Newsletter

Of the

New York Microscopical Society

1 Prospect Village Plaza
(66F Mt. Prospect Avenue)
Clifton, New Jersey 07013-1918
GPS: Latitude 40.8648N, Longitude 74.1540W

May 2015	Editor: (201) 791-9826	Volume 9 (29) Number5

Clean Sweep Spring Sale at NYMS in Clifton
Sunday May 31, 2015, Noon to 5 pm

Here is your opportunity to find something you need, or would just like to acquire: Some microscopy/photography-related item(s) that have accumulated over many decades.

Many of the various items from our basement work/storage areas may not be easily attainable through other sources. The tables will be loaded. Feel free to make offers if you find something you like.

Come in and “shmooze:” You may actually find something useful to you.

All NYMS events provide opportunities for information interchange between members and also their guests.

Guests are encouraged to join the New York Microscopical Society and enjoy our events, use our library and equipment and meet other members.

Doors open at Noon Refreshments will be available. For additional information, please contact Mel Pollinger (pollingmel@optonline.net) or call (201)791-9826, between 9am & 9pm before the day of the sale, or by cell: (201) 314-1354, (meeting day only).

Microscope Day at John Jay College – April 122, 2015 (see email suppliment for more photos)

Save a Tree: Get The Extended Newsletter: By Email Only

Board of Managers

For additional information contact the Editor: Mel Pollinger at (201) 791-9826, or pollingmel@optonline.net

Dues and Addresses
Please remember to mail in your Dues to:
Mel Pollinger
Treasurer, NYMS
18-04 Hillery St.
Fair Lawn, NJ 07410-5207

Junior (under age 18) $10 Annually
Regular $30
Student (age 18 or above) $20 Annually
Supporting $60 Annually
Corporate (includes one advertisement in NYMS News) $175 Annually
Life $300 (payable within the year)
To avoid missing notices:
Notify Mel Pollinger if you have changed your address, phone or email.

Awards Given by the New York Microscopical Society

The New York microscopical Society takes great pleasure in recognizing and rewarding individuals who have contributed to either the activities of the society or to furthering microscopy. These awards are described in our website and in a pdf file for our email newsletter recipients. All members are eligible to nominate individuals for these various awards, and are encouraged to do so.
John A. Reffner, Awards Committee Chairperson

Awards Committee
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To Order Your NYMS Lapel Pins
Send a check in the amount of $12.00 per pin to:
New York Microscopical Society
c/o Mel Pollinger, 18-04 Hillery Street, Fair Lawn, NJ 07410. To avoid shipping & handling charges, pins may be purchased directly at any NYMS meeting for $10.00.

The Mission of the New York Microscopical Society is the promotion of theoretical and applied microscopy and the promotion of education and interest in all phases of microscopy.

Alternate Meeting Notifications
Please note that due to time constraints in publishing, some meeting notices may be available by calling Mel Pollinger at 201-791-9826, or by visiting the NYMS website, or emailing: pollingmel@optonline.net

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Please remember to pay your dues

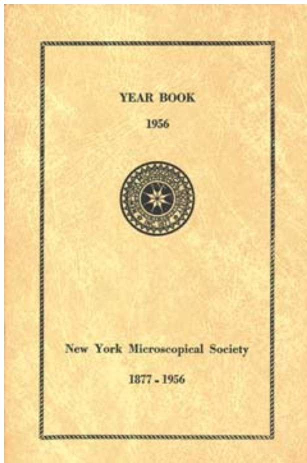
Buy and Read a Good Book on Microscopy.

From the Library:

The NYMS Library contains over 3,700 cataloged volumes, among these is a full set of McCrone's Particle Atlas and copies of Microbe Hunter Magazine.

Come on down and read!

Contact: Mel Pollinger (201) 791-9826, or email Mel at pollingmel@optonline.net



NYMS Yearbook 1877-1956

Be A Volunteer – There's *Always* Something to do and see at NYMS.

If you wish to contribute some of your time to NYMS, please contact me at (201) 791-9826 or by email at pollingmel@optonline.net

Coming Up in 2015

Estuary Day at Coney Island Creek

NYMS Outreach participation on Saturday, May 30th 2015.

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EAS Live Webinars for 2015:

Please search on the below indicated web address and review the EAS Website below for information regarding the upcoming Live Webinars in 2015.

http://easinc.org/wordpress/?page_id=2974

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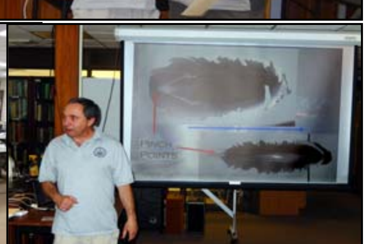
NYMS Forensic Course a Success

NYMS Forensic Course at Clifton on April 15m 2015 a success. Andrew Winter will be arranging for the next course in 2016. (more photos by Andrew Winter in email suppliment)



Marine Biology Link to check out.
http://research.mblwhoilibrary.org/works

The following abstract is of a talk given before the New York Microscopical Society in October, 1955. More detailed information may be found in the Minutes of the Society.

PURE CULTURE ALGAE AND PROTOZOA AS BIOLOGICAL TOOLS Dr. S. H. Hunter October 7, 1955

The metabolism of small molecules has been found much the same in man and microbes. The nutritional requirements of fresh water Ochromonas malhamensis reveal that it probably interconverts food-stuffs much as do higher animals, especially as to vitamin b12 requirements. This gives reason for the optimistic belief that we have a "humanoid" protoist—one that will serve as a dependable guide to the cell metabolism of higher animals.

(Excerpted from the New York Microscopical Society Year Book of 1956)

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Dr. John A. Reffner celebrates his 80th birthday

EAS
CALL FOR PAPERS

On-line submission is now open!

Join us November 16-18, 2015 in Somerset, NJ

We invite you to be part of EAS by contributing a paper for oral or poster consideration. EAS seeks contributions from scientists in **ALL** areas of analysis, which make its program uniquely strong. Submit at: www.eas.org/asubmit

Introducing new submission deadlines for 2015!

Visitors Always Welcome to NYMS

Although most of our lecture meetings, workshops and classes are held in the NYMS Clifton facility on the last Sunday of the month, the building may be opened for special purposes at other times, by appointment only. For such an appointment, please contact Mel Pollinger by phone at (201) 791-9826, M-F noon to 9:30pm, or by email at pollingmel@optonline.net.

From The Editor...

if you have an email address: Getting the newsletter by email means you can receive an **extended pdf version** that cannot be sent by "snail mail." Even if you only continue your USPS delivery of the newsletter, NYMS needs your email address for reporting priority events and special news. Being able to contact you quickly by email means better communication between you & NYMS■■ Mel

Need to use a Microscope?

The various microscopes that are presently set up on the main floor of the New York Microscopical Society building in Clifton, N.J. are there for the use of its members.

From Gary Mayer: In need of parts for older Olympus Microscopes? Contact J.C. Ricky in Ohio at (740) 862-9252

Microscope Cleaning Kit

A complete set of tools and accessories to keep your microscope in optimum operating condition. The kit is put together by our previous Curator/Educational Chairman, Don O'Leary, and available directly from NYMS, while they last, for only $35.00 plus shipping & handling, or may be purchased at a meeting. Call or email Mel Pollinger for details (see page two for contact numbers).

NYMS Meeting Dates

Most meetings of NYMS are usually held in Clifton on the last Sunday of the months of Jan., Feb., Mar., Apr., May, Sep., Oct. Exceptions will be noted in the Newsletter.

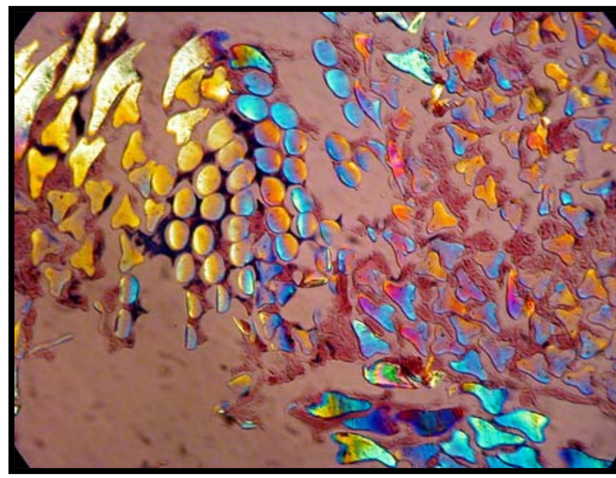
NYMS microscope slide collections are available for study at meetings and by appointment.

Please note that our website is presently under repair.

Answer to Mystery Photo for April 2015

Vanadinite & Barite. Correctly guessed by Tony Nikischer. The barite (white) crystal is 1.5mm across. Did you guess correctly? The specimen was imaged on a flatbed scanner *by Mel Pollinger*

Mystery Photo for May 2015



Want to take a guess? Send it to me by email or call me: pollingmel@optonline.net, (201) 791-9826

Additional Historical NYMS Supplements

Email Newsletter recipients will also be getting copies of NYMS Newsletter pdf back-Issues from 2007. Copies of older newsletters will be sent as I convert them.

Attention NYMS Members

Got something to sell? Article to publish? Pictures for the newsletter? Looking to buy something? Want to use the library? Want to use a NYMS microscope? For any of the above, contact the Editor, Mel Pollinger.

Supporting Member

N.Y.M.S. NEWSLETTER SUPPLEMENT

May 2015

In This Section:

Cholesterol crystal in polarized light from melt. The single crystal is approximately 1mm in length.
Preparation and imaging by Mel Pollinger.

Messages impressed in clay: Scientific study of Iron Age Judahite bullae from Jerusalem

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1. Introduction

The application of ceramic petrography in archaeology is celebrating now about seven decades since its introduction. Over the years, it has become one of the most common scientific methods in archaeology, due to its availability, low cost and impressive track record. Even the introduction of other, often more sophisticated methods for provenancing ceramics, first and foremost Neutron Activation Analysis (NAA), has not effected the use of petrography due to its ability to supply a wide range of technological as well as provenance data. However, the method has always been limited by its destructive nature, making the analyses of delicate artifacts practically impossible.

During the last decade, one of us (YG) developed a methodology for petrographic examination of delicate clay objects, such as cuneiform tablets and clay seal impressions (bullae). Amongst other things, it has been used for provenance studies of cuneiform tablets from Amarna (Goren *et al.* 2004), Ugarit (as yet unpublished), Hatti (Goren *et al.* 2011) and Israel (Goren *et al.* 2004; 2007; 2009), and the so-called Knossian Replica-Rings from Crete and Thera (Goren and Panagiotopoulos, as yet unpublished). The present paper presents the methodology, results, and implications of the examination of Iron Age bullae from the City of David, namely Iron Age Jerusalem.

Little has been preserved in the archaeological record from the rich literary material of the Kingdom of Judah (Fig. 1). Despite the discovery of some contemporary written sources, such as ostraca and seals, it may be assumed that many of the documents were apparently written on scrolls or papyri that have not survived. Consequently, most of the scholarly records from this period often referred to in the biblical sources, have been lost forever. Only some meager remains of these texts have been preserved in the form of bullae, namely, the clay sealings that were once attached to them. Bullae are small lumps of clay, often fingernail-sized and shaped as flat disks. They were usually affixed to a cord binding a papyrus-document and then stamped with a seal (Fig. 2). Other bullae were apparently sealing basketry or fabrics, most likely small bags containing some commodities, as evident by the impressions on their reverse sides.

Only a relatively small amount of bullae have been found in the course of over a century of archaeological exploration of the major Iron Age sites of Judah (Avigad 1997, 167-241). The reasons for this situation are as follows: First, due to their small size, such tiny clay objects can easily escape the attention of inexperienced workers who do not search specifically for them. Moreover, careful sifting was not always the common practice in many of the large-scale excavations of the major Judahite tells in the past. Last but not least, the preservation of unfired bullae is often impossible in the sub-humid conditions of the southern Levant, hence most of the bullae found in recorded excavations were discovered as part of very few caches, which survived due to specific depositional conditions.

The bullae sampled in our research include two major groups, dating to two different phases of the Iron Age. The first group, comprising 51 items, was uncovered during the 1982 season of excavations in Area G at The City of David by Shiloh (1984, 19-20; 1986; Shiloh and Tarler 1986) and was published by Shoham (2000) and Brandl (2000). At the base of the famous stepped stone structure, a series of buildings was erected during the seventh century BCE. They spread over two terraces: the 'House of Ahiel' and the 'Burnt Room' were found on the upper terrace while on the lower one stood the 'Bullae House'. The floor of the latter, only partly excavated, was covered by a thick charred destruction layer containing the bullae together with pottery vessels, arrowheads, a scale weight and four limestone altars. The finds are typical of the final stage of the Iron Age and the bullae found in this context clearly date to the last phase before the Babylonian destruction of Jerusalem in 586 BCE. Most of the bullae are in very good state of preservation, hence fully legible (Fig. 2); four of which are unepigraphic. They bear dozens of Hebrew personal names, two of which belong to figures known from the Bible. The first is Gemaryahu son of Shaphan (Shoham 2000, 33), a high official at the court of King Jehoiakim, and the second is 'Azaryahu son of Hilkiyahu (*ibid*, 43), a member of a priestly family appearing in the book of Chronicles (Schneider 1988).

Cite this article as: Goren Y, Gurwin S, Arie E (2014). Messages impressed in clay: Scientific study of Iron Age Judahite bullae from Jerusalem. In M Martinón-Torres (Ed.), Craft and science: International perspectives on archaeological ceramics. Doha, Qatar: Bloomsbury Qatar Foundation http://dx.doi.org/10.5339/uclq.2014.cas.ch16

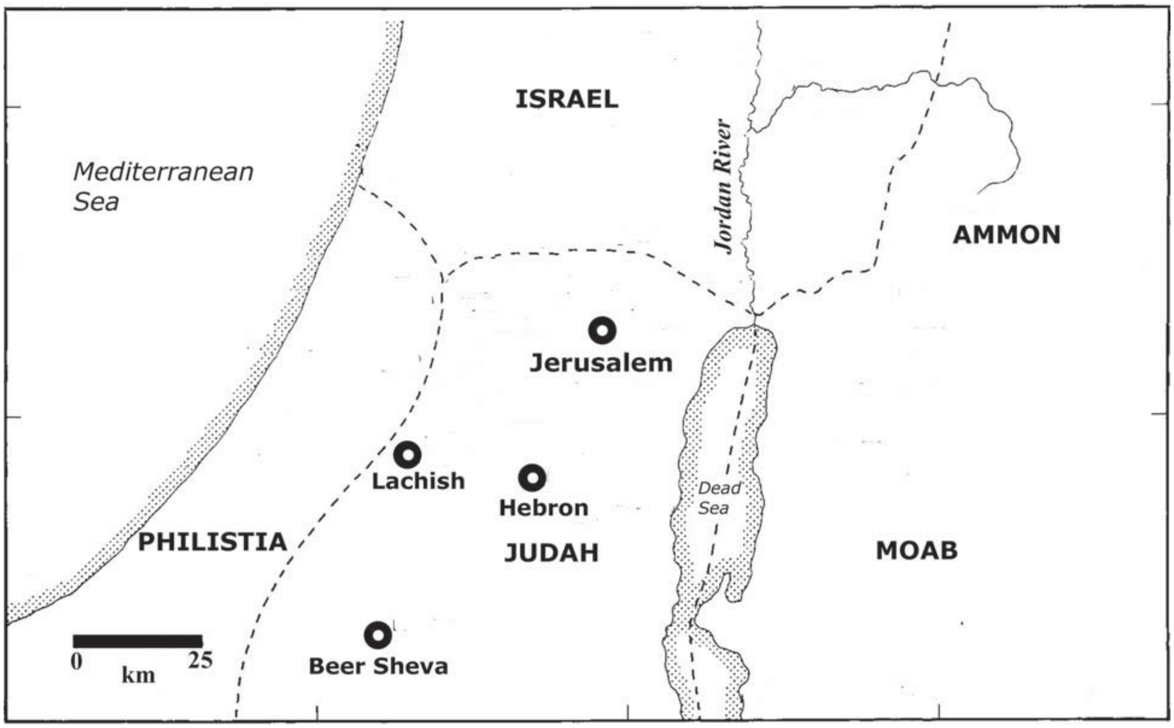

Figure 1. Jerusalem and the boundaries of the Kingdom of Judah between the 8th and the 6th century BCE.

The second group of bullae includes over 120 items, dating to the 9th - late 8th Centuries B.C., discovered only recently in the water system of City of David near the Gihon spring (Reich *et al.* 2007, 156-157). Being earlier to the second group, these bullae are not epigraphic and their seal impressions contain only decorative patterns. These bullae will be discussed in here only with regard to the methodology of their examination.

2. Method

This study was aimed at providing the opportunity to analyze some as yet undetermined aspects of the Judahite bullae. Since it is widely believed that bullae were used to seal documents or small parcels sent from one authority to another, ensuring the discrete reading of a message or opening of the parcel by the addressee alone, we first attempted to disclose the geographical origin of the bullae through the provenance of their clays, in order to map the network of the administrative correspondence of Judah during the middle to the end of the Iron Age. By doing so, we hoped to reveal the location of several personalities and to draw the network of Judahite bureaucracy. Therefore, our first question was whether the material composition of a given assemblage of bullae would reflect sufficient similarity to justify their assignment to a single site, or whether the analysis would show that they were made of clay from different locations. The answer to this question was the key to the research questions that followed, since if the first option were true, then the following question had to be related with the issue of provenance of the entire lot. However, if greater diversity of raw materials were recognized, then the study would need to focus on the correlation of the clay types with the textual and stylistic characteristics of the bullae and the location of their discovery. As in standard provenance studies of ceramics in archaeology, it would be naïve to expect that the mineralogical or chemical analyses of small samples of clay would enable provenance determinations to the single site level. Moreover, there are obviously some fundamental differences between bullae and pottery, and consequently, between the preferences of potters and scribes or other officials. However, as is the case of pottery, the background of the study of bullae is such that the interpretation of the results can be considerably narrowed by many archaeological and historical considerations. In fact, the distribution of the Judahite Late Iron Age sites where bullae could have been issued and used is such that it leaves only very few possibilities open, if the analysis were to suggest even a general area within the confines of Judah.

As a result, our research project was planned to be made in three stages. In the first stage we examined the structural and technical aspects of the bullae based on surface microscopic observations under a stereomicroscope, with magnifications ranging between 10 to 100 times. This was made in order to record minute details of the papyrus, fabric, or leather, and the cord impressions, the fingerprints and other imprints, and of course the seal impression themselves. These examinations attempted to address some technical questions, such as the general composition of the fabric and the formation process.

In the second stage, minute samples were extracted from the bullae by the peeling technique and examined in thin sections under the petrographic microscope. In this

Figure 2. General stereomicroscopic view of one of the inscribed bullae from the "Bullae House" in Area G, the City of David (IAA 84-123). The palaeo-Hebrew seal reads: "(of) Nachum son of Sha'ala". Late 7^{th} - early 6^{th} century BCE, field width: about 2.5 cm.

method, a shallow lamina, sizing only few millimeters, is peeled off from a broken facet of the bulla or from its reverse side under the stereomicroscope with the aid of a scalpel or a botanical needle. The samples were set in improvised moulds made of small rounded polyethylene test tube cups, and dried at room temperature for a few hours. Then the cups with the samples were put in a dessicator, where the samples were impregnated with Buehler Epo-Thin low viscosity epoxy resin under vacuum conditions. After curing, the resulting pellet was used for the preparation of a standard thin-section and subjected to routine petrologic examination under a polarizing microscope using X40 - X400 magnifications.

The petrographic definition of each sample was then supported by structural and chemical examinations under the analytical Quanta 200 FEG Environmental Scanning Electron Microscope (ESEM), operated by the Wolfson Applied Materials Research Center of the Tel Aviv University. The microscope combines high vacuum, low vacuum and wet-mode to support a variety of material characterization applications. The specific instrument was chosen because it allows for the examination of non-conducting, contaminated, hydrated and even living samples without significant sample preparation, in addition to those samples that have always been viewable under conventional scanning electron microscopes. It allows for user selection of accelerating voltage, magnification, gas type, gas pressure, and detector type. The microscope uses tungsten electron source and allows wide range of accelerating voltages from 200 V to 30 kV. It also has complete set of detectors providing imagining in secondary and backscattered electrons in all the operating modes (high and low vacuum) at the resolution of 3.5 nm. The system also includes energy dispersive spectroscopy (EDS, supplying qualitative and quantitative data) with Ultra-Thin Window for light element detection down and including carbon with spectral resolution better than 132 eV. Hence

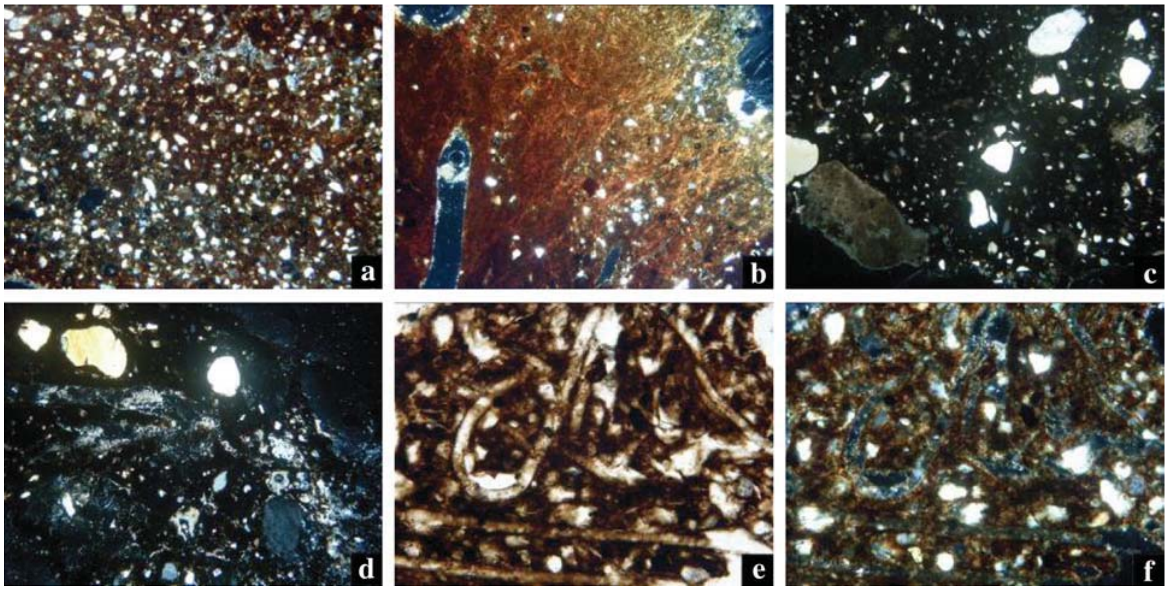

Figure 3. Bullae fabrics in thin section: (a)Bulla 20867, XP, Alluviated *Terra Rossa* with high silt contents. Field width: 2.5 mm. (b) Bulla 18692, XP, *Terra Rossa* with low silt contents, note the typical high optical activity with striated b-fabric. The elongated voids indicate vanished vegetal material. Field width: 2.5 mm. (c) Bulla 16771, XP, *Terra Rossa* with nearly isotropic silty matrix and sand inclusions containing spherical quartz and some limestone. Field width: 2.5 mm. (d) Bulla 19314, XP, as 3c but with secondary (post-depositional) crystallization of calcite in the voids. Field width: 2.5 mm. (e) Bulla 22112, PPL, the *Terra Rossa* matrix is mixed with fine fibers (see also Figure 5). field width: 0.8 mm. (f) As 3e but under XP. Field width: 0.8 mm.

the ESEM enables the examination of the intact bullae at low vacuum, without any process of coating.

3. Results

Based on the petrographic data, combined with the ESEM results, the raw material of all the examined specimens are readily identified as derived from soil deposits which are, in fact, Quaternary alluvial beds derived from *Terra Rossa* soils and, in few cases, *Terra Rossa* from *in situ* exposures. It should be emphasized that none of the bullae that we have examined so far were made of clay or marl from older geological formations, such as the local Moza and Teqiye clay formations, even though these were extensively used for pottery production in Judah throughout the ages.

In thin section, most of the bullae appear as non calcareous, ferruginous matrix (Figure 3a). This fabric is typified by reddish-tan to dark matrix in thin section, highly optically active to nearly opaque under crossed polarizers, with silt ranging between 5% (rare) to nearly 20% (common). The silt is mainly quartzitic but it often contains some accessory heavy minerals of which hornblende and zircon are the most common. The inclusions are made of fine sand containing mainly quartz or limestone. Other minerals or rock fragments that rarely appear in the inclusions are chert or chalcedony.

Terra Rossa soils occur on hard limestone and dolomite exposures in the semiarid to subhumid Mediterranean climatic zones. This soil material is eroded downslope, forming colluvial-alluvial soils. All the soil materials in Israel include, to varying extents, aeolian dust of desert origin. Carbonate rocks do not contain silt-size quartz grains, but large amounts of such grains occur in the soils that developed on these rocks. The external source of the silt-size quartz grains is considered to be an aeolian contribution to the soil. The largest amount of aeolian dust occurs in soils that developed on hard limestone and dolomitic limestone, in which the residual material released from the dissolution of the rocks is only about 2% (Adan-Bayewitz and Wieder 1992). Only in a few cases nearly non-silty *Terra Rossa* was used (Fig. 3b), indicating the employment of soil from an *in situ* exposure.

The inclusions are sparsely spread and occasional, reflecting opportunistic use of different soil mixtures where often fine sand naturally occurs. This sand is essentially quartzitic, often with the addition of calcareous rock fragments (Fig. 3c). In many cases, very fine splinters of vegetal material were added, as indicated by the void structure, often infilled by secondary re-crystallization of calcite (Fig. 3d). This vegetal material can be, in fact, the result of the inclusion of cords in the bullae. In one case, delicate fibers of unidentified type were densely packed within the matrix of a bulla (Fig. 3 e,f).

The petrographic examinations were enhanced by the ESEM-EDS analyses. The latter were made on the entire surfaces of the bullae rather than on samples which were extracted from them. This necessitated the opening of the vacuum chamber of the ESEM whenever the bulla needed to be tilted, hence in many cases we preferred to define *a priori* the desired surface for scanning. In many cases, this

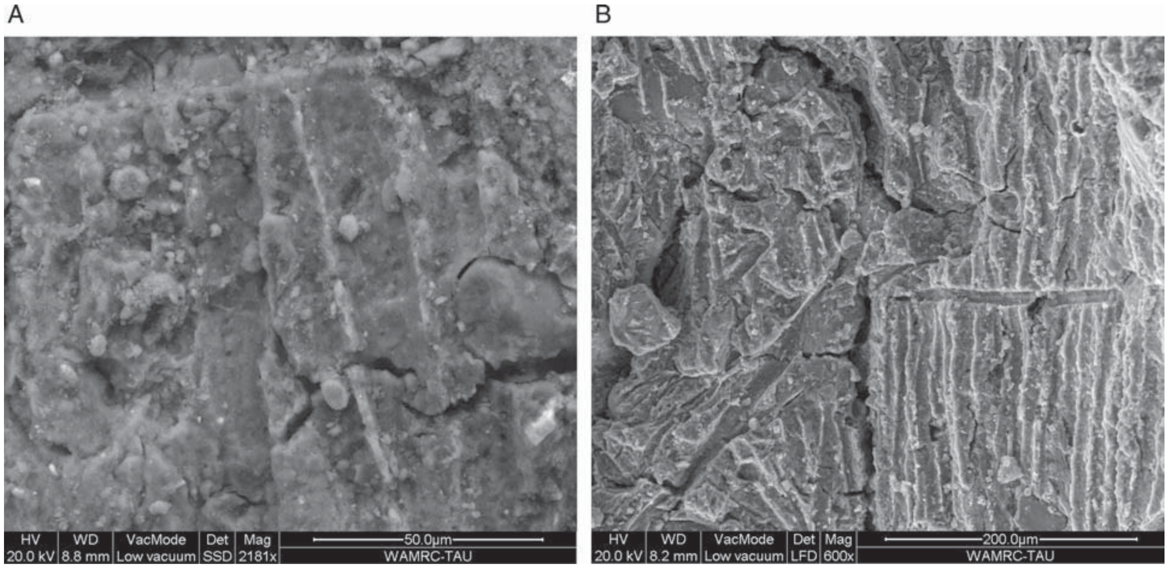

Figure 4. (a,b) ESEM view of bulla 22112 showing the fiber imprints in the matrix seen also in Figure 3e.

was the surface where the sample for petrography was extracted by the peeling method. This enabled a comparison between the petrographic sample and the surface scanned by the ESEM. A few examples can be seen in Figures 4 and 5: the non plastics (silt and fine sand) could be observed also by the ESEM and identified on the spot with the aid of the EDS system. Structural features, such as the cord impressions, fibers within the clay (Fig. 4), secondary crystallization of calcite (Fig. 5) and other phenomena, could be observed by the ESEM using the secondary and backscattered electron detectors.

To sum up, both the petrographic and the ESEM analyses revealed that the entire two groups of bullae from the City of David in Jerusalem were made of *Terra Rossa* soil, having the same mineralogical composition of silt and temper inclusions. Although *Terra Rossa* soils are quite widespread in the Mediterranean sub-humid parts of Israel, where they develop on hard limestone and dolomite of the Mediterranean climatic zones, the uniform composition of the silt with its accessory minerals, and the coarse fraction, suggests that the assemblage is the product of a single location. Moreover, the distribution of *Terra Rossa* in the confines of Judah is limited to the Judean Anticline, where Jerusalem is the only major site of this period. In addition, this composition is identical to the fabric of the numerous local pillar figurines from the City of David (Goren *et al.* 1996). Therefore, the entire two sets of bullae from the City of David may be regarded as the local production of this site.

4. Discussion

The rather unexpected results of this study indicate that the entire assemblage of bullae from the City of David was most likely made locally around Jerusalem. It enables us now to define more precisely the nature of bureaucratic networks of Judah according to the evidence at hand. The fact that all the bullae were found to be made of clay from the major city where they were deposited negates the assumption that the bullae sealed letters that arrived from far away. Instead, it appears that either the bullae sealed locally circulated documents, restricted to the immediate surroundings of the city in which they were found, or that they were used to seal local legal and administrative documents.

The contents of the Lachish ostraca (Torczyner 1938), dating to the same period as the later lot of bullae sampled in our research, indicate that letters written on papyrus were sent together with ostraca. Na'aman's analysis of the archive of Ya'ush points out that the ostraca uncovered in the gate of Lachish were part of a much wider correspondence, most of which was written on papyri (Na'aman, 2003, 175, 179). The assumption that letters were written on papyri is reinforced by the Wadi Murabba'at document, the only provenanced Iron Age

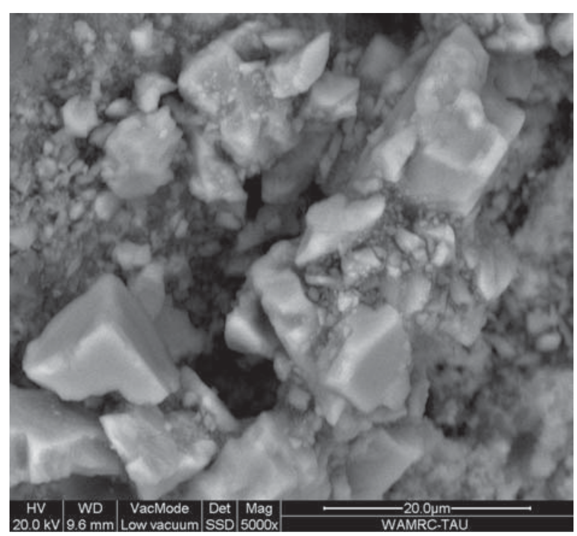

Figure 5. ESEM view of secondary re-crystallization of calcite in a void as seen in thin section in Figure 3d.

papyrus found so far in the southern Levant (Milik 1961, 93-100). Although it is a palimpsest and its text is fragmented, it is clear that it was a personal letter. Hence it seems that while ostraca are more frequent than papyri in the archaeological record, they substituted for papyri only for economic reasons, while the latter constituted the common writing material.

Can we thus assume that the bullae in question represent a local correspondence of letters? Before jumping to a conclusion, let us check some more data that might help in our interpretation. Two important archives of papyri dated to the Persian period, hence somewhat later than our case, were unearthed in our region. The first one, dated to the 5th century BCE, was discovered at Elephantine in Upper Egypt (Porten 1992; 1996). It consists of almost one hundred Aramaic documents from several private and communal archives that were mostly composed of contracts and letters. The second archive was found in a cave in Wadi Daliyeh, in the desert east of Samaria (Cross 1974; Lapp 1974; Leith 1997; Gropp 2001). It was dated to the 4th century BCE and contained 18 legal documents, all written in Aramaic. In these two groups, found in areas of extreme aridity, some papyri were discovered with their bullae still attached (Gropp 2001, Pls. 1-3, 17). Their perfect state of preservation and their proximity in time to the Late Iron Age may hint at the possible contents of the Iron Age sealed papyri as well.

The papyri from Elephantine and Wadi Daliyeh illustrate the sealing practices used in the Persian period. After the text was written and witnessed, it was rolled from bottom to top, flattened and folded. Strings and pieces of papyrus-fiber were looped around separately to tie the documents, which in turn were sealed by the bullae.

A comparison between the letters and the contracts found in Elephantine made by Porten (1992, 447-448) raises some significant technical differences, which are relevant to our case: letters were shorter than contracts and unlike contracts, they were usually written on both sides of the papyrus. While contracts were rolled up and folded in thirds, letters were rolled up and folded in half. Since contracts were meant to be stored for an extended period of time, a blank space at the top of the contract was an insurance against any external damage obliterating any part of the opening lines. These differences illustrate the special treatment of legal documents, most likely due to their long-term importance, as opposed to letters.

The archives from Elephantine and Wadi Daliyeh demonstrate that most of the sealed documents were formal legal records, which were concerned with the most personal forms of social interaction. The impression of personal seals upon these papyri was thus a highly complex act of signification. The seal must have had a complex power and its imprint was the insurance of the owner for the authority. A seal impression therefore established a set of moral obligations, which bound those who encountered it. To break or forge of a seal was an act which everyone knew was wrong.

Therefore we join the opinion first presented by Avigad (1997, 33-39) and Shiloh (1986, 36-37) and we assume that Judahite bullae were used as sealings of legal documents. In order to support this hypothesis, a brief cross-cultural account of sealing practices of legal documents is required. The most informative description of the preparation of a deed of sale in the days of the monarchy is found in the Book of Jeremiah (32:1-15). It concerns the purchase of a field by Jeremiah just a few days before the Babylonian conquest. The story reveals the technical features of the legal bureaucracy during the same days of the later group of bullae examined in our research. Although Jeremiah's purchase was of symbolic nature, this is most likely an accurate description of the legal process by which deeds were carried out at that time. Two texts, an original and a duplicate copy, were written on two separate sheets of papyrus. The first was termed the "sealed deed" because it was rolled up and sealed with a bulla or bullae; it would be opened before judicial authorities only when absolutely necessary. The second, "open deed" was a copy of the sealed one and was intended for daily use.

5. Conclusion

The use of delicate sampling techniques for petrographic analyses, combined with other complementary methods for the examination of extremely small samples, is a rewarding approach. It enables now the study of unique, delicate artifacts which could not be hitherto examined by the highly efficient and informative method of petrography. The results of the present study, which were not predicted by the visual examination of the bullae under discussion, provide significant information about the nature of the Judahite bureaucracy and the historical significance of the few clusters of Iron Age bullae which were discovered in recorded excavations. Since hundreds of contemporary, unprovenanced bullae originating from the antiquities market are found now in several museums and private collections, this methodology can be applied also on them. Besides serving as a tool for authenticity determinations, it may disclose the possible existence of some other Judahite administrative centers where legal administration may have been practiced.

References

Adan-Bayewitz D. and Wieder M., 1992, Ceramics from Roman Galilee: A comparison of several techniques for fabric characterization. *Journal of Field Archaeology*, 19, 189-205.

Avigad N. (*Revised and completed by Sass, B.*), 1997, *Corpus of West Semitic Stamp Seals*, Israel Exploration Society, Jerusalem.

Brandl B., 2000, Bullae with Figurative Decoration. In *Excavations at the City of David 1978-1985 Directed by Yigal Shiloh. Volume IV. Inscriptions*, Qedem, 41, (ed. D.T. Ariel), 58-74, Jerusalem.

Cross F.M., 1974, The Papyri and Their Historical Implications. In *Discoveries in the Wa dõ ed-Da liyeh*, (eds. P.W. Lapp and N. Lapp), 17-29, AASOR XLI, Cambridge.

Goren Y., Finkelstein I. and Na'aman N., 2004, *Inscribed in Clay: Provenance Study of the Amarna Tablets and Other Ancient Near Eastern Texts*, Institute of Archaeology of Tel Aviv University, Tel Aviv.

Goren Y., Kletter R. and Kamaiski E., 1996, The technology and provenience of the Iron Age figurines from the City of David: Petrographic Analysis. In *City of David Excavations, Final Report IV*, (eds. D.Z. Ariel and A. de Grott), 87-89, Jerusalem.

Goren Y., Na'aman N., Mommsen H. and Finkelstein I., 2007, Provenance study and re-evaluation of the cuneiform documents from the Egyptian residency at Tel Aphek. *Ägypten und Levante*, XVI, 161-171.

Goren Y., Mommsen H., Finkelstein I. and Na'aman N., 2009, Provenance study of the Gilgamesh fragment from Megiddo. *Archaeometry*, 51, 763-773.

Goren Y., Mommsen H. and Klinger J., 2011, Nondestructive provenance study of cuneiform tablets using portable X-ray fluorescence (pXRF). *Journal of Archaeological Science*, 38, 684-696.

Gropp D.M., 2001, *Wadi Daliyeh II: The Samaria Papyri from Wadi Daliyeh*, Discoveries in the Judaean Desert XXVIII. Oxford.

Lapp P.W., 1974, An Account of the Discovery. In *Discoveries in the Wa dõ ed-Da liyeh*, (eds. P.W. Lapp and N. Lapp), 1-6, AASOR XLI, Cambridge.

Leith M.J.W., 1997, *Wadi Daliyeh I: The Wadi Daliyeh Seal Impressions*, Discoveries in the Judaean Desert XXIV, Oxford.

Milik J.T., 1961, Textes He breux et Arame ens. In *Les Grottes de Murabba'a t*, (eds. P. Benoit, J.T. Milik and R. de Vaux), 67-205, Discoveries in the Judean Desert II, Oxford.

Na'aman N., 2003, The Distribution of Messages in the Kingdom of Judah in Light of the Lachish Ostraca. *Vetus Testamentum*, 53, 169-180.

Porten B., 1992, Elephantine Papyri. In *The Anchor Bible Dictionary* (vol. II), (ed. D.N. Freedman), 445-455, Yale University Press, New York.

Porten B., 1996, *The Elephantine Papyri in English. Three Millennia of Cross-Cultural Continuity and Change*, Brill, Leiden.

Reich R., Shukron E. and Lernau O., 2007, Recent Discoveries in the City of David, Jerusalem. *Israel Exploration Journal*, 57, 153-169.

Schneider T., 1988, Azariahu Son of Hilkiahu (High Priest?) on a City of David Bulla. *Israel Exploration Journal*, 38, 139-141.

Shiloh Y., 1984, *Excavations at the City of David I. 1978-1982. Interim Report of the First Five Seasons*, Qedem 19, Jerusalem.

Shiloh Y., 1986, A Group of Hebrew Bullae from the City of David. *Israel Exploration Journal*, 36, 16-38.

Shiloh Y. and Tarler D., 1986, Bullae from the City of David. A Hoard of Seal Impressions from the Israelite Period. *The Biblical Archaeologist*, 49/4, 196-209.

Shoham Y., 2000, Hebrew Bullae. In *Excavations at the City of David 1978-1985 Directed by Yigal Shiloh. Volume IV. Inscriptions*, (ed. D.T. Ariel), 29-57, Qedem 41, Jerusalem.

Torczyner H., 1938, *Lachish I (Tell ed Duweir): The Lachish Letters*, Oxford University Press, London.

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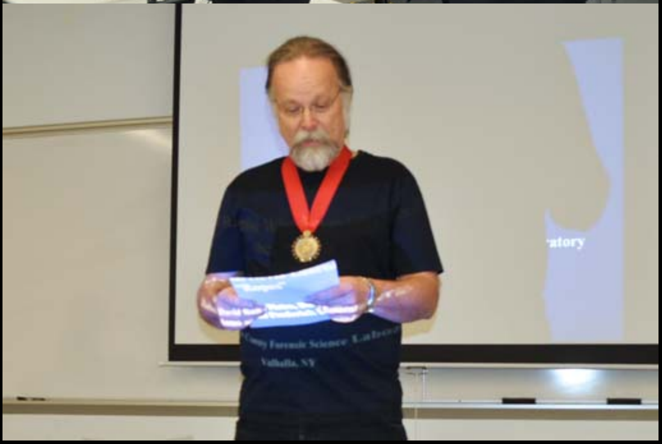

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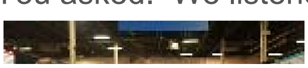

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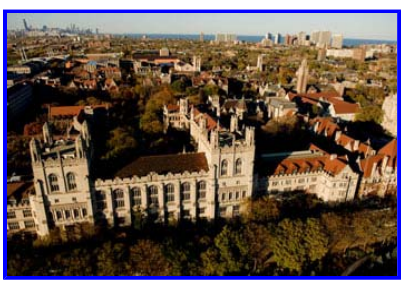

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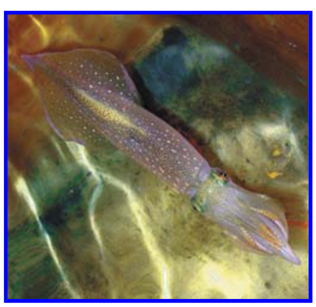

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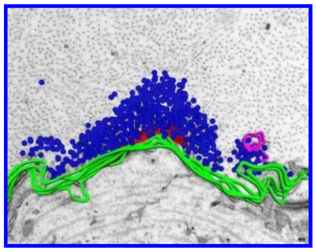

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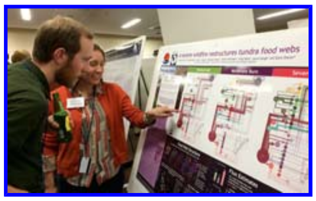

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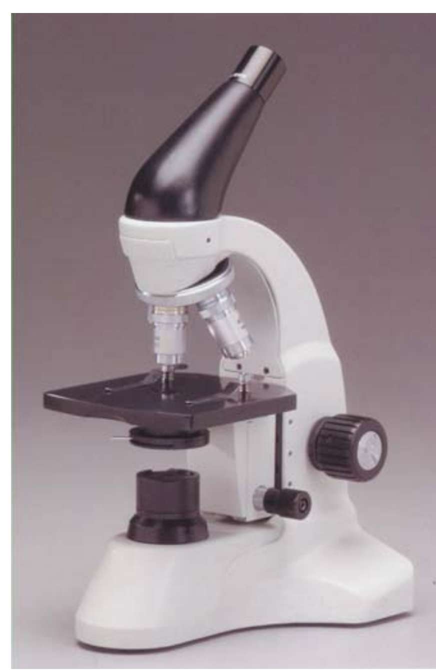

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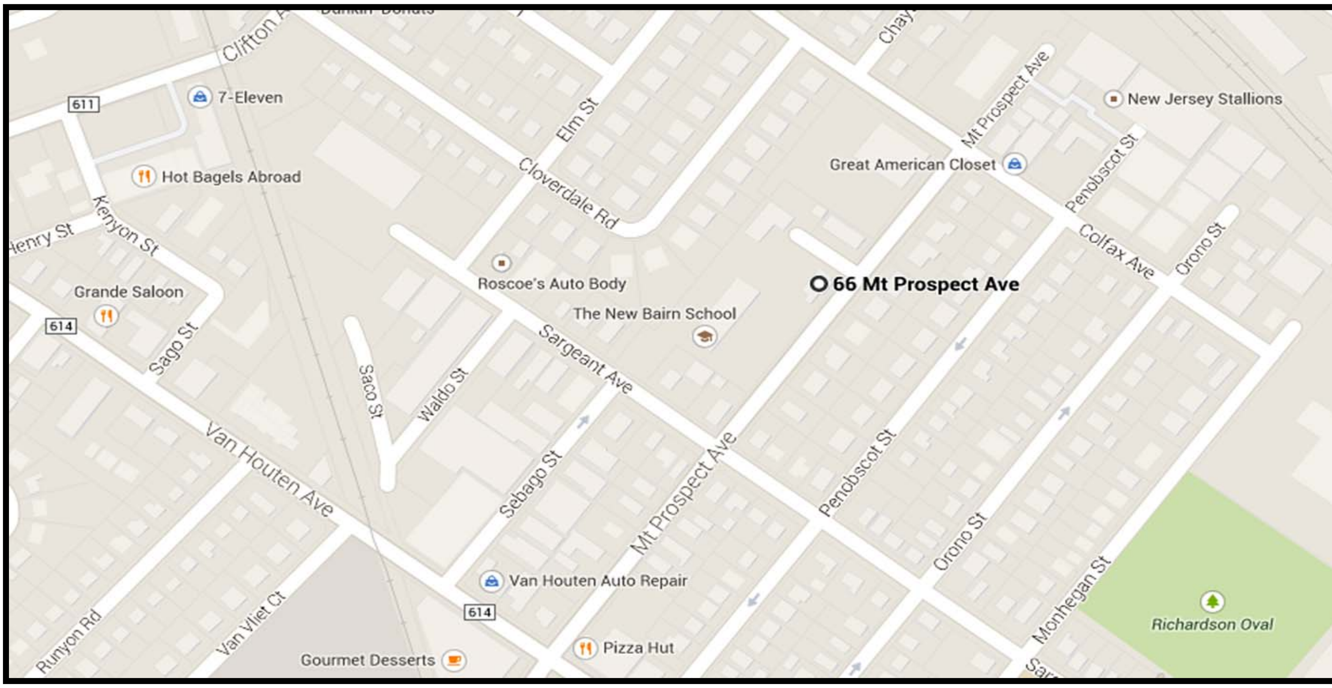

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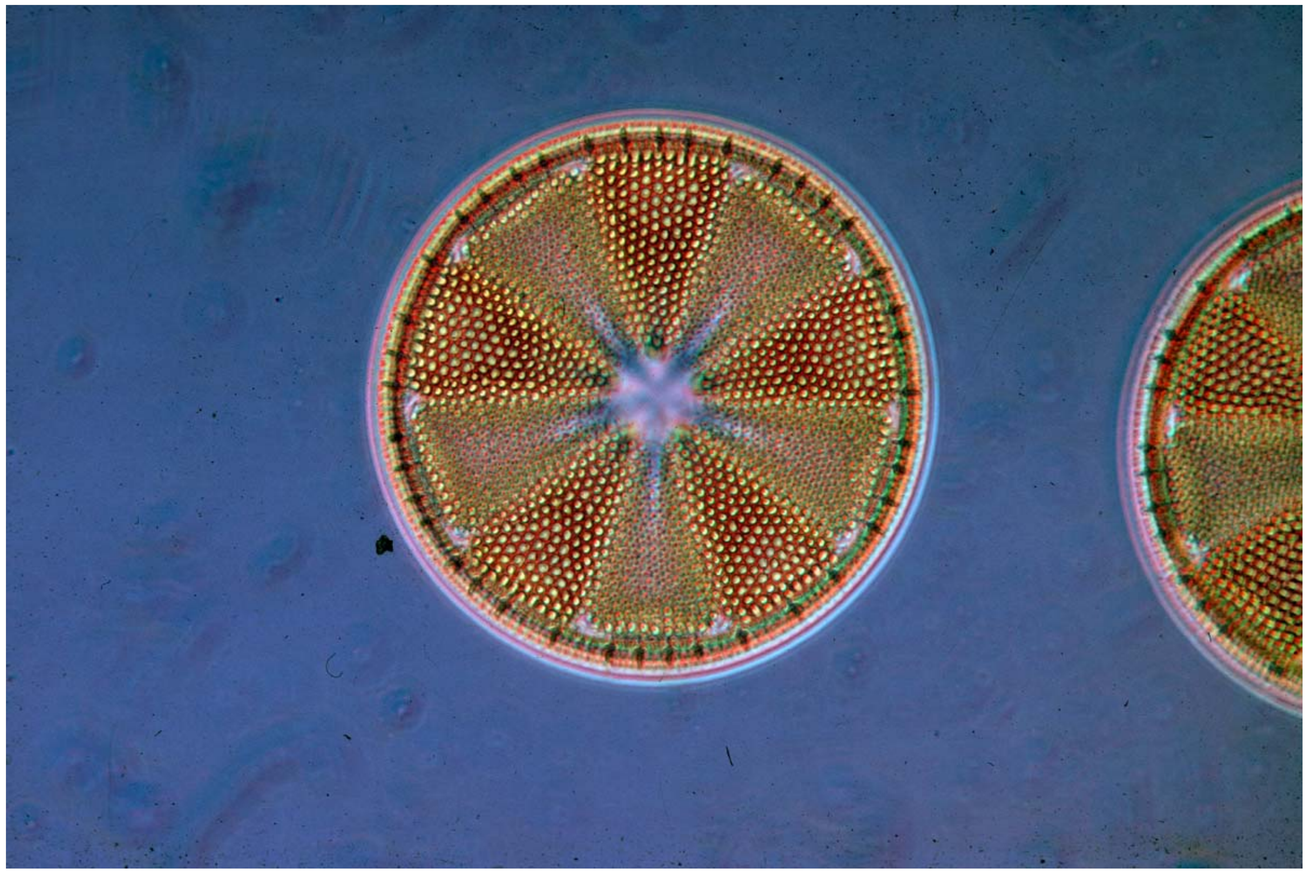

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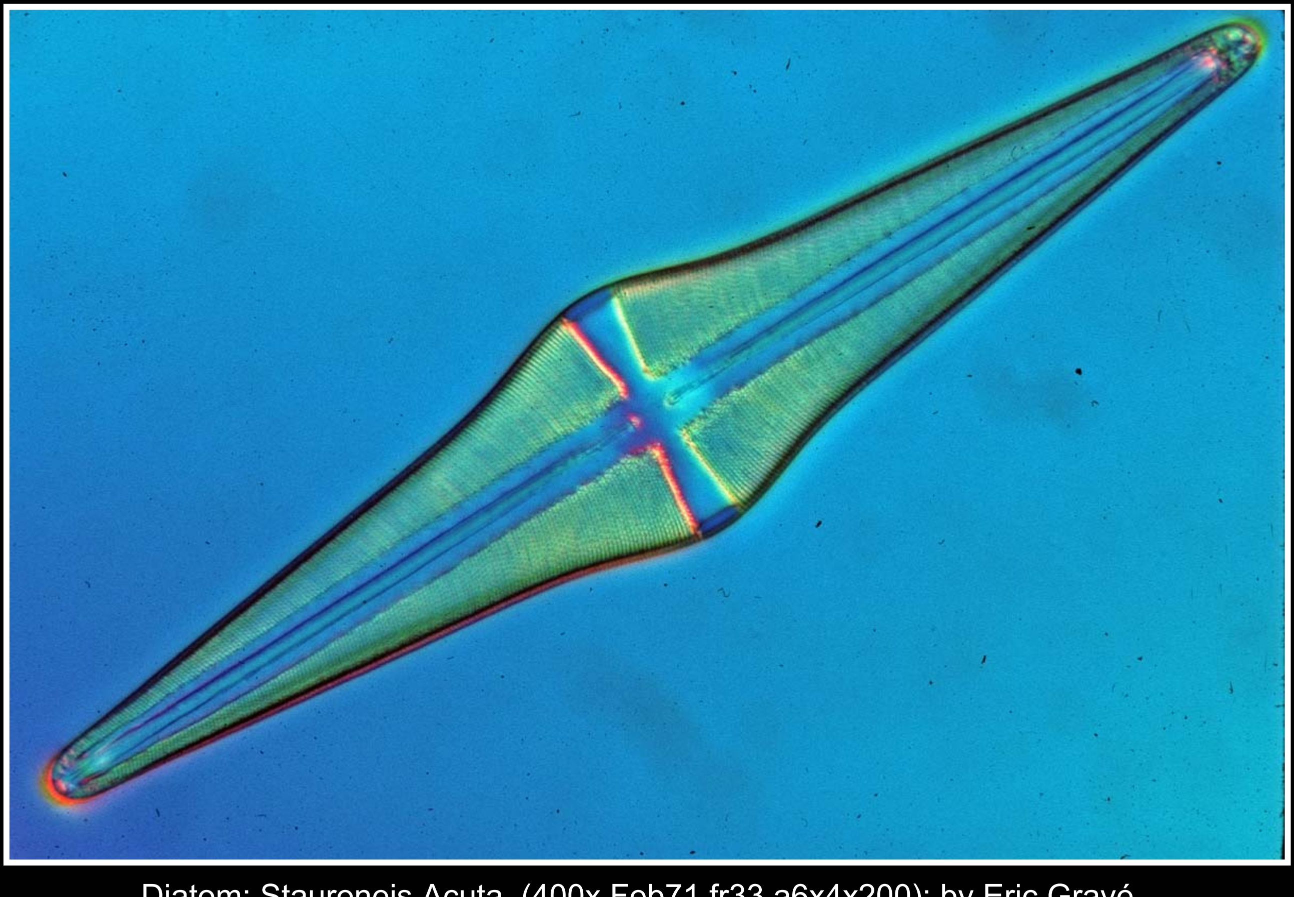

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