also occur together.

N° 26. LL6 chondrite - Yamato 75258. Poorly defined chondrules, mainly consisting of olivine. There is a chondrule in which olivines radiate from an opaque core. Olivine grains also occur in the fine grained groundmass.

N° 27. CI carbonaceous chondrite - Yamato 82162.
Irregular chondrule-like grains can be found in the dark carbonaceous groundmass. One grain contains fine fibrous material - possibly devitrifying glass ([2] p. 180-181.).

N° 28. CM2 carbonaceous chondrite - Yamato 74662.
In the dark carbonaceous matrix mainly olivine (clear, transparent) and pyroxene (less clear) chondrules occur ([2] p. 47.)

N° 29. CO3 carbonaceous chondrite - Yamato 791717.
Well developed chondrules embedded into a fine grained groundmass which seems fresh. Spheroidal olivine chondrules occur. In a chondrule olivine, metal phase and hematite occur together. There is a chondrule with skeletal olivine between glass, so forming a spinifex textural character, and this all is surrounded with olivine grains ([2] p. 111.)

N° 30. CV3 carbonaceous chondrite - Yamato 86751.
Well defined chondrules in the fine grained matrix. There is a chondrule with many small olivine and twinned clinopyroxene surrounded with a glassy material ([2] p. 200.).

SUMMARY ABOUT ANTARCTIC SET OF NIPR
The Japanese NIPR Antarctic Meteorite Educational Thin Section Set is an excellent occasion to get an overview on the available materials of the Solar System. Chondrites, achondrites, Martian and lunar samples make it useful for the university planetary geology education. We used it in making comparisonal studies and videofilm for eduaction purposes [6-7].

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REFERENCES
[1] Cassidy W., Harvey R., Schutt J., Delisle G., Yanai K. (1992): *Meteoritics,* **27**. 490-525.[2] Yanai K. & Kojima H. (1987).: *Photographic Catalog of the Antarctic Meteorites.* NIPR. Tokyo, [3] Yanai, K., Kojima, H., Haramura, H. (1995) *Catalog of the Antarctic Meteorites*, NIPR, Tokyo; [4] Yanai K. & Kojima H. (1991): *Proc. NIPR Symp. Antarct. Meteorites*, **4**. 70-90. [5] Hutchison R. (1991): 16th Symposium on Antarctic Meteorites, NIPR, Tokyo, 4-1. [6] Sz. Bérczi, T. Földi, I. Kubovics, B. Lukács, I. Varga (1997): *LPSC XXVIII*. 101; [7] Sz. Bérczi, B. Lukács, T. Földi, Á. Holba, S. Józsa, G. Marosi, L. Szabó Sóki, Gy. Szakmány (1997): *22th NIPR Symp. Ant.Met.*, 12;