were obtained in the laboratory at a resolution comparable to that of the planetary spectra. The ice crystals were formed in a thin layer on a metal plate cooled by a piece of "dry ice." Both blocks had a milky appearance, that is, the ices were not transparent. Thus that fraction of the sunlight which penetrated the (roughly planar) front surfaces was scattered internally before emerging to be analyzed by the spectrograph. The dimensions of each block were sufficient to permit the acceptance of the full incident beam on the front (reflecting) surface, whereas no light was observed to pass through to the back surface. In each case a spectrum of sunlight reflected from a layer of MgO deposited on a sheet of metal was recorded on the same plate as the spectrum of sunlight reflected from the sample under investigation. The reflectivity of MgO is uniform in this region. An effort was made to keep the densities of each pair of spectra as equal as possible in the "neutral" region ($\lambda <$ 10,000 Å). Visual inspection of the plates obtained in this way indicated that the reflection spectrum from the ice block gave the best match to the absorption observed in Saturn's ring. A slight weakening was noticeable in the appropriate region of the spectrum from the ice crystals, while the CO_2 block gave an essentially neutral spectrum. Densitometer tracings verified these conclusions. The fact that the ice block produced a better fit to the ring spectrum than the ice crystals indicates that the light path in the latter was insufficient, that is, the layer of crystals was too thin.

Thus Kuiper's original suggestion is substantiated by the results described here. The observation of a second absorption at the correct wavelength makes it virtually certain that the absorbing substance associated with the ring particles is indeed water ice. The absorption observed by Kuiper at 1.5 μ is the solid-state equivalent of the ψ vapor band at 1.38 μ. The absorption described in this report corresponds to the ρ vapor band at 0.93 μ. It is therefore not surprising that Slipher (*4*) was unable to detect any absorption in spectra of the ring from 3500 to 7600 Å, since no strong water-vapor bands occur in this region. It is also apparent that what is observed in this case is a true solid-state absorption and not an evaporation effect, since in the latter case one would only expect to see the low-temperature rotational lines of the vapor band at 0.93 μ.

The explanation for the persistence of ice under conditions of high vacuum lies in its low vapor pressure at the predicted temperature of the ring, as Kuiper (*1*) has pointed out. The vapor pressure of ice at 90°K is given by Koller (*5*) as 1.5×10^{-19} μ-Hg. The use of this value in a formula for evaporation at low pressures, also given by Koller, indicates that the largest ice particle which could have evaporated since the origin of the solar system is only slightly larger than a water molecule. The same argument may be added to the spectral evidence to exclude ices of methane and ammonia (the most likely alternatives) since their vapor pressures are too high: 7×10^{4} μ-Hg and 10^{-4} μ-Hg, respectively, at 90°K.

The observations of the Galilean satellites of Jupiter were made to test for the presence of gaseous atmospheres. The advantage of extending the wavelength range over which the satellites are observed lies in the fact that the strongest methane band in the photographically accessible region of the spectrum can be recorded. This band has its maximum at 8873 Å, a fact which was verified by overexposed spectra of Jupiter which clearly showed the structure of the band at the resolution of the satellite observations. Methane is present in the atmospheres of the major planets and Saturn's largest satellite, Titan. Its relatively high molecular weight, its high vapor pressure at low temperatures, and the high cosmic abundance of carbon and hydrogen make methane a likely constituent of cold, tenuous atmospheres in the outer regions of the solar system. Spectra of Io, Ganymede, and Callisto (three of the four largest satellites) were obtained and compared with laboratory spectra of methane taken at the same resolution. No trace of any nonsolar features was found. The laboratory spectra permitted the establishment of an upper limit of 100 cm atm (NTP) (*6*) for the methane abundance in possible atmospheres of these bodies. This negative result lowers Kuiper's (*1*) limit by a factor of two and is of particular interest in view of the recent observations reported by Binder and Cruikshank (*7*), which suggest the presence of an atmosphere about Io.

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8. Contribution No. 108 of the Kitt Peak National Observatory, where I was a graduate research student, 1963 and 1964. I thank Dr. N. U. Mayall and the staff of the Kitt Peak National Observatory for making their facilities available for this study and J. V. Marshall for assistance in obtaining the comparison spectra. The laboratory program was supported by ONR contract NR046-791.

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Antarcticite: A New Mineral, Calcium Chloride Hexahydrate, Discovered in Antarctica

Abstract. *A new mineral, calcium chloride hexahydrate, was discovered in the Don Juan Pond in Victoria Land, Antarctica. The optical properties, chemical analysis, and powder patterns obtained by x-ray diffraction agree with those of artificial calcium chloride hexahydrate. The name Antarcticite is proposed for the new mineral.*

Samples of a new mineral, calcium chloride hexahydrate, were collected by one of us (T.T.) at Don Juan Pond, Victoria Land, Antarctica, on 30 December 1963, and brought to the laboratory in Tokyo. Don Juan Pond is about 300 m long from east to west and 100 m wide (north to south); its depth is only 10 cm. It is situated at 77°34′S, 161°10′E. Don Juan Pond was mentioned by Meyer *et al.* (*1*). The pond is situated nearly at the cen-

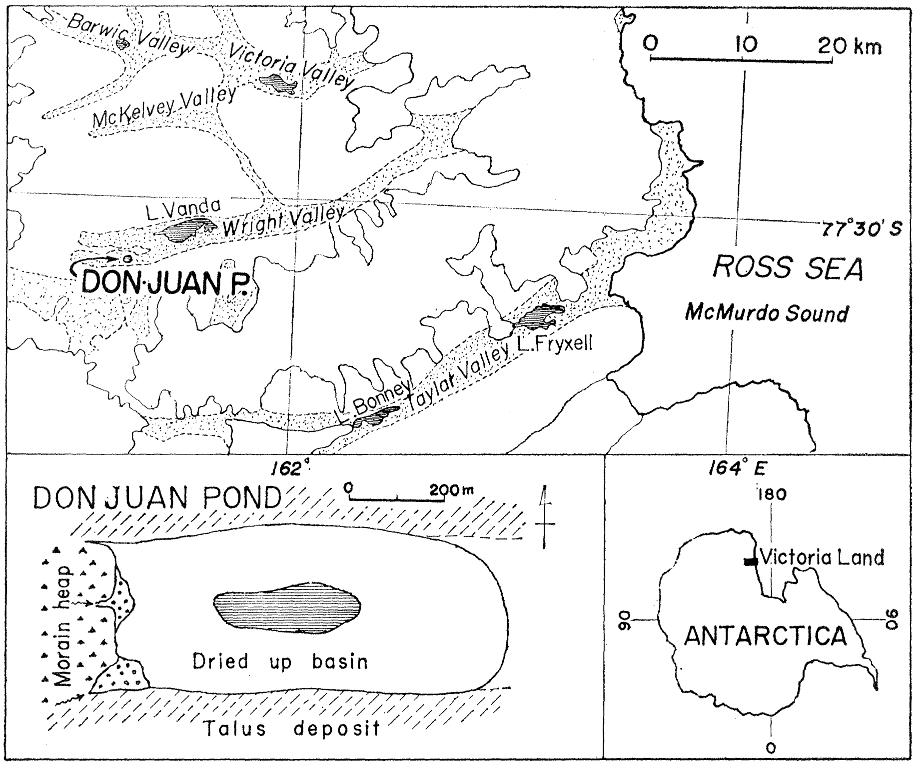

Fig. 1. Don Juan Pond and its vicinity.

ter of the flat plain surrounded by moraine heaps and talus deposits at the end of the Wright Valley, which is one of the Dry Valleys (Fig. 1).

The water in the pond contains an extremely large amount of salt (Table 1), the salinity and the chemical composition changing considerably from time to time. The extraordinarily high salinity seems to prevent the water from freezing, even in winter. The crystals of calcium chloride hexahydrate were found in the water and at the bottom of the pond; crystals of sodium chloride and calcium sulfate were found around the edge of the

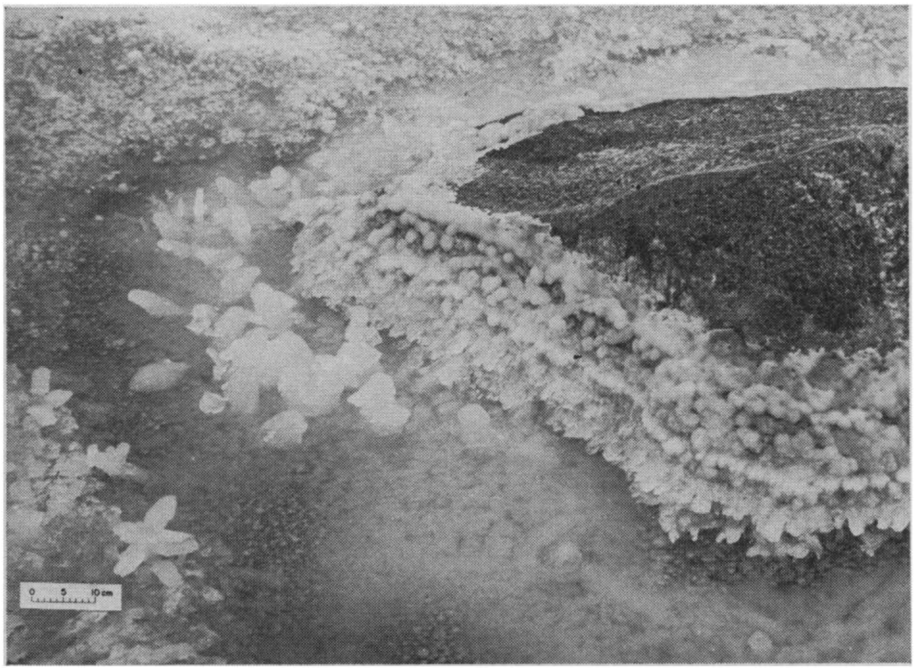

Fig. 2. Antarcticite crystallizing out in the Don Juan Pond. The scale represents 10 cm.

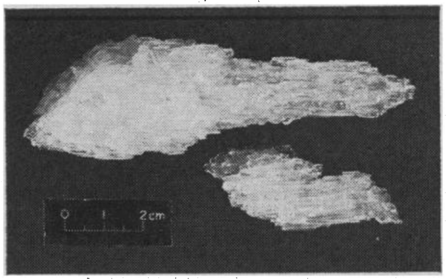

Fig. 3. Crystals of Antarcticite. The larger crystal is about 10 cm in length.

Table 1. Chemical composition and specific gravity of samples of pond water taken on three different dates.

Property or substances	Components (g/kg) 11 Oct. 1961*	16 Dec. 1962	30 Dec. 1963
Salinity		361.9	388.8
Na	11.5	4.11	2.16
K	0.16	0.15	0.23
Ca	114.0	123.9	130.5
Mg	1.20	1.82	2.59
Cl	212.0	229.4	250.5
SO_4	0.011	0.00	0.00
Specific gravity	1.251	1.351	1.380

* After Meyer *et al.* (*1*).

Table 2. X-ray powder diffraction data for Antarcticite and $CaCl_2 \cdot 6H_2O$.

Antarcticite d(Å)	I	$CaCl_2 \cdot 6H_2O$ (A.S.T.M.) d(Å)	I	Indices
6.92	9	6.9	15	100
3.98	18	3.93	75	110
3.44	24	3.41	31	011
2.80	23	2.78	63	111
2.60	22	2.58	50	021
2.28	13	2.27	50	300
2.16	23	2.16	100	121
1.98	8	1.97	50	220
1.90	7	1.90	15	310
1.77	4	1.76	13	112
1.71	5	1.70	38	
1.57	2	1.57	10	
1.50	3	1.49	38	
1.46	2	1.45	20	
1.40	1	1.39	15	
1.37	2	1.37	5	

Table 3. The chemical composition of Antarcticite.

Component	Weight (%)	Mole (%)	Molar ratio
Ca	17.5	0.437	1.000
Mg	0.41	.017	0.039
Na	0.34	.015	.034
K	0.008	.002	.000
Cl	32.7	.923	2.11
H_2O	49.2	2.730	6.25
Total	100.1		

pond. The calcium chloride crystals were mostly in the form of needles, as shown in Figs. 2 and 3.

The crystal is uniaxial and the optic sign is negative; the refractive indices measured by the immersion method are $n_0 = 1.550$, $n_e = 1.495$. These are in good accordance with those of the artificial crystals of calcium chloride hexahydrate ($CaCl_2 \cdot 6H_2O$) given by Winchell and Winchell (*2*). The powder patterns of six different crystals collected at the pond and of the crystal of pure calcium chloride hexahydrate (guaranteed reagent) were studied by x-ray diffraction (Table 2) and found to agree very well with each other and with the data for calcium chloride hexahydrate given in the A.S.T.M. x-ray diffraction data cards (*3*). The lattice constants of crystals calculated by comparing observed values with the silicon standard are as follows: hexagonal, $a_0 =$ 7.89 Å, $c_0 = 3.95$ Å, and $c/a = 0.501$. The values are very close to those given by A.S.T.M., namely, $a_0 = 7.90$ Å, $c_0 =$ 3.92 Å, and $c/a = 0.497$ (*3*).

The results of chemical analysis of one of the samples are shown in Table 3. In addition to the minor constituents magnesium, sodium, and potassium, the presence of strontium was confirmed by the emission-arc spectral analysis.

The concentration of the solution and the crystallization of the salts in the Don Juan Pond may have been effected by low temperature and extremely dry climate. There is little doubt that the crystals we have examined are naturally occurring calcium chloride hexahydrate. Because of the highly hygroscopic nature of the salt, its occurrence in nature has not been reported previously. We propose the name "Antarcticite" for this new mineral after the name of the continent in which it was discovered (*4*).

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4. The name of the mineral has been approved by the Commission on New Minerals and Mineral Names, International Mineralogical Association.
5. This work formed a part of some studies supported by the U.S. Antarctic Research Project being conducted by the NSF. We thank the staff members of NSF at McMurdo Sound and helicopter pilots of U.S. Navy Air Development Squadron Six. Thanks are also due to Drs. N. Yamagata, T. Cho, and Mr. Y. Yoshida who participated in the field study. Dr. M. Fleischer is acknowledged with thanks for his suggestion of the name for this new mineral. We thank Profs. K. Sugawara, E. Minami, and Y. Miyake for their encouragement and advice.

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Simple Microcentrifuge for Use in the Field

Abstract. *A novel, simply made, hand-powered microcentrifuge has been developed for use in the field. It handles as many as eight samples simultaneously. The principal materials are sheet nylon, polyester cord, and polyethylene tubing. Maximum speed of the centrifuge is 10,000 revolutions per minute; maximum radial acceleration, 8400g. Among other uses, the centrifuge serves to obtain plasma for immunoelectrophoresis and flocculation and agglutination tests and for determination of plasma cholinesterase and total solids (refractometrically). Hematocrit values may be obtained and blood parasites concentrated.*

In this age of automation and increasingly complex laboratory instruments, little has been devoted to the development of simple, practical instruments for use in the field under difficult conditions—notably the absence of electric power. Mainly from plastics, I have devised an extremely simple, hand-powered, portable centrifuge that works on the same principle as a well-known toy; spun by alternate tensing and slackening of cords, a nylon disc alternately rotates and contrarotates. A similar device (*1*) introduced by the de Laval Company proved to be impractical in service. My version has served admirably in West Africa, notably in separating plasma for determinations of cholinesterase activities by the Acholest method (*2*).

The main component, the centrifuge disc (Fig. 1), is a nylon elliptoid measuring 164 by 64 mm. The disc incorporates eight tubular channels, four pairs of parallels, paralleling the one side or the other of the disc; each pair occupies roughly one-quarter of the periphery. The bore of the channels is great enough to easily accommodate doubled lengths of certain polyethylene tubing that is described below. The length of each of the four outer channels is 75 mm; of the inner, 67 mm. The distance from the center of the disc to the ends of the outer channels is 75 mm; to the ends of the inner channels, 72 mm. The outer sections of the channels should preferably lie at an angle of 40 to 45 degrees from the radius of the disc. At the midpoint of each side of the disc, where two pairs of channels come together, a depression in the disc gives access to the inner ends of the channels so that tubes can be inserted; insertion and removal are facilitated by the fact that the outer ends of the channels debouch from the edge of the disc. A 30-mm diameter in the center of the disc is reinforced with sheet nylon; through this reinforcement are drilled four equidistant holes, each 12 mm from the center, large enough for passage of the cord to be described. Weight of the disc may be reduced by drilling in noncritical areas; a typical weight is 15 g. The finished disc should be polished to minimize air friction.

The four cords (Fig. 1), 90 cm long, are of long-fiber, three-ply, left-twined polyester yarn (*3*) with a tensile strength of 45 to 50 kg; they are plasticized. They are threaded through the holes in the disc, and one set of four ends is formed into a loop for

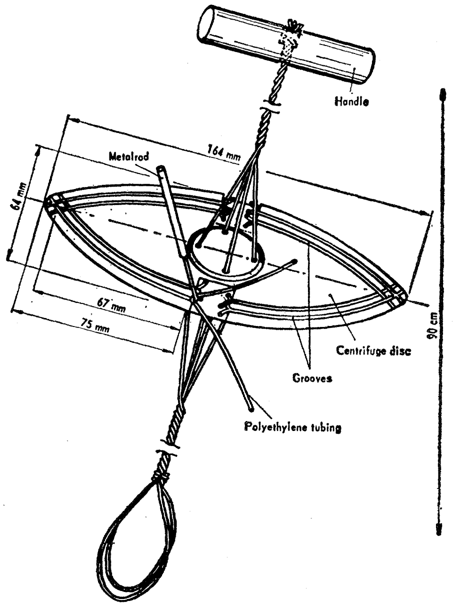

Fig. 1. The complete centrifuge.