Journal of
THE MICROSCOPICAL SOCIETY OF SOUTHERN CALIFORNIA
Volume 7 Number 1 Jan 2002

THE "ZIG ZAG" MICROSCOPE

By Dave Hirsch

In most modern microscopes, rack and pinion arrangements raise and lower the body tube and/or the stage to achieve coarse adjustment. For fine adjustment, a variation of the micrometer screw may apply. Other methods for fine adjustment were featured in some 19th century microscopes, two of which are described below.

The stage detail of a Chevalier stand signed, "C.W.Dixeys" is shown in fig. 1. A spring loaded adjustment screw is secured beneath the lower right hand portion of the lower stage assembly. The upper stage portion includes a pair of attached pins which pass freely through, and move parallel to the lower stage by means of the adjustment screw.

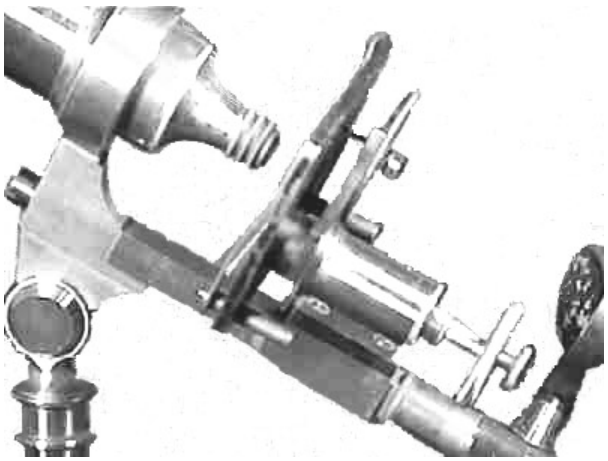


Figure 1

A second fine focus scheme was applied on a circa 1909 Leitz compound monocular. This stand is shown as Fig. 232 on page 122 of the "Billings

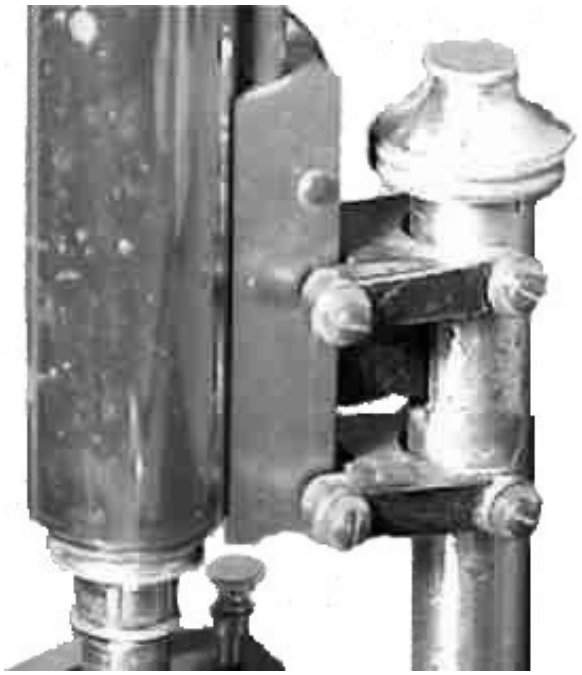


Figure 2

Microscope Collection", 2nd ed. AFIP, 1974. In principle, this fine focussing system, shown in Fig.2, utilizes parallel linkages which connect the post to the body tube assembly. The linkages remain parallel to each other as the body tube is raised or lowered. The body tube is at a maximum distance from the post when the linkages are in a horizontal position. When the linkages are above or below the horizontal position, the body tube arcs toward the arm. All portions of the specimen will remain in focus but the optical center will be longitudinally displaced.

A further search of the literature would turn up other fine focussing mechanisms, but rugged in-

dividualism abetted by curiosity besets us and we go forth in search of that "better (fine adjustment) mousetrap". With sincere apologies to the likes of Rube Goldberg, et. al., let's "beat the dead horse" one more time and present yet another version of a fine focussing system. Actually, the project started after a carefree day of junk yard cruising many moons ago. The price was right for one metal treasure; a twenty pound coil of .0301, thick x .3751, wide, half hard brass strip. For several years the coil reposed in my garage along with other "gotta have it, might need it some day" debris until the brass took on a nice patina. From time to time brainstorms occurred, proposing applications which could make use of this brass strip.

It became evident that the dimensions along with the physical properties of brass, such as springiness, might apply to stuff like forceps. In time, over two dozen forceps designs came into being. Moot flashes of alleged ingenuity short circuited the urge to create more forceps, leading to the development of a fine focussing system for microscopes.

What then, is the connection between forceps and microscopes? Designwise, a forceps comprises a pair of flat (leaf) springs joined at one end and forced together to grasp and hold objects with the other end. How could the flexing action of the forceps blades apply in the development of a focussing mechanism for a microscope? When the

MSSC Journal
Volume 7 Number 1 January 2002
CONTENTS

MICROSCOPICAL SOCIETY OF SOUTHERN CALIFORNIA

blades are pressed toward each other, the open end of each blade is constrained to move in an arc. Our objective (no pun) was to devise a configuration whereby the forceps tips were constrained to move in a straight path. Using a short length of brass strip a workable thingy came into being.

To illustrate the concept, a brass strip was bent into a "zigzag" configuration with the four sections set parallel to one another as shown in Fig.3. Applying a force (f) at distance (a/2) will cause all four sections to flex the same amount. The free ends of the configuration are constrained to move parallel to each other, providing the basis for a fine focussing mechanism.

Further enhancement of the design resulted in the use of two leaves in each arm as shown in Figs. 4a and 4b. The increased stiffness of this configuration yielded a higher spring rate and smoother action than a body made from a continuous single strip of brass. Coil springs placed between the leaves at their center span minimized backlash and assured an equal amount of deflection of each section. Spacers joining the leaf ends were sized to allow for optimum displacement of the end leaves while at the same time assuring a minimal assembled height of the configuration.

The spring blade assembly fits on a vertical retaining shaft which serves to keep the blades in mutual alignment. A knurled, internally threaded adjustment thimble presses on the spring and blade complex. The top and bottom spring blade elements remain parallel to each other as deflection occurs. The retaining shaft is assembled to a 0.5" diameter knurled brass post which enables the instrument to be hand held. The surfaces of the upper end of the post and the lower end of the adjustment thimble are spherical to assure smooth and continuous contact with the faying spring blade surfaces during flexure. A slotted detent secured to the upper part of the post prevents the spring assembly from rotating. The post has an internal thread on the bottom to which a pedestal base can be added.

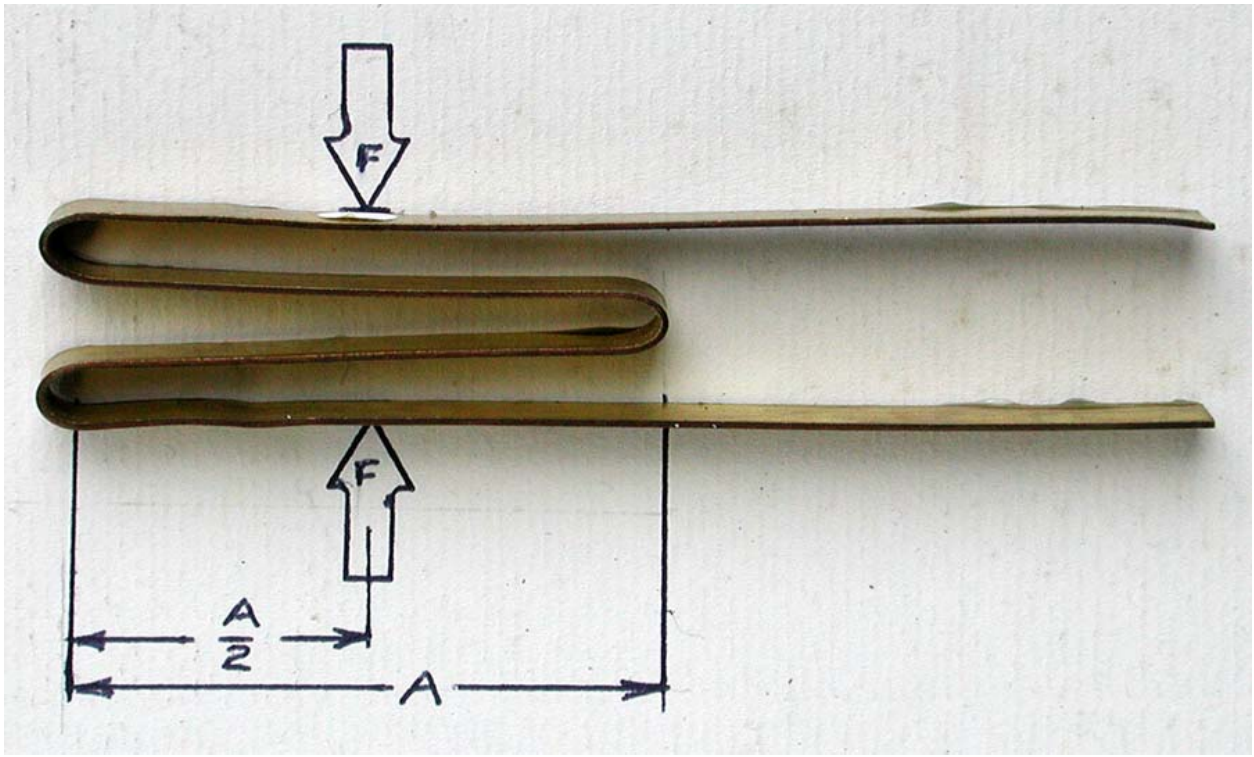


Figure 3

The microscope was fitted for two types of magnification systems. The first attachment, shown in Fig. 4a, uses an early Bausch & Lomb magnifier containing three fold out lenses. Various combinations of the three lenses yields seven magnifications, from 5X to 20X. A removable brass mounting assembly secures the magnifier to the upper blade.

For the second attachment, a romp through my goody box brought forth a lens module which once served as part of the telescopic eyepiece assembly in a long defunct surveyors instrument. The 2" long x .51' diameter assembly shown in Fig.4b was converted into a 30X microscope. The ocular and objective are held in the tube by a friction fit, allowing the lens assemblies to slide in and out for varying the magnification.

The one inch diameter stage is made of brass. It is assembled to a mounting screw which provides for vertical positioning of the specimen.

A gimballed substage mirror mount (lacking a mirror) was fitted with a short focal length lens to serve as a bullseye condenser. The assembly fits into a block which mounted on a rod which, in turn, fits into a rotatable collar on the upper part of the post. This arrangement allows for maximum adjustability of the bullseye.

To wind up this project, a suitable carrying case was built. Finding lumber was the first order of business. By-passing Home Depot, I searched through my cornucopia of random objects for suitable wood pieces. I found a thick piece of maple which, in its former life, was the seat portion of a kitchen chair. That part which was not converted into sawdust and wood chips became the fitted carrying case enhanced by brass hardware shown in the two photos in Fig.5.

Figure 4a

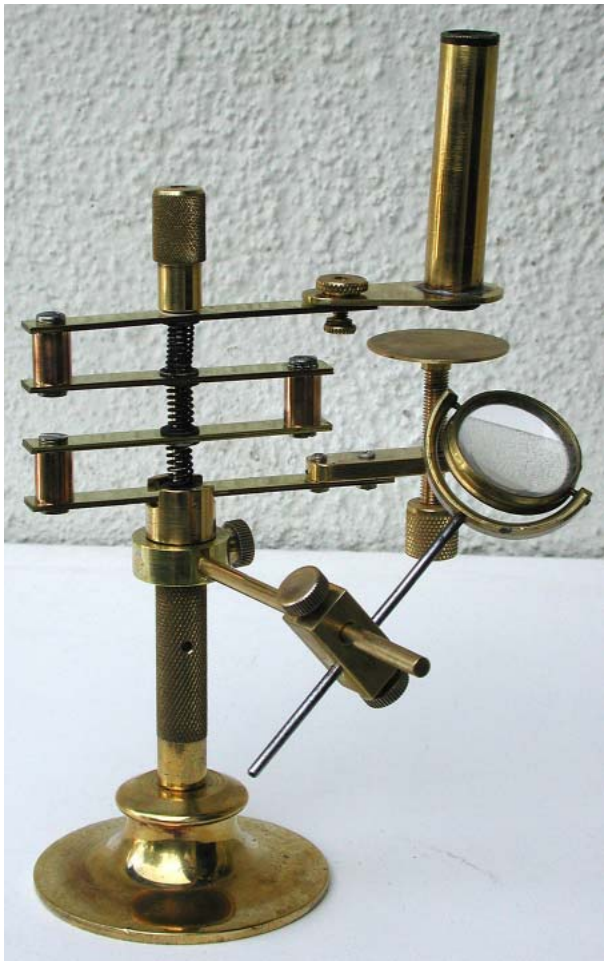


Figure 4b

Figure 5

A parting shot. As exemplified by this project, the seed of an idea can lay dormant for years. Couple that idea with odds and ends of materials which lie about waiting for the "right idea" to kick in. Such previously useless but nevertheless indispensible materials will suddenly take on high value as candidates for integral parts of an end product. Fragmented ideas come together, forming the concept. A nip here, a tuck there, we cut and try until everything falls into place and voila! Another hunk of hardware to fondle and fawn over. we had fun and maybe-just maybe, we learned a thing or two.

WORKSHOP of the Microscopical Society of Southern California

by: George G. Vitt, Jr.

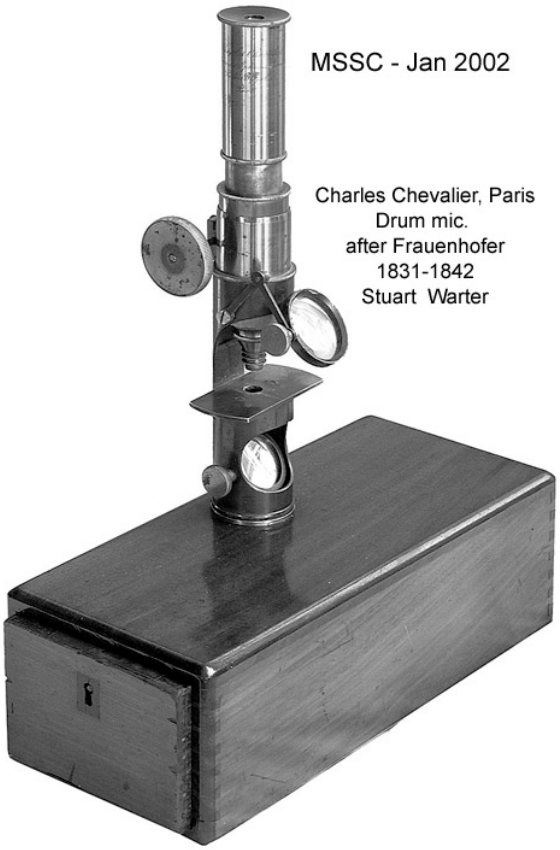
Date: Saturday, 5th January 2002
Location: Izzy Lieberman's Residence

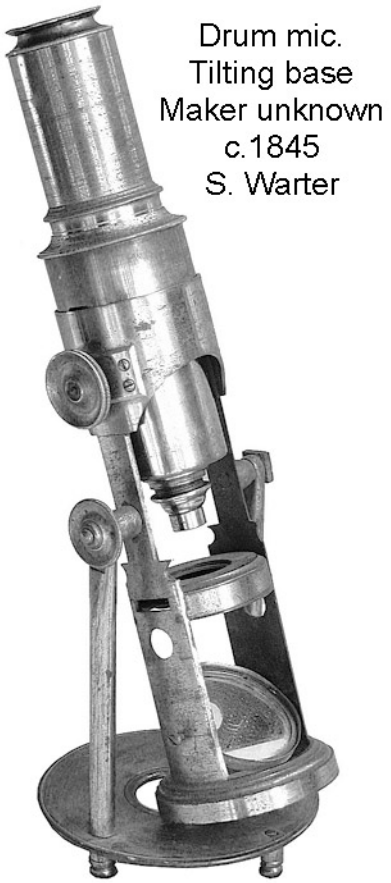
1. Jim Solliday recounted our successful Christmas party and congratulated all those who planned this event. He reported that he, Pete Teti and Joe Wise have arranged for MSSC to have its storage cabinet permanently located at New Roads School. He added that a hands-on workshop is being planned to be held every other month and this will be in addition to the regular meetings and workshops.

2. Attendees adjourned to Izzy's living room where an excellent video, provided by Victor Silveria, was viewed. The video concerned itself with the principles and applications of the Hoffman Modulation technique to light microscopy, and was prepared by the Company that manufactures and installs this equipment. Everyone congratulated Victor on the excellent presentation.

3. Stuart Warter brought a signed early box mounted drum microscope by Charles Chevalier (see photo). The Paris address engraved on the instrument was occupied from 1831 - 1842, thus dating the instrument within 12 years. It appears to be an exact copy of the drum microscope first introduced by Fraunhofer in 1811 in Germany. It may be one of the earliest achromatic instruments. Its distinctive features are that it has two methods of focusing - a sliding tube that moves through a sleeve which in turn is moved by a rack and pinion. There is a bullseye condenser attached by a jointed arm to the side of the hood. The drum microscope is usually attributed to Benjamin Martin of London, whose original Pocket "Reflecting" Microscope of 1738 was designed for portability, but it may have in fact been first introduced in Germany by Nicholas Bion in 1717. Stuart also showed a drum mic. of unknown make, which features a tilting base (see photo).

4. Dave Hirsch, MSSC Treasurer, reported that MSSC balance is $2,392.14. He reminded us that the dues are now payable, and then presented a new member, Pierrino Mascarino.





5. Jim Solliday exhibited a Carl Zeiss, Jena, Stand 1c, Photomicroscope, s/n No.43011, 1905. Stand 1c was designed for photomicrography and projection. The upper limb features Berger's micrometer movement. It also has a very wide body with the draw-tube in a secondary sliding sleeve. The limb is shaped to form a convenient handle better known as the "jug handle" type. It comes with an Abbe condenser (N.A. 1.40) and a large mechanical stage,(Zeiss Cat. No.44). The coarse adjustment is by rack & pinion and tightly fitted to carry the weight of a camera. In 1898 Zeiss introduced the side-fine adjustment alone with a new type of limb to represent their first class stands. This new limb houses the side fine adjustment and features a "D" or jug handle as mentioned above. A full description of this new form of micrometer screw can be found in Zeitschrift für Instrumentenkunde, Vol.XVIII, 1898, pp.129-133. The designer of this new system was Mr. Max Berger, the Chief of construction at the Zeiss Works. Berger's micrometer side movement was far better then the old standard design, having much greater delicacy. The divisions on the milled-head correspond to a variation of 0.002mm in the position of the body tube. The body-tube is not only for photomicrography, but could also carry Mikro-Planar lenses. The nosepiece is an adapter for quick attachment of the objectives (sliding objective changer). At the time it was thought that the slide changer had an advantage over the revolving nosepiece in that it kept the objective centered with greater accuracy (the changer included adjustments for centering). The optical components include a double-sided mirror which is easily removed for horizontal photomicrography. The condenser is a Zeiss-Abbe combination with triple elements (Cat. No.26, N.A. 1.40), and a focal length of 8mm. It fits into the substage in a sleeve. The whole illumination apparatus also features a shifting iris diaphragm that can be turned aside on a joint. Accompanying the

stand are five eyepieces including: Zeiss No.2 projection, No.4, No.8, No.12 and No.18, all compensating type (Compens okulars). The objectives include: Apochromatic 4mm, n.a.0.95, 160mm Tubus, with correction collar. Also, Zeiss D, Zeiss F (correction collar), Zeiss 16mm Apo, Zeiss a*(low power). The finish of the stand is brass and black. The condition is almost like new. There was no cabinet, but one was provided by Allen Bishop.

6. Dario Solares showed a special cable release adapter he had made for use with his Nikon 990 digital camera (see photo).

7. John De Haas showed a Watson & Son Student Stand mic. that he had beautifully restored from its previously deplorable condition (see photo). Stuart Warter is the proud new owner.

8. Ken Gregory showed three microscopes (see photos):

a) A Leitz Mineralogical Stand, Stativ-II, c.1898, s/n 49726, a polarizing microscope. The substage condenser on rack-and-pinion can be replaced with a condenser mount having five substage pinhole stops. The Nicol prism polarizer and the graduated circular stage are both rotatable. The de-centerable carrier with diaphragm for the polarizer has a pivot swing-out. The triple nosepiece carries 3 Leitz objectives: #3, 6, 7 and a 1/12 oil. The original analyzer was of the eyepiece type with a slot for the insertion of gypsum and mica retardation plates. Somewhere along the line, someone replaced the eyepiece analyzer with its calibrated circle with a modified eyepiece that fits over the eyepiece in the draw-tube. It consists of two wooden washers with a piece of polarizer sheet sandwiched in between. As with the original design, the Bertrand lens fits into the tube like an original eyepiece (this lens is present). Since the current polarizer does not have the slot for the mica and gypsum plates (both present) a slot is present at the lower end of the body tube just above the nosepiece to accept these plates. The draw tube has a guide slot to prevent rotation. Overall condition is quite good

b) Since only twelve people were present at the previous workshop, Ken returned with his 1907 jug-handle B&L polarizing microscope, whose description will appear in the Dec 2001 workshop notes. These two microscopes are near contemporary.

c) Ken also presented a 1983 replica outfit of Zeiss' 1880 Stand VII microscope (No. 233 of 1,000 made), cased, in its original protective envelope. The scope is virtually unused and is complete with all accessories, and German language instruction book.

Zeiss Stand VII
1983 Replica
#232 of 1,000
K. Gregory

Zeiss Stand VII
1983 Replica
#232 of 1,000
K. Gregory

9. Pierrino Mascarino showed his Nikon Eclipse E-200 biological mic. (see photos) which he intends to place on eBay. He stated that the Getty Museum has an excellent exhibition of antique microscopes.

10. Gary Legel brought misc. goodies and books for sale.

11. Izzy Lieberman related his recent experience in the new Planetarium (using a Zeiss MK IX projector) at the Museum of Natural History in New York. He stated that it is a great advance over the previous installation but that the familiar NY skyline was no longer there. He then showed a Spencer Mod.7 biological binocular mic. (see photo), which is for sale, ca. 1949.

Nikon
Eclipse E200
2001
P. Mascarino

12. Ed Jones showed several freeby magazines whose covers featured color photomicrographs of birefringent crystals. He also described the book on the founder of forensic science, Raspail (1790-1878).

13. Gaylord Moss described the amazing automata exhibited at the Getty Museum.

14. George Vitt demonstrated the usefulness of a miniature Leitz tripod and a C clamp device (by Bewi, Germany) for use in giving a steady and handy support for small cameras such as the Nikon 990.

We give our thanks to Bill Hudson for providing us with refreshments and tasty pastries, and Izzy Lieberman for his great hospitality.

THE MICROSCOPE PLAYS A VITAL ROLE IN SOLVING A PERUVIAN MYSTERY

by: George G. Vitt, Jr.

The November 1997 issue of R&D Magazine contained a report by Fred Jueneman, concerning a recent archeological find in Peru. The true meaning and significance of this find remained unknown for seven years, however, until the time that the microscope was put to use and a keen-eyed and erudite investigator made a startling analysis. While many of us throw up our hands at the mere mention of histological microslides and histology because we lack the requisite high degree of specialization, nevertheless we realize its vital importance to the human species. The following describes the sequence of events in this interesting discovery.

>>>> <<<<

Back in 1987, the San Diego Museum of Man received two children's mummified limbs that had been excavated in Peru's Chillon Valley. Interestingly, each right hand held a hollow funerary cane stoppered with raw cotton, not unlike items associated with ancient Egyptian funeral rituals. Inside both tubes was a white powder that was first thought to be a hallucinogenic drug. Subsequent scanning electron microscopy and x-ray diffraction analysis at Scripps Institution of Oceanography identified it as gypsum, an inorganic material that in its dehydrated state-(plaster of Paris)-acts as a desiccant.

There the matter might have stood, leaving the mystery as to both why these canes were filled with gypsum and why they were held in the children's hands. But a sample of the powder from one cane was sent in 1993 to medical technologist George Talbott, a museum research associate. Talbott didn't know it at the time, but there were uncharacterized dark specks in the gypsum.

Talbott had a Zeiss Universal light microscope at his disposal, supporting brightfield, darkfield, phase contrast, and polarization applications, with trinocular optics for preparing photos of any specimen. Using the advanced technique of light staining, supported by phase contrast, darkfield, and polarization, Talbott first observed a small sample of the gypsum at 400X-and recognized one of the dark spots as a fragment of what appeared to be triturated heart tissue. Other sampies were then found to contain myocardial cells with pseudomorphs of mitochondria, heart-muscle fiber, intercalated disks, and both epicardial and pericardial wall material.

Talbott sent several photomicrographs to associate Allen Steinmetz, a microbiologist at the Univ. of California at Berkeley. He confirmed Talbott's findings. A formal report was then filed with the San Diego museum in early 1994.

Still, such a curious finding required additional support, which the museum apparently secured from pathologist Art Aufderheide of the Univ. Of Minnesota. Talbott's report was subsequently featured in a paper presented by Rose Tyson, the museum's curator in physical anthropology, at the annual meeting of the Paleopathology Association held that spring in Denver.

Why is the finding of mummified heart-tissue fragments in Peruvian funerary paraphernalia so curious? In ancient Egyptian funeral ritual, such a ritual is not unknown. Sir Wallis Budge, the noted Egyptologist and Assyriologist, said that the Egyptians mummified the heart separately from other organs of the body in their rituals, but others more recently have dissented. Still others claim that such practice was performed in the late dynasties of Egypt.

Nonetheless, however late such rituals were performed in ancient Egypt doesn't detract in the least from the fact of a parallel practice in Peruvian antiquity. The question naturally arises as to what-if any-influence Egypt might have had on the Chillon Valley in Peru.

Standard archaeological persuasion says that there was little or no contact between the Old World and the New prior to the Phoenicians, and in any case it would have been by

accident-storm-blown shipwreck-rather than by design. Succinctly put, anything before Columbus automatically becomes apocryphal. Be that as it may, Talbott waxes poetic in his final discussion:

"I did not begin my microscopic analysis with any expectation of finding heart material, but when I did observe structures resembling cardiac tissue, I was deeply moved," writes Talbott. *"I was moved by a reasonable image of the youngster, cut off from his games and family and times so early, walking across the sky to his gods, holding his credentials in his hand, credentials housed in a thin stoppered tube.*

>>>> <<<<

I believe that the ancient Egyptians were well acquainted with the process of making plaster of Paris from mined gypsum by the application of heat. The resulting product, usually in the form of powder, reverts at the rigid stone-like gypsum after it is mixed with water and allowed to set up. Whether they knew of the dessication properties of the dry plaster, and put it to use as such, remains a question. Was the preparation of Plaster of Paris independently discovered by the Peruvians is an even more intriguing question. How does such a discovery take place in the natural course of events - especially in ancient times? Probably the same way that the making of steel was discovered. In any case, it is possible that the Peruvian human parts were mixed with the dry plaster to dessicate them and that, with the passage of time, the moisture that penetrated the not very hermetic seal caused the plaster to set up. On the other hand, since the report states that the substance was found in powder form, it may have been the powdered raw gypsum right from the beginning.

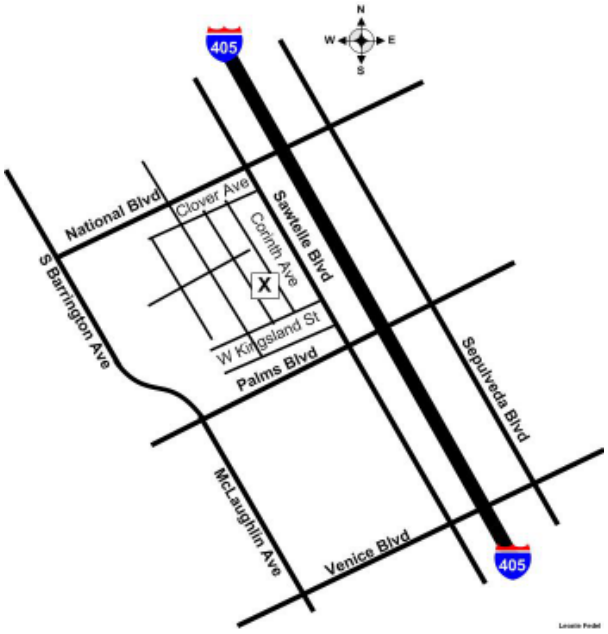
Any ideas?

Saturday Workshop Announcement

9.00am 2nd Feb 2002

At the home of Izzy Lieberman

3300 Corinth Avenue
Los Angeles CA 90066
310-391-6076



The activities should begin by 9:00 AM. You are invited to bring any and all manner of items related to microscopy. If you have something new or old, its time to share it will the fellowship. If you have something you would like to sell, please feel free to bring it and set it up at the sales table. Lunch after the meeting will be at Coco's. If you have any questions please send me a message.

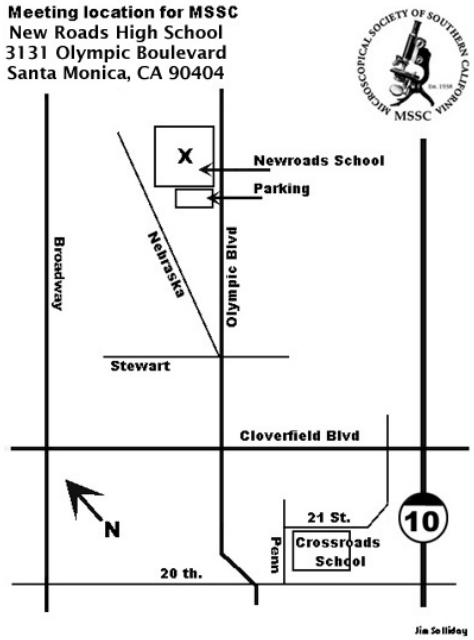
I look forward to see all of you at the workshop...

Sincerely, Jim (MSSC).

MSSC Meeting Announcement

7pm 20th Feb 2002

at Newroads School



This month we are very pleased to have an associate of Ken & Stuart provide out program. Dessie Underwood has studied the social behavior of a certain butterfly in northern Mexico and will be sharing her discoveries with out Society this Wednesday (a description of her talk has been included below). I understand the presentation is quite fascinating and will include a power-point projection program. You will not want to miss this presentation as she comes with the highest recommendations.

For the second half we can all look forward to hearing from Alan de Haas. I'm sure that we will once again benefit greatly from his encyclopedic knowledge associated with microscopy. We are planning on a very informative and interesting evening, so please plan on attending.

For those of you who enjoy a good meal before the meeting, we will again be meeting at Coco's at about 5:30pm. I do hope to see you there...

Sincerely, Jim Solliday (President)

Speakers Abstract

Sex and behavior in a social butterfly
Dessie L. A. Underwood
California State University, Long Beach

Eucheira socialis westwoodi (Pieridae), a social caterpillar endemic to the highlands of northern Mexico, exhibits extreme chromosomal irregularities in meiosis, has an exceedingly male-biased primary sex ratio, and the rudiments of a caste system where male larvae appear to be workers. Metaphase I spreads vary from cell to cell within the same individual. Some cells have apparently normal associations of bivalents while others have multi-chromosomal exchange structures and univalents. Chromosomes lag during anaphase and are apparently excluded in micronuclei that are produced in association with sperm nuclei. For four generations at two populations, the mean primary sex ratio varied from 64 to 79% male with some sibships exceeding 90% male. Late instar larval mortality is also disproportionately male-biased (84 - 100% male). Eggs are laid in masses of up to 450. Larvae begin spinning a silken shelter soon after hatching and this shelter is expanded and fortified throughout all nine months of larval development. Larval communication and foraging occurs from silken trails laced with a pheromone excreted from a site between the anal prolegs. Male larvae spend more time spinning silk on the nest than females and are the first to venture out to feed.

References

Fitzgerald, T. D. and D. L. A. Underwood. 2000. Temporal foraging patterns and voluntary hypothermia in the social caterpillar Eucheira socialis (Lepidoptera: Pieridae) Ecological Entomology 25:35-44.

Underwood, D. L. A. and A. M. Shapiro. 1999. Evidence for division of labor in the social caterpillar Eucheira socialis (Pieridae: Lepidoptera). Behavioral Ecology and Sociobiology 46(4):221-227.

Underwood, D. L. A. and A. M. Shapiro. 1999. A male-biased primary sex ratio and sex-biased mortality in the pierid butterfly Eucheira socialis. Evolutionary Ecology Research 1: 703-717.

Fitzgerald, T. D. and D. L. A. Underwood. 1998. Trail marking by the larva of the Madrone butterfly Eucheira socialis and the role of the trail pheromone in communal foraging behavior. Journal of Insect Behavior 11: 247-263.

Porter, A. H., H. Geiger, D. L. A. Underwood, J. Llorente-Bousquets, and A. M. Shapiro. 1997. Relatedness and population differentiation in a colonial butterfly, Eucheira socialis (Lepidoptera: Pieridae) Annals of the Entomological Society of America 90:230-236.

Underwood, D. L. A. 1994. Intraspecific variability in host plant quality and ovipositional preferences in Eucheira socialis (Pieridae: Lepidoptera). Ecological Entomology 19: 245-256.

Underwood, D. L. A. 1994. Methods for sexing larval lepidopterans using external morphology. Journal of the Lepidopterists' Society 48: 258-263.

Dessie L.A. Underwood
Biological Sciences
California State University
Long Beach, CA 90840

Voice (562) 985-7475
FAX (562) 985-8878
dlunderw@csulb.edu

Editor's Note.

I would like to introduce myself. I have taken over from Gaylord Moss as MSSC Journal Editor, so Gaylord can concentrate on his other commitments.

I am a new member of MSSC, and recently married to John Fedel, another MSSC member. Microscopes have always been in my family - my grandfather (a keen geologist) produced his own rock sections and I was given a microscope aged eight and spent many an hour dissecting animals and insects and staining samples as part of my biology studies.

I have an extensive background in desktop publishing and newsletter production and will be working closely with the MSSC Officers to bring the journals back up to date and out to you as soon as is realistically possible. I must apologize for the late production of this January 2002 Journal, held up as I was in the process of moving to Los Angeles from the UK. I had to return to the UK for most of January/early February. Future issues should be more prompt!

Your contributions to the journal are critical to its continued success, so please send any articles, photos, details of forthcoming events or other material to me:

10945 Rose Avenue #209
Los Angeles CA 90034
(310) 839-9881
lfedel@attbi.com

The preferred route is via email, with text and graphics as attachments. Text in the following formats: plain/rich text format/word documents graphics in the form of jpgs. If you need any help in converting information to these formats, please contact me, I'd be happy to help.

Leonie Fedel

CALL FOR NEW MEMBERS PROFILES

In continuing MSSC tradition, this is a request for newly joined MSSC members to write a short profile of themselves and their interests for inclusion in the Journal.

Please send profiles to the editor.

FORTHCOMING EVENT....

West Coast Annual Scientific and Technical Antique & Collectible Show

Hacienda Hotel at LAX
525 North Sepulveda Bld
(405 Freeway to 105 Freeway (west) to Sepulveda South Ramp)

Sat May 18 2002
Free admission Noon to 2pm
Free parking 10 to Noon
Regular admission $5
Early admission (8-10am) $20

More information: Al or Bobbie Roberts
(310) 476-6277
email: show@therationalpast.com