

The Project Gutenberg eBook of Fossil Ice Crystals: An Instance of the Practical Value of "Pure Science", by Johan August Udden

This ebook is for the use of anyone anywhere in the United States and most other parts of the world at no cost and with almost no restrictions whatsoever. You may copy it, give it away or re-use it under the terms of the Project Gutenberg License included with this ebook or online at www.gutenberg.org. If you are not located in the United States, you'll have to check the laws of the country where you are located before using this eBook.

Title: Fossil Ice Crystals: An Instance of the Practical Value of "Pure Science"

Author: Johan August Udden

Release Date: September 18, 2010 [EBook #33760]

Language: English

Credits: Produced by Chris Curnow, Iris Gehring and the Online Distributed Proofreading Team at <https://www.pgdp.net> (This file was produced from images generously made available by The Internet Archive)

*** START OF THE PROJECT GUTENBERG EBOOK FOSSIL ICE CRYSTALS: AN INSTANCE OF THE PRACTICAL VALUE OF "PURE SCIENCE" ***

University of Texas Bulletin

No. 1821: April 10, 1918

Fossil Ice Crystals ***An Instance of the Practical Value of "Pure Science"***



Bureau of Economic Geology and Technology
Division of Economic Geology
J. A. Udden, Director of the Bureau and Head of the Division

Published by the University six times a month and entered as second-class matter at the postoffice at
AUSTIN, TEXAS

Publications of the University of Texas

Publications Committee:

F. W. GRAFF
J. M. BRYANT

R. H. GRIFFITH
J. L. HENDERSON

The University publishes bulletins six times a month, so numbered that the first two digits of the number show the year of issue; the last two the position in the yearly series. (For example, No. 1701 is the first bulletin of the year 1917.) These comprise the official publications of the University, publications on humanistic and scientific subjects, bulletins prepared by the Department of Extension and by the Bureau of Municipal Research and Reference, and other bulletins of general educational interest. With the exception of special numbers, any bulletin will be sent to a citizen of Texas free on request. All communications about University publications should be addressed to the Chairman of the Publications Committee, University of Texas, Austin.

University of Texas Bulletin

[p.1]

No. 1821: April 10, 1918

Fossil Ice Crystals *An Instance of the Practical Value of "Pure Science"*



Bureau of Economic Geology and Technology
Division of Economic Geology
J. A. Udden, Director of the Bureau and Head of the Division

Published by the University six times a month and entered as second-class matter
at the postoffice at
AUSTIN, TEXAS

The benefits of education and of
useful knowledge, generally
diffused through a community, are
essential to the preservation of a
free government.

[p.2]

Sam Houston

Cultivated mind is the guardian
genius of democracy... It is the only
dictator that freemen acknowledge
and the only security that freemen
desire.

Mirabeau B. Lamar

FOSSIL ICE CRYSTALS

[p.3]

By J. A. UDDEN

AN INSTANCE OF THE PRACTICAL VALUE OF "PURE SCIENCE"

The practical value of the service of the geological profession is, with every year, being more and more appreciated, especially among people who are developing the mineral resources of our country. Nevertheless, we still hear men who speak of geologists as theorists that render our profitable industries but little assistance. It is true that much of the work that geologists do has but a remote bearing on practical questions. The fact is that in geology, as in other sciences, one can never know when a purely scientific observation may turn out to have a practical application. Paleontologists who study the minutest details of fossils have been held up as impractical people, even though their science has more than once proved to be of the greatest practical importance for the finding of valuable natural deposits. Certainly those who have been most prominent in the promotion of paleontology as a science have seldom, if ever, had any economic motive in the pursuit of their work. I think the same is true of our leading petrographers. I believe that the men who have advanced the science of geology most, have seldom contributed much to the practical application of the principles they have discovered. Much scientific work naturally appears unprofitable or useless to the uninitiated. I shall here relate a case that suggests how entirely wrong it may be to regard as of no economic value any geologic fact, however insignificant it may appear.

In the summer of 1890 I took occasion to make a trip to the Black Hills in South Dakota in order to profit, as I could, by a few weeks' tramping in this interesting region. Going one day in a southwest direction from Minnekahta, to look for fossil cycads, I stumbled on a block of sandstone with a rather smooth surface on which were some peculiar markings, such as I had never seen figured or described. The rock was evidently a block from the Dakota sandstone. Its smooth upper surface, which represented a bedding plane, was covered with a thin coating of silt or fine clay which adhered to the block. The markings were in this clay. They were straight, shallow grooves from one-half to two inches in length, and from one-sixteenth to one-eighth inch in width. They were joined into patterns in which some sprang out from the sides of others and again themselves sent out other branches. Some crossed each other. I noticed that there was a quite uniform angle of divergence in these branches, and I was able to make out that this usual angle was about sixty degrees. I also noted that the grooves narrowed to sharp points. Somehow, immediately I concluded that the cracks were the result of ice crystals, and I at once saw the propriety of frozen water having existed in an age during which deciduous trees began to appear. This was theory. We have since that time learned to know that cold climates far antedate the coming of the dicotyledons.

As I had no suitable photographic equipment, I took pains to make accurate drawings of a part of the pattern as it appeared on the rock. My original drawing is shown in [Plate I](#). A brief description of these markings was later furnished in the *Scientific American*, of February 19, 1895.

It took me some years to find any similar markings again. In the early spring of 1903 I had occasion to make a visit to Mexico, when I spent a half day in Ojinaga, which is a little village south of Presidio, in Texas, on the Mexican side of the river. Some sidewalks in this little village are built of flags of limestone belonging to the Eagle Ford formation. To my great delight I found some of these slabs having precisely the same kind of markings that I had noted on the sandstone in Dakota. Naturally I attached some importance to the fact that the Eagle Ford corresponds quite closely in age to that of the Dakota sandstone. Both were made at about the beginning of the upper Cretaceous age. I noticed here a considerable variation in the closeness of the patterns of the markings. Occasionally they were found as separate single lines, several inches removed from each other; and on other rocks they would be found crossing in close networks. In the summer of 1904 I again found my ice markings on a layer of arenaceous limestone in the same formation in the Big Bend country in Texas. This time I collected some specimens which were subsequently photographed. One of these photographs is shown in [Plate II](#). Again in 1906 I noticed the same markings on some thin sandy flags which occur in the Del Rio clay near the city of Del Rio. In this case the needle-like crystals were somewhat more slender than those previously seen, and some were slightly curved and somewhat more elongated. These of course interested me as showing the occurrence of freezing temperatures no doubt at a somewhat earlier time than that pertaining to my previous observations.

During all these years my residence was in Illinois, and I was naturally watching for similar markings in recent mud, resulting from late and early frosts. I found them in the fall of 1909. At this time some excavations were being made in the loess in Rock Island, when some rains fell in the late fall. These rains evidently happened to give the mud the amount of moisture necessary for such crystals to develop, as the ground froze. The rains had washed the loess extensively, and I found a number of places where it lay redistributed, with a fairly smooth surface. It was evident that the moisture content of the ground, together with the temperature conditions,

[p.4]

[p.5]

determined the size and the closeness of the frozen patterns. In places the crystals were long and slender, in others they were short and stout. At some points they were straight and in others slightly curved. Here and there the patterns were close enough to resemble the fine lines which we sometimes notice in the hoarfrost on windowpanes. In other places the crystals occurred in radiating groups, and elsewhere they would form scattered separate units. For preserving a record of what I saw, I poured plaster over several patterns and had these casts photographed, as appears in [Plates VIII, IX, X](#). Placing these side by side with the photographs of the patterns I have photographed from the Eagle Ford, it appears to me that no doubt can be left as to the origin of the markings found in the fossil state.

[p.6]

Recently I have found that these ice crystal marks are quite common at one horizon in the Eagle Ford beds of Brewster County, in Texas. There is also a layer in which they can be usually seen in the vicinity of Austin, Texas. This lies about twenty-five feet below the Austin Chalk, near Austin. A like layer occurs about 100 feet below the Austin Chalk in the Big Bend country. Here I have found the markings in localities thirty miles apart. They occur at the north point of Mariscal Mountain and in a number of places near the Fossil Knobs and on the Chisos Mining Company property at Terlingua.

Unprofitable as observations on such a simple matter as this may seem, I find that other geologists have given it some attention. Quite recently, Dr. John M. Clarke^[A] has figured slabs showing what has been described as *Fucooides graphica*, by Hall. The markings figured by Professor Clarke are undoubtedly of the same kind as those I have found in the Eagle Ford. They occur in the Upper Devonian in New York. I also find that the formation of ice crystals in wet mud has been observed in the clays about Boston by Marbut and Woodworth.^[B] Other observations of similar recent markings are said to have been made by some English geologists.

To "practical people" it may indeed appear that no more unprofitable or more idle curiosity could be indulged in, than making observations on what kind of crystals are formed when water freezes in mud. I must confess that my own first observations had no motive whatever, except for the desire to know something new; and I never expected that anything I could learn about these fossil marks would ever turn out to have any practical application, at least not in my own work.

But it has turned out differently. For some time, I have been called upon occasionally to advise with regard to the finding of the ore in one of our quicksilver mines in West Texas. It is now a well established fact that the distribution of the ore in this mine, and I believe in the entire Terlingua district, bears a definite relation to geological horizons. Successful mining requires search in these horizons. The cinnabar, as it appears, has accumulated in greatest quantity under impervious rocks such as shales and marls along planes that separate these from underlying rocks of more open texture, mostly limestones. The ore has clearly come from below and has risen through fissure planes, which in some cases separate large blocks of the Cretaceous formations. The best ore has been found under the basal part of the Boquillas flags, and under the Del Rio clay in the upper part of the Georgetown limestone. The workings must be so arranged in the mine that these horizons can be entered on both sides of a fault fissure. The problem of locating the depth of the desirable horizons in the mine in question would be easy enough, if it were not for the fact that the outcropping rocks consist of a series of sediments with few characteristic fossils. Most of the fossils which occur extend through a range of several hundred feet and the beds themselves are quite uniform in character, consisting of alternating thin layers of impure limestones and marls. An attempt was made to correlate the outcropping beds by close examination of the layers exposed, but the result was not very satisfactory. A close scrutiny made of each layer on the section resulted, however, in the finding of two features that enabled me to measure the throw of the fault under investigation. Interbedded in the Boquillas flags there are some thin layers of bentonite, which are quite persistent and can be followed for several miles. By comparing the distances between these layers and by taking note of their individual thickness, it was possible to make a correlation that seemed to be correct. But the proof sought fell just short of being certain. In cases of this kind one always looks for corroborating facts to check one's conclusions. I found this check in the discovery of the layer which carries ice crystal markings in these beds. The layer had a definite relation to the seams of bentonite, and, with this additional evidence, I was confident there was no possible chance of a mistake. It enabled me to locate not only the right horizon but also a horizon in the underlying heavy Comanchean limestone, which is water-bearing, and which must be avoided to prevent serious injury to the underground operations. I need not add that the information obtained was of real practical value in this case.

[p.7]

[p.8]

[p.9]

Plate I. Forms of frost cracks seen on the exposed flat bedding plane of a block of Dakota sandstone in a ravine a few miles southwest of Minnekahta, South Dakota. As sketched in the field. Natural size.

[p.10]

Plate I

[p.11]

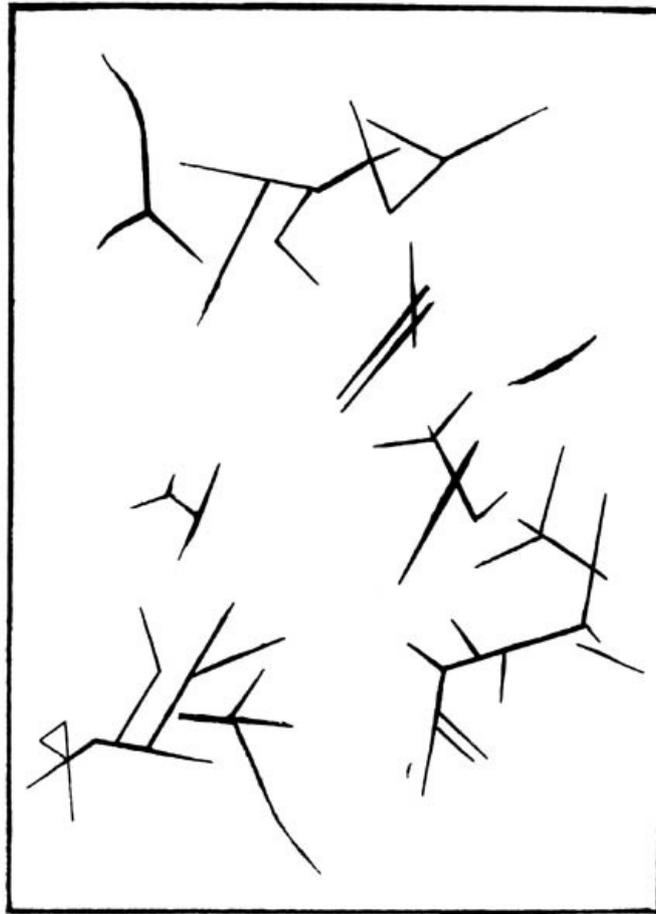


PLATE II

[p.13]

Plate II. Photographs of fossil imprints of ice crystals on flags of the Eagle Ford. The upper rock shown in the Plate is from the south side of Cuesta Blanca in Brewster County, Texas, and shows casts of crystals which represent fillings of sandy mud projecting slightly down into an underlying bed of more argillaceous material. The lower part of the figure shows a similarly marked flag from the same formation at a point about five miles north of the old Boquillas postoffice near Tornillo Creek, east of the Chisos Mountains, in Texas. Here are seen the original grooves made by the ice on a layer of muddy material later buried. Slightly reduced.

[p.14]

Plate II

[p.15]



PLATE III

Plate III. Photograph of fossil casts of a close tangle of ice crystals seen in a stony calcareous layer in the Eagle Ford shale in Walnut Creek, about eight miles north of Austin, Texas. This tangle is closer than any of the recent ice crystal marks figured here, but equally closely grown crystals have been seen by the writer on frozen mud in Illinois. Natural size. Compare with [Plate VIII](#).

Plate III

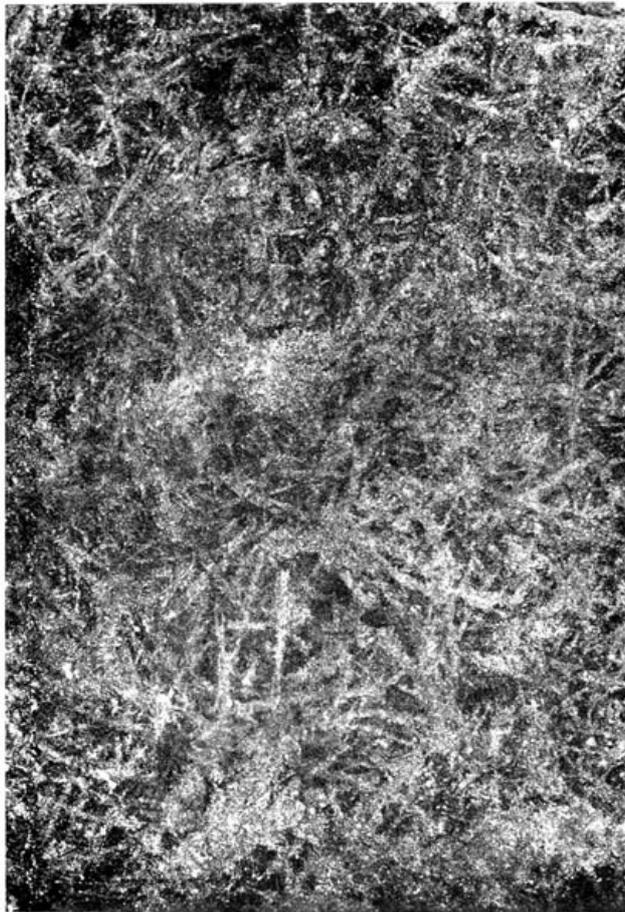


PLATE IV

[p.21]

Plate IV. Photograph of fossil casts of ice crystals seen on some stony flags in the upper part of the Eagle Ford at Fossil Knobs, about two miles northwest of the Chisos Mine in Brewster County, Texas. These may be characterized as relatively short and scattered. This shows ridges projecting into the grooves formed by ice crystals on the surface of a muddy layer originally underlying the layer photographed. Slightly reduced.

[p.22]

Plate IV

[p.23]



PLATE V

Plate V. Photograph of fossil casts of ice crystals seen on the under side of flaggy layer of calcareous sandy rock in the upper part of the Eagle Ford at Fossil Knobs, about two miles northwest from the Chisos Mining Company's property, Brewster County, Texas. It will be seen that some of the crystals are gently curved. Similar curving crystals are also seen in the figures showing recent growths at Rock Island, Illinois. Compare with [Plate IX](#). Slightly reduced.

Plate V

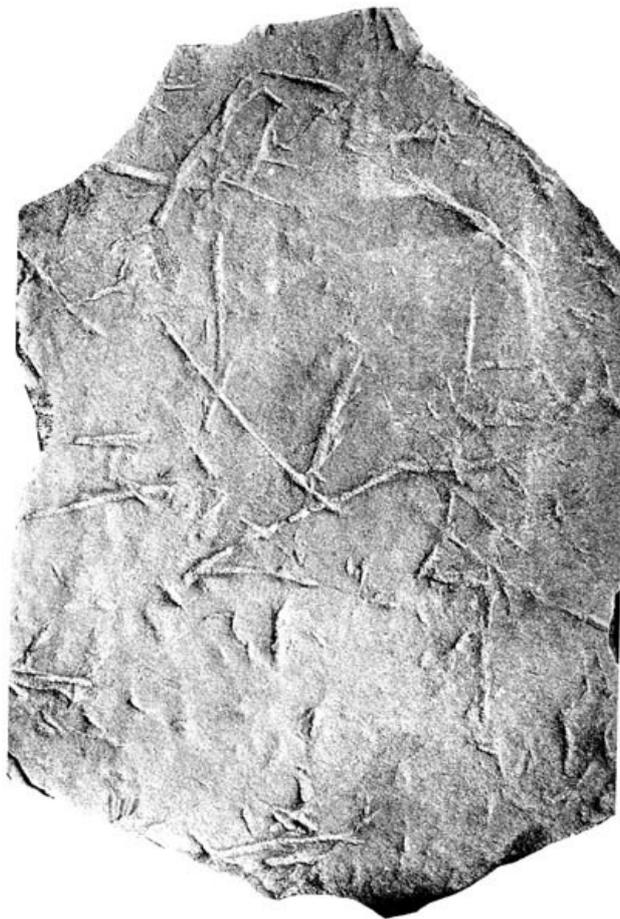


PLATE VI

[p.29]

Plate VI. Photograph of a thin flag of sandy limestone from the Eagle Ford at Fossil Knobs in Brewster County, showing molds left by ice crystals.

[p.30]

Plate VI

[p.31]



PLATE VII

[p.33]

Plate VII. Photographs of three fragments of flags showing casts of ice crystals on the under side. All observations made on crystals of this kind indicate local differences in the forms of ice crystals presumably due to differences in the rate of freezing, in the texture of the mud and probably in variations in water content of the mud. Some crystals in the locality from which these specimens came, show pinnate secondary growths. Specimens shown here are from near the upper part of the Eagle Ford at a point about two miles north from the Chisos Mining Company's property. Brewster County, Texas. Slightly reduced.

[p.34]

Plate VII

[p.35]

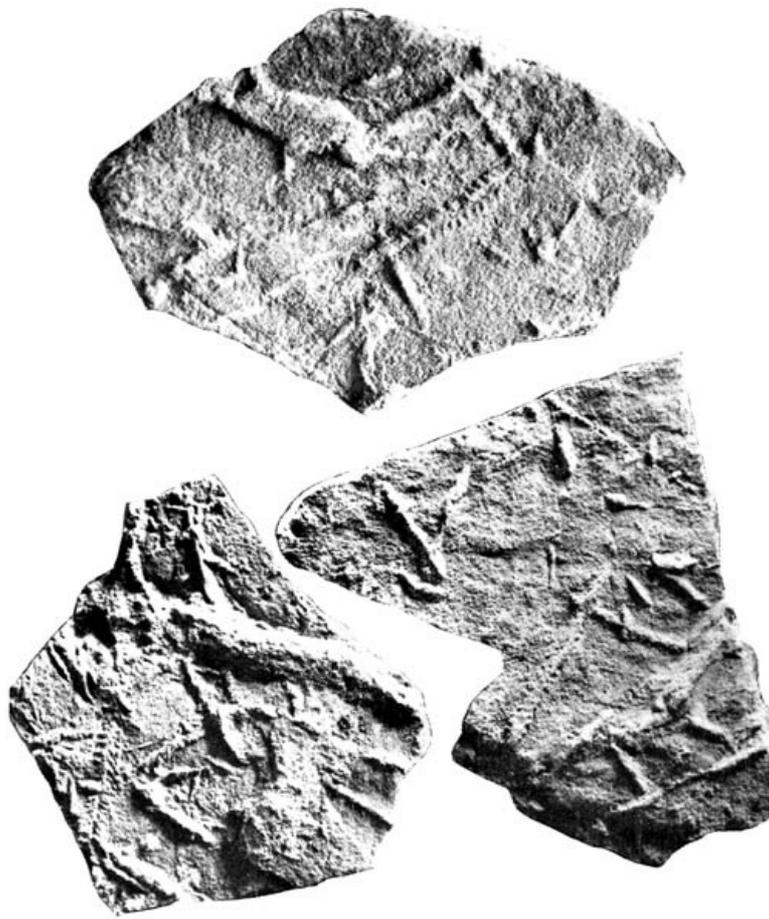


PLATE VIII

Plate VIII. Photograph of a cast made by pouring plaster over a surface of mud in which ice crystals had recently formed, in Rock Island, Illinois, after the ice in the crystals had been removed by slow natural sublimation into the atmosphere, leaving open cracks in the mud. The comb-like ridges on the plaster cast have the form of the ice crystals. Compare with [Plate III](#).

Plate VIII



PLATE IX

[p.41]

Plate IX. Photograph of a cast made by pouring plaster over a surface of mud in which ice crystals had formed, in Rock Island, Illinois, soon after the ice in the crystals had been removed by slow natural sublimation into the atmosphere, leaving open cracks in the mud. In the locality where this cast was made, the crystals were relatively slender, distant, and some gently curved, like those seen in [Plate V](#). Slightly reduced.

[p.42]

Plate IX

[p.43]

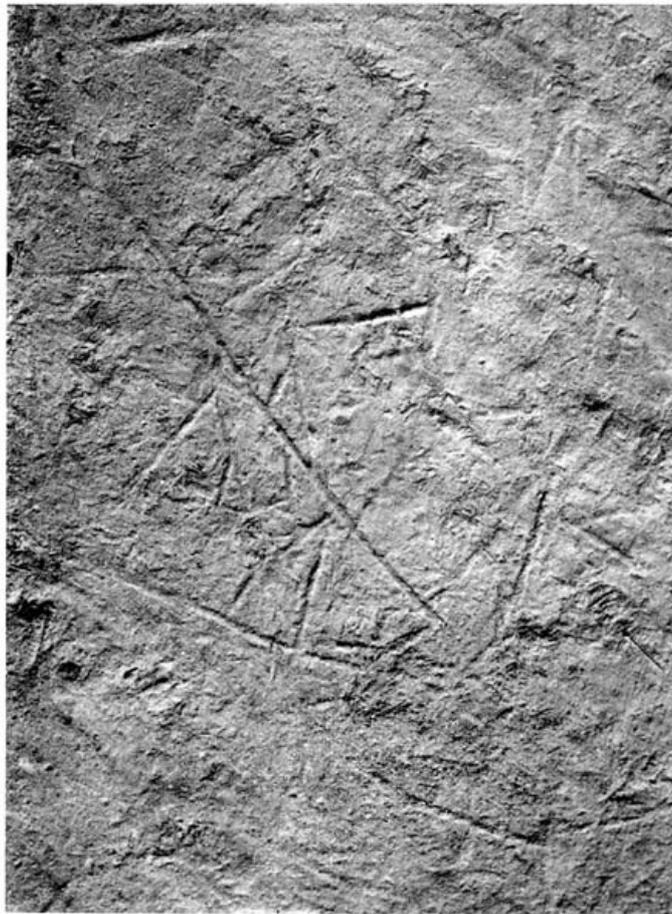


PLATE X

[p.45]

Plate X. Photograph of a cast made by pouring plaster over a surface of mud in which ice crystals had recently formed, in Rock Island, Ill., and where they had later been removed by natural sublimations into the atmosphere, leaving open cracks in the mud. It will be seen that the crystal growth in this case involves an x-like or radiating pattern formed of relatively very slender forms that almost everywhere are very gently curved somewhat reminding of the slender thread-like crystals sometimes seen in frost on windows. I have not yet seen any similar fossil crystal growths as slender as these. Slightly reduced.

[p.46]

Plate X

[p.47]



FOOTNOTES:

[p.48]

[A](#) Strand and undertow markings, etc., New York State Museum, *Bulletin No. 196, April 1, 1917*, pp. 199-210; pl. 20-23.

[B](#) Brick clays of Rhode Island, Massachusetts; Marbut and Woodworth, *U.S. Geol. Survey, 17th Ann. Rep., Pt. 1*, p. 992.

Transcriber's Notes:

Missing page numbers correspond to blank pages.

Printer's inconsistencies in spelling and punctuation have been retained.

*** END OF THE PROJECT GUTENBERG EBOOK FOSSIL ICE CRYSTALS: AN INSTANCE OF THE PRACTICAL VALUE OF "PURE SCIENCE" ***

Updated editions will replace the previous one—the old editions will be renamed.

Creating the works from print editions not protected by U.S. copyright law means that no one owns a United States copyright in these works, so the Foundation (and you!) can copy and distribute it in the United States without permission and without paying copyright royalties. Special rules, set forth in the General Terms of Use part of this license, apply to copying and distributing Project Gutenberg™ electronic works to protect the PROJECT GUTENBERG™ concept and trademark. Project Gutenberg is a registered trademark, and may not be used if you charge for an

eBook, except by following the terms of the trademark license, including paying royalties for use of the Project Gutenberg trademark. If you do not charge anything for copies of this eBook, complying with the trademark license is very easy. You may use this eBook for nearly any purpose such as creation of derivative works, reports, performances and research. Project Gutenberg eBooks may be modified and printed and given away—you may do practically ANYTHING in the United States with eBooks not protected by U.S. copyright law. Redistribution is subject to the trademark license, especially commercial redistribution.

START: FULL LICENSE

THE FULL PROJECT GUTENBERG LICENSE

PLEASE READ THIS BEFORE YOU DISTRIBUTE OR USE THIS WORK

To protect the Project Gutenberg™ mission of promoting the free distribution of electronic works, by using or distributing this work (or any other work associated in any way with the phrase “Project Gutenberg”), you agree to comply with all the terms of the Full Project Gutenberg™ License available with this file or online at www.gutenberg.org/license.

Section 1. General Terms of Use and Redistributing Project Gutenberg™ electronic works

1.A. By reading or using any part of this Project Gutenberg™ electronic work, you indicate that you have read, understand, agree to and accept all the terms of this license and intellectual property (trademark/copyright) agreement. If you do not agree to abide by all the terms of this agreement, you must cease using and return or destroy all copies of Project Gutenberg™ electronic works in your possession. If you paid a fee for obtaining a copy of or access to a Project Gutenberg™ electronic work and you do not agree to be bound by the terms of this agreement, you may obtain a refund from the person or entity to whom you paid the fee as set forth in paragraph 1.E.8.

1.B. “Project Gutenberg” is a registered trademark. It may only be used on or associated in any way with an electronic work by people who agree to be bound by the terms of this agreement. There are a few things that you can do with most Project Gutenberg™ electronic works even without complying with the full terms of this agreement. See paragraph 1.C below. There are a lot of things you can do with Project Gutenberg™ electronic works if you follow the terms of this agreement and help preserve free future access to Project Gutenberg™ electronic works. See paragraph 1.E below.

1.C. The Project Gutenberg Literary Archive Foundation (“the Foundation” or PGLAF), owns a compilation copyright in the collection of Project Gutenberg™ electronic works. Nearly all the individual works in the collection are in the public domain in the United States. If an individual work is unprotected by copyright law in the United States and you are located in the United States, we do not claim a right to prevent you from copying, distributing, performing, displaying or creating derivative works based on the work as long as all references to Project Gutenberg are removed. Of course, we hope that you will support the Project Gutenberg™ mission of promoting free access to electronic works by freely sharing Project Gutenberg™ works in compliance with the terms of this agreement for keeping the Project Gutenberg™ name associated with the work. You can easily comply with the terms of this agreement by keeping this work in the same format with its attached full Project Gutenberg™ License when you share it without charge with others.

1.D. The copyright laws of the place where you are located also govern what you can do with this work. Copyright laws in most countries are in a constant state of change. If you are outside the United States, check the laws of your country in addition to the terms of this agreement before downloading, copying, displaying, performing, distributing or creating derivative works based on this work or any other Project Gutenberg™ work. The Foundation makes no representations concerning the copyright status of any work in any country other than the United States.

1.E. Unless you have removed all references to Project Gutenberg:

1.E.1. The following sentence, with active links to, or other immediate access to, the full Project Gutenberg™ License must appear prominently whenever any copy of a Project Gutenberg™ work (any work on which the phrase “Project Gutenberg” appears, or with which the phrase “Project Gutenberg” is associated) is accessed, displayed, performed, viewed, copied or distributed:

This eBook is for the use of anyone anywhere in the United States and most other parts of the world at no cost and with almost no restrictions whatsoever. You may copy it, give it away or re-use it under the terms of the Project Gutenberg License included with this eBook or online at www.gutenberg.org. If you are not located in the United States, you will have to check the laws of the country where you are located before using this eBook.

1.E.2. If an individual Project Gutenberg™ electronic work is derived from texts not protected by U.S. copyright law (does not contain a notice indicating that it is posted with permission of the copyright holder), the work can be copied and distributed to anyone in the United States without paying any fees or charges. If you are redistributing or providing access to a work with the phrase “Project Gutenberg” associated with or appearing on the work, you must comply either with the requirements of paragraphs 1.E.1 through 1.E.7 or obtain permission for the use of the work and the Project Gutenberg™ trademark as set forth in paragraphs 1.E.8 or 1.E.9.

1.E.3. If an individual Project Gutenberg™ electronic work is posted with the permission of the copyright holder, your use and distribution must comply with both paragraphs 1.E.1 through 1.E.7 and any additional terms imposed by the copyright holder. Additional terms will be linked to the Project Gutenberg™ License for all works posted with the permission of the copyright holder found at the beginning of this work.

1.E.4. Do not unlink or detach or remove the full Project Gutenberg™ License terms from this work, or any files containing a part of this work or any other work associated with Project Gutenberg™.

1.E.5. Do not copy, display, perform, distribute or redistribute this electronic work, or any part of this electronic work, without prominently displaying the sentence set forth in paragraph 1.E.1 with active links or immediate access to the full terms of the Project Gutenberg™ License.

1.E.6. You may convert to and distribute this work in any binary, compressed, marked up, nonproprietary or proprietary form, including any word processing or hypertext form. However, if you provide access to or distribute copies of a Project Gutenberg™ work in a format other than “Plain Vanilla ASCII” or other format used in the official version posted on the official Project Gutenberg™ website (www.gutenberg.org), you must, at no additional cost, fee or expense to the user, provide a copy, a means of exporting a copy, or a means of obtaining a copy upon request, of the work in its original “Plain Vanilla ASCII” or other form. Any alternate format must include the full Project Gutenberg™ License as specified in paragraph 1.E.1.

1.E.7. Do not charge a fee for access to, viewing, displaying, performing, copying or distributing any Project Gutenberg™ works unless you comply with paragraph 1.E.8 or 1.E.9.

1.E.8. You may charge a reasonable fee for copies of or providing access to or distributing Project Gutenberg™ electronic works provided that:

- You pay a royalty fee of 20% of the gross profits you derive from the use of Project Gutenberg™ works calculated using the method you already use to calculate your applicable taxes. The fee is owed to the owner of the Project Gutenberg™ trademark, but he has agreed to donate royalties under this paragraph to the Project Gutenberg Literary Archive Foundation. Royalty payments must be paid within 60 days following each date on which you prepare (or are legally required to prepare) your periodic tax returns. Royalty payments should be clearly marked as such and sent to the Project Gutenberg Literary Archive Foundation at the address specified in Section 4, “Information about donations to the Project Gutenberg Literary Archive Foundation.”
- You provide a full refund of any money paid by a user who notifies you in writing (or by e-mail) within 30 days of receipt that s/he does not agree to the terms of the full Project Gutenberg™ License. You must require such a user to return or destroy all copies of the works possessed in a physical medium and discontinue all use of and all access to other copies of Project Gutenberg™ works.
- You provide, in accordance with paragraph 1.F.3, a full refund of any money paid for a work or a replacement copy, if a defect in the electronic work is discovered and reported to you within 90 days of receipt of the work.
- You comply with all other terms of this agreement for free distribution of Project Gutenberg™ works.

1.E.9. If you wish to charge a fee or distribute a Project Gutenberg™ electronic work or group of works on different terms than are set forth in this agreement, you must obtain permission in writing from the Project Gutenberg Literary Archive

Foundation, the manager of the Project Gutenberg™ trademark. Contact the Foundation as set forth in Section 3 below.

1.F.

1.F.1. Project Gutenberg volunteers and employees expend considerable effort to identify, do copyright research on, transcribe and proofread works not protected by U.S. copyright law in creating the Project Gutenberg™ collection. Despite these efforts, Project Gutenberg™ electronic works, and the medium on which they may be stored, may contain “Defects,” such as, but not limited to, incomplete, inaccurate or corrupt data, transcription errors, a copyright or other intellectual property infringement, a defective or damaged disk or other medium, a computer virus, or computer codes that damage or cannot be read by your equipment.

1.F.2. LIMITED WARRANTY, DISCLAIMER OF DAMAGES - Except for the “Right of Replacement or Refund” described in paragraph 1.F.3, the Project Gutenberg Literary Archive Foundation, the owner of the Project Gutenberg™ trademark, and any other party distributing a Project Gutenberg™ electronic work under this agreement, disclaim all liability to you for damages, costs and expenses, including legal fees. YOU AGREE THAT YOU HAVE NO REMEDIES FOR NEGLIGENCE, STRICT LIABILITY, BREACH OF WARRANTY OR BREACH OF CONTRACT EXCEPT THOSE PROVIDED IN PARAGRAPH 1.F.3. YOU AGREE THAT THE FOUNDATION, THE TRADEMARK OWNER, AND ANY DISTRIBUTOR UNDER THIS AGREEMENT WILL NOT BE LIABLE TO YOU FOR ACTUAL, DIRECT, INDIRECT, CONSEQUENTIAL, PUNITIVE OR INCIDENTAL DAMAGES EVEN IF YOU GIVE NOTICE OF THE POSSIBILITY OF SUCH DAMAGE.

1.F.3. LIMITED RIGHT OF REPLACEMENT OR REFUND - If you discover a defect in this electronic work within 90 days of receiving it, you can receive a refund of the money (if any) you paid for it by sending a written explanation to the person you received the work from. If you received the work on a physical medium, you must return the medium with your written explanation. The person or entity that provided you with the defective work may elect to provide a replacement copy in lieu of a refund. If you received the work electronically, the person or entity providing it to you may choose to give you a second opportunity to receive the work electronically in lieu of a refund. If the second copy is also defective, you may demand a refund in writing without further opportunities to fix the problem.

1.F.4. Except for the limited right of replacement or refund set forth in paragraph 1.F.3, this work is provided to you ‘AS-IS’, WITH NO OTHER WARRANTIES OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO WARRANTIES OF MERCHANTABILITY OR FITNESS FOR ANY PURPOSE.

1.F.5. Some states do not allow disclaimers of certain implied warranties or the exclusion or limitation of certain types of damages. If any disclaimer or limitation set forth in this agreement violates the law of the state applicable to this agreement, the agreement shall be interpreted to make the maximum disclaimer or limitation permitted by the applicable state law. The invalidity or unenforceability of any provision of this agreement shall not void the remaining provisions.

1.F.6. INDEMNITY - You agree to indemnify and hold the Foundation, the trademark owner, any agent or employee of the Foundation, anyone providing copies of Project Gutenberg™ electronic works in accordance with this agreement, and any volunteers associated with the production, promotion and distribution of Project Gutenberg™ electronic works, harmless from all liability, costs and expenses, including legal fees, that arise directly or indirectly from any of the following which you do or cause to occur: (a) distribution of this or any Project Gutenberg™ work, (b) alteration, modification, or additions or deletions to any Project Gutenberg™ work, and (c) any Defect you cause.

Section 2. Information about the Mission of Project Gutenberg™

Project Gutenberg™ is synonymous with the free distribution of electronic works in formats readable by the widest variety of computers including obsolete, old, middle-aged and new computers. It exists because of the efforts of hundreds of volunteers and donations from people in all walks of life.

Volunteers and financial support to provide volunteers with the assistance they need are critical to reaching Project Gutenberg™’s goals and ensuring that the Project Gutenberg™ collection will remain freely available for generations to come. In 2001, the Project Gutenberg Literary Archive Foundation was created to provide a secure and permanent future for Project Gutenberg™ and future generations. To learn more about the Project Gutenberg Literary Archive Foundation and how your efforts and donations can help, see Sections 3 and 4 and the Foundation information page at www.gutenberg.org.

Section 3. Information about the Project Gutenberg Literary Archive Foundation

The Project Gutenberg Literary Archive Foundation is a non-profit 501(c)(3) educational corporation organized under the laws of the state of Mississippi and granted tax exempt status by the Internal Revenue Service. The Foundation's EIN or federal tax identification number is 64-6221541. Contributions to the Project Gutenberg Literary Archive Foundation are tax deductible to the full extent permitted by U.S. federal laws and your state's laws.

The Foundation's business office is located at 809 North 1500 West, Salt Lake City, UT 84116, (801) 596-1887. Email contact links and up to date contact information can be found at the Foundation's website and official page at www.gutenberg.org/contact

Section 4. Information about Donations to the Project Gutenberg Literary Archive Foundation

Project Gutenberg™ depends upon and cannot survive without widespread public support and donations to carry out its mission of increasing the number of public domain and licensed works that can be freely distributed in machine-readable form accessible by the widest array of equipment including outdated equipment. Many small donations (\$1 to \$5,000) are particularly important to maintaining tax exempt status with the IRS.

The Foundation is committed to complying with the laws regulating charities and charitable donations in all 50 states of the United States. Compliance requirements are not uniform and it takes a considerable effort, much paperwork and many fees to meet and keep up with these requirements. We do not solicit donations in locations where we have not received written confirmation of compliance. To SEND DONATIONS or determine the status of compliance for any particular state visit www.gutenberg.org/donate.

While we cannot and do not solicit contributions from states where we have not met the solicitation requirements, we know of no prohibition against accepting unsolicited donations from donors in such states who approach us with offers to donate.

International donations are gratefully accepted, but we cannot make any statements concerning tax treatment of donations received from outside the United States. U.S. laws alone swamp our small staff.

Please check the Project Gutenberg web pages for current donation methods and addresses. Donations are accepted in a number of other ways including checks, online payments and credit card donations. To donate, please visit: www.gutenberg.org/donate

Section 5. General Information About Project Gutenberg™ electronic works

Professor Michael S. Hart was the originator of the Project Gutenberg™ concept of a library of electronic works that could be freely shared with anyone. For forty years, he produced and distributed Project Gutenberg™ eBooks with only a loose network of volunteer support.

Project Gutenberg™ eBooks are often created from several printed editions, all of which are confirmed as not protected by copyright in the U.S. unless a copyright notice is included. Thus, we do not necessarily keep eBooks in compliance with any particular paper edition.

Most people start at our website which has the main PG search facility: www.gutenberg.org.

This website includes information about Project Gutenberg™, including how to make donations to the Project Gutenberg Literary Archive Foundation, how to help produce our new eBooks, and how to subscribe to our email newsletter to hear about new eBooks.