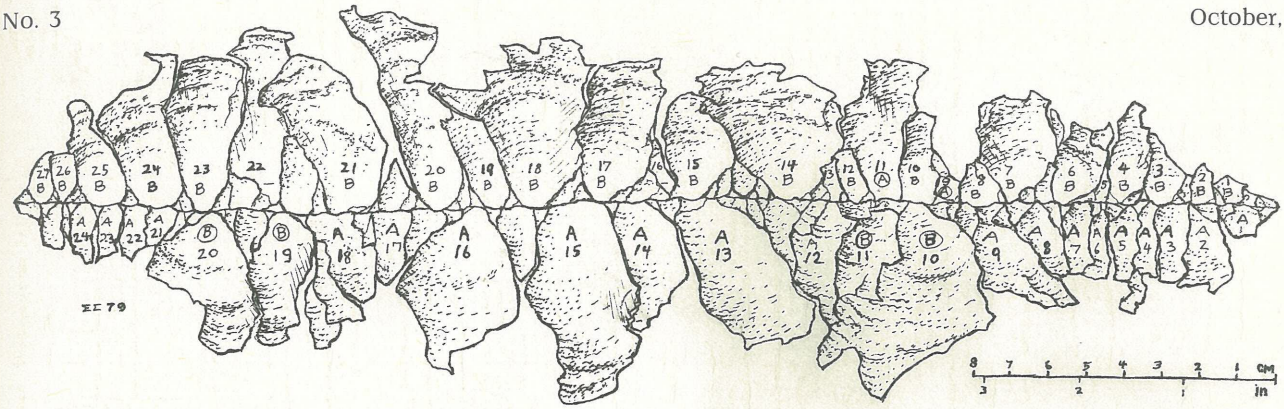
Vol. 3, No. 3 October, 1980



FLINTKNAPPERS' EXCHANGE

AN EXCHANGE MEDIUM OF, BY,
AND FOR LITHIC TECHNOLOGISTS

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FE is published three times a year as an informal medium of exchange among flintknappers and lithicologists in all walks of life. Controversial issues will not be discouraged. Letters, comments, and other contributions on any aspect of lithic technology may be sent to the managing editor, Penelope Katson. Subscription for *FE* is $7.50 per year. Single issues may be purchased for $5.00. Please send all orders to Penelope Katson, 4426 Constitution N.E., Albuquerque, New Mexico 87110.

Managing Editor

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The Illustrations: both faces of one margin of a Solutrean laurel leaf #2 from Volgu, France. "Craftsman" illustrations are by Errett Callahan: others are submitted by the authors, as noted.

LETTERS AND ANNOUNCEMENTS

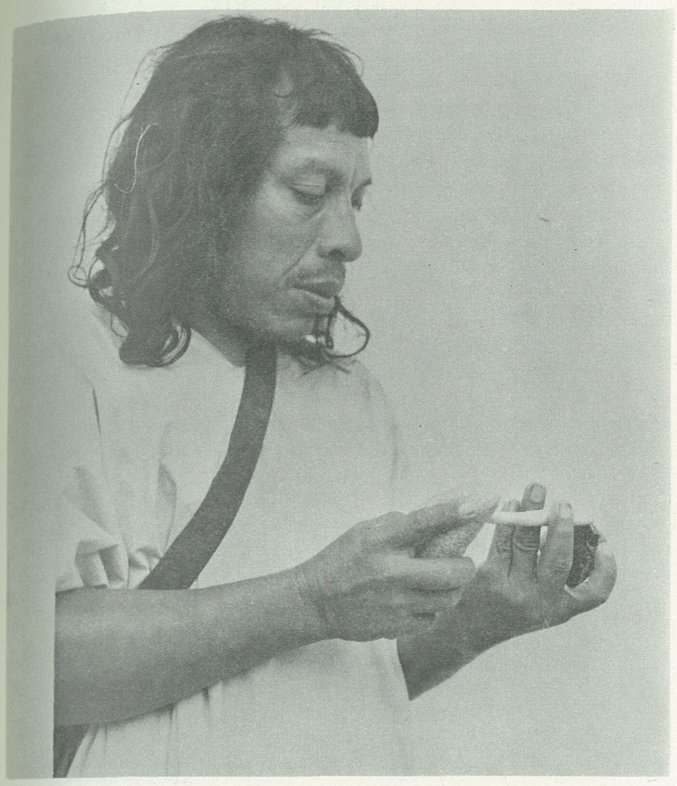

Figure 1. A Lacandon Maya Indian manufacturing blades using an indirect percussion technique. The knapping techniques of this group will be discussed at the upcoming Pachuca Conference entitled: Obsidian in Mesoamerica. (Photo courtesy of Douglas D. Bryant -- New World Archeological Foundation.)

The Pachuca Regional Center of the National Institute of Anthropology and History invites you to participate in the conference entitled:

OBSIDIAN IN MESOAMERICA

This conference will be organized in symposia which will cover specific aspects of the general theme. Interested persons are invited to attend and/or present papers. Papers will be limited to 20 minutes. The major topics of concern will be the following:

1. Characterization of obsidian as a raw material. This includes geomorphological and physico-chemical aspects and hydration dating.
2. Technology.
3. Classificatory methods.
4. Artifact function.
5. Workshops and quarries.
6. Commerce and/or interchange.
7. Division and specialization of labor in relation to the production of obsidian artifacts.
8. Modern-day use of obsidian. (Fig. 1)

Knapping sessions covering basic Mesoamerican obsidian technology will be held throuthout the conference. All persons attending the conference are invited to these workshops and will have an opportunity for individualized instruction.

The conference will be held in Pachuca, Hidalgo, Mexico on the 26th through 31st of January, 1981. Those interested in delivering a paper(s) or participating in the workshops should contact Margarita Gaxiola, Centro Regional de Hidalgo, Exconvento de San Francisco, Pachuca, Hidalgo, Mexico, Tel. 2-66-90, or John E. Clark, Apartado Postal 140, San Cristobal de Las Casas, Chiapas, Mexico. The deadline for submitting abstracts will be October 31, 1980. Please include the title of the paper and institutional affiliation with the submitted abstract.

John E. Clark
Brigham Young University
New World Foundation
Apartado Postal 140
San Cristobal Las Casas
Chiapas, Mexico

* * * * * * * * * *

Errett, you have done a beautiful job at the Pamunkey Museum of associating and collecting artifacts from all of the different knappers. Yours is probably the most comprehensive study of different individual technologies any place in the world. I am only sorry that I haven't sent you better examples. I am one that puts off to the next day what could be done today.

You and Jackie are doing a simply great job in expanding FE. I am sure there will be an accelerated demand for this publication as it is the only comprehensive study or association of different and diverse knapping techniques of world technology.

Don Crabtree
Route 1, Box 210
Kimberly, Idaho 83341

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EDITORIAL NOTE

Contrary to what you read in the last issue, this writer did not go to Denmark in September as announced. The date has now been moved to May or June and the stay only till September or so. The International Flintworking Seminar has been rescheduled for mid-summer, 1981. I am still hard at work writing my dissertation on Pamunkey and may continue to do so -- as well as revise it for publication -- this coming spring. After that, it's job hunting. Still, I will not be quite as inaccessible as I implied before. (Contact me at my home place below, not at Lejre.)

I am soliciting your opinions as to whether or not I should continue with the interviews and with the drawings. Both are exhaustively time consuming. Also would readers be interested in our having as a regular or occasional feature a centerfold of a two-page, extra large, flint masterpiece of one kind or another? These could include Danish daggers, Solutrean Laurel Leaves, Egyptian daggers, French Neolithic blade cores, or whatever -- even replicas. This would entail considerable effort to locate and draw these babies so we'll need a flood of mail in order to act on this. Would you still be interested if it caused the price to go up? Write to me personally or through these pages.

The Pamunkey Indian Museum got off to a flying start October 11, with an impressive opening celebration. Be sure to catch it if you're in the area. Photos will be published soon.

Errett Callahan (Jr.)
3412 Plymouth Place
Lynchburg, VA 24503

Some weeks ago I received my first copy of Flintknappers' Exchange and enjoyed it very much. I noted articles by a number of knappers I met at Little Lake in April. At this time I wish to thank the numerous persons who gave me important information, traded materials, and who gave me a lesson or two in percussion work. Some of these folks include Rod Reiner, J.B. Sollberger, Bob Patton and a number of others who shared their time and wonderful talent with me.

To those knappers traveling in California, I highly recommend the Southwest Museum in Highland Park in the Los Angeles Area. The Southwest has a fascinating collection of ancient artifacts: including a wide variety of stone tools, spear points and arrow points representing Paleo-Indians up to more contemporary cultures. Also be sure to visit the Museum of Natural History in Los Angeles for a real treat.

The Lowie Museum in Berkeley on the Berkeley Campus has a small but interesting collection on display of Ishi's materials, including arrows, points and his flaking tools (which appear to be pressure-flaking tools). Incidentally, I recently met a man of 85 years who met Ishi when he was a young man and he had the great pleasure of having Ishi make a point for him, which he has to this day.

I have decided to offer some copies of a rare photograph of a Chumash Indian pressure chipping a point or some other tool. The photo was taken in 1878 and the original is in France. This will be available in December or January, and it is not a money-making idea. I am interested in most aspects of Native American Culture and the photograph will be for those only with a sincere interest.

Terry P. Frederick
3185 Johnson Avenue
San Luis Obispo, CA 93401

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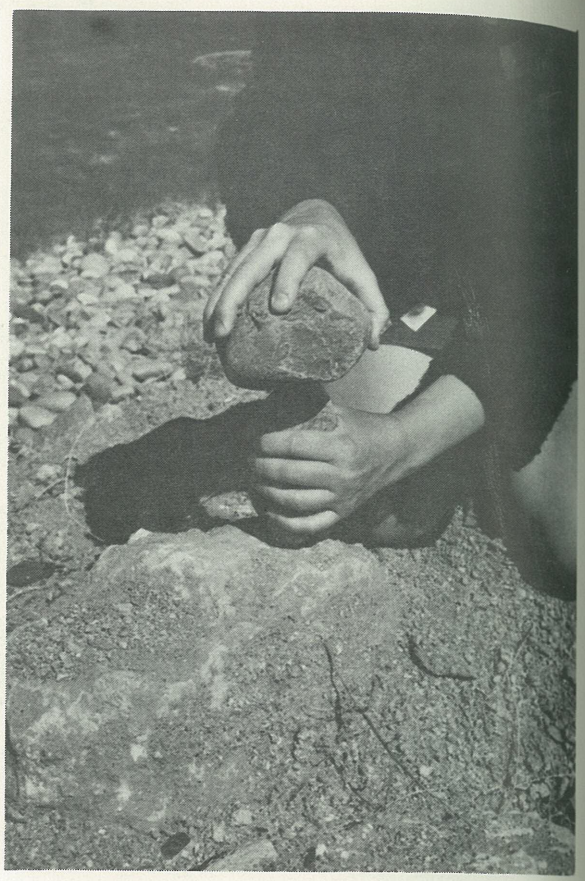

Figure 2. Bipolar Technique

It is with great sadness that we report the death on Sunday, November 16 of Don Crabtree. We will publish a memorial and information concerning a memorial fund next issue.

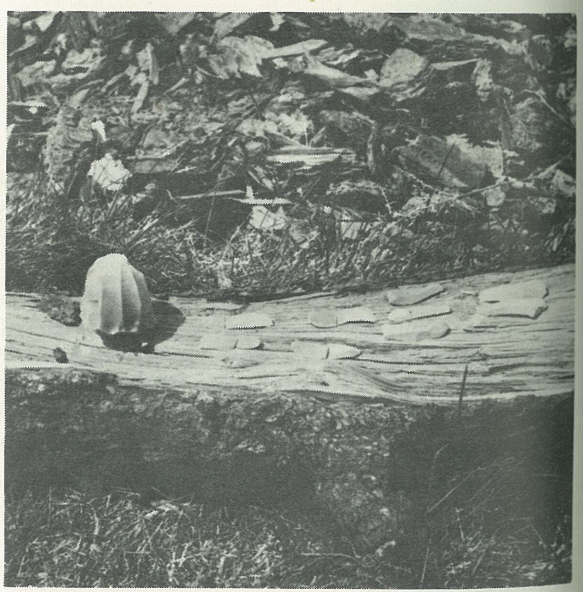

Figure 3. Reverse punch with core and blades. Note copper punch inserted in log in front of the core.

We regret the poor quality of the photographs in our last issue (3:2). The screen size used by the lithographer was too fine, and the error was not discovered until the issues were printed. Several of the photographs have been reprinted in this issue. Figures 2 and 3 in this issue's *Letters and Announcements* section were Figures 16 and 17 in the last issue. Figure 5c in the *Little Lake Knap-in* section was Figure 3 in the last issue.

THE LITTLE LAKE KNAP-IN

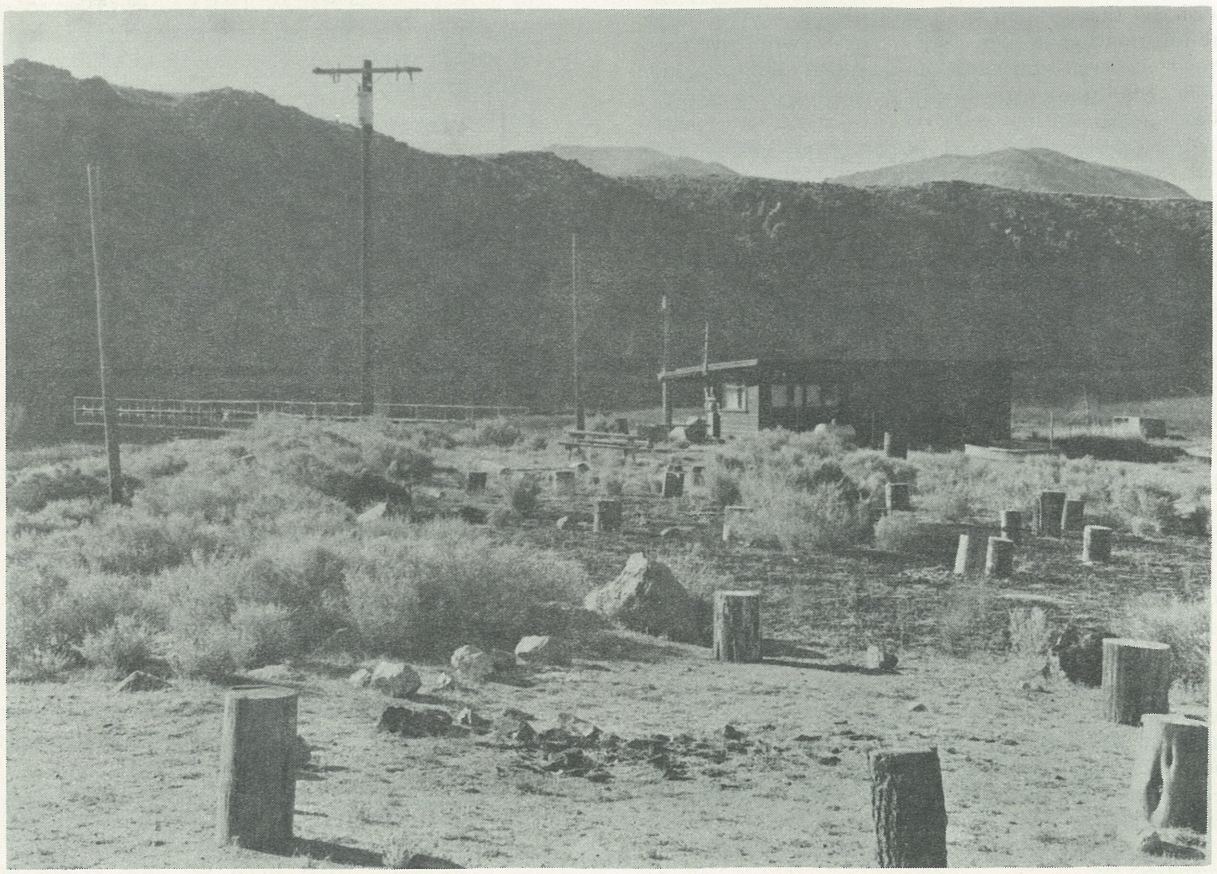

Figure 1. "Ca – Iny – 1600" : The Little Lake knap-in site.

The knap-in at Little Lake this year was a significant event in the field of American experimental archeology. We hope to share a taste of what transpired during the weekend of April 19 and 20 with those unable to attend. In this report we will look at the format and structure of the knap-in, the development of an experimental archeology site, and some of the problems we encountered. This will be followed by individual comments from some of the flintknappers and guests who attended. Finally we are pleased to include articles on specific issues that were raised during the event: J.B. Sollberger discusses the use of lever flaking devices, Gene Titmus describes strategies of large boulder reduction, and Jeff Flenniken comments on the nature of obsidian and on prehistoric fluting techniques.

In 1979 permission was granted by the Little Lake Duck Club to stage the knap-in on their property. It was agreed that the site area and the flakes and tools produced there during the event would be protected from future impact, with the exception of most of the points and bifaces which would be collected and stored. After the event, a site report would be drawn up and submitted to the state archeological authorities.

Approximately a month before the event, a proposed format was sent to the guest stoneworkers for their evaluation and comment. Though generally enthusiastic, many felt that the topics and questions raised could not be justly covered in a single weekend, so another was drawn up and given to them upon their arrival.

FORMAT FOR THE LITTLE LAKE KNAP-IN
April 19-20, 1980

SATURDAY MORNING

1. Introduction
   A. Participants
   B. General Outline for Saturday's Program

SESSION I: TECHNIQUES OF BOULDER REDUCTION

A. MATERIALS: OBSIDIAN, SILICEOUS MATERIALS, BASALT, OTHERS IF AVAILABLE

B. QUESTIONS/PROBLEMS/SOLUTIONS

1) What are the natural attributes which make a boulder conducive for boulder reduction? Size? Edge angles? Quality of material?

2) What are the techniques to reduce boulders? Are there any set techniques or are there sets of general guidelines to follow, especially when attempting to maximize the material?

3) Are there diagnostic attributes which fingerprint the various techniques? And how do the particular materials being reduced reveal these attributes?

4) If time permits:

a) roughly biface the flakes produced above

b) prepare a blade core for future blade production --use obsidian

LUNCH

SESSION II: FLUTING TECHNIQUES

A. MATERIALS: CLOVIS AND FOLSOM PREFORMS OF OBSIDIAN, RAW AND HEAT TREATED SILICEOUS MATERIALS WILL BE SUPPLIED BY THE CRAFTSMEN. QUARTZITE & BASALT PREFORMS WILL BE SUPPLIED IF AVAILABLE.

B. FOCUS: DISCUSSION AND IMPLEMENTATION OF VARIETIES OF FLUTING TECHNIQUES

1) Points to be discussed will include the

a) difference between basal thinning and fluting

b) speculations into fluting origins, i.e., what brought about the necessity of channel flake removal?

c) what are the diagnostic attributes of each fluting technique as represented on their by-products? These will be collected and examined later in the evening.

C. PROBLEMS/SOLUTIONS

1) Each knapper will give a brief word on the history of his fluting experience, the range of fluting techniques that has been attempted, and the one that works best for him. Also, discuss chief problems of replication.

2) Do fluting techniques differ depending on the type of material being worked, e.g., were the quartzite Folsom points from the Lindenmeier site fluted by the same techniques as the siliceous points that were recovered? Are there any diagnostic attributes linking technique to by-product (channel flake and channel flake scars)?

END OF SESSION II.

EVENING DISCUSSION

TOPICS

1. Where and when did bifacial thinning become a practical art? What were its non-stone antecedents? The nature of its evolvement--hand-axe refinement?
2. Where and when did pressure flaking become a practiced craft?
3. a) Where and when did heat-treating begin to upgrade available raw materials?

   b) How did it bear on the evolution/refinement of highly controlled percussion and pressure techniques?

   c) What were the highest temperatures prehistoric peoples could generate during heat-treating and what materials were the toughest to upgrade in terms of "flakability"? Give specific examples.
4. When did obsidian begin to be used on a regular basis -- Old World and New World? Give specific examples.
5. What are some of the prehistoric masterpieces of pressure flaking on "hard" materials? Describe and give time/space coordinates.

SUNDAY--ALL DAY

SESSION III: THE LITHIC REDUCTION TECHNIQUES OF EARLY MAN

Part I

A. MATERIALS: RAW SILICEOUS MATERIALS (FLINTS, CHERTS, AND CHALCEDONYS), BASALT, ANDESITE AND QUARTZITE IF AVAILABLE.

B. FOCUS: EXPLORATION OF REDUCTION TECHNIQUES PREVAILING BEFORE BIFACIAL THINNING, STONE PROJECTILE POINTS, AND HEAT-TREATING (?)

C. DISCUSSION

1) A brief review of those techniques utilized by early man in the New and Old World.

2) What are concrete methods of observation, measurement and/or experimentation we can apply to discriminate between naturally broken rocks and those which have been culturally reduced?

3) What were the blade-making techniques prevailing before 35,000-40,000 years ago in Europe? In Asia?

D. PROBLEMS/SOLUTIONS

1) Define and implement

a) block-on-block

b) percussion

c) bi-polar or bi-directional

d) indirect percussion

e) boulder smashing (optional) and possibly others

2) Briefly discuss diagnostic attributes of each technique. Do these or could these attributes change when different materials are submitted to the same technique?

3) Fabricate stone tool types one would expect to find in early sites capable of shaping and carving bone and wood into strong projectile points, shafts and handles, and shelters. Can we call these tools "TYPES" --i.e., must they be morphologically similar, functionally similar, or technologically similar? How can we tell? What must we look at for determining "TYPE"?

SESSION III:

Part II. CALICO EARLY MAN MATERIALS: A FLINTKNAPPING INVESTIGATION

A. EARLY MAN QUARRYING PRACTICES

DISCUSSION:

In consideration of the Calico Early Man site and its 100,000 year (plus) age, and given the nature of the lithic material, i.e., various grades of chalcedony from vein and/or float, speculate and hypothesize how early man would tackle the problem of reducing this material to suit his needs. We ought to discuss early African or Asian quarrying practices rather than European, since the early populations entering the New World came from Asia and utilized Asian traditions. Calico materials and artifacts to be supplied.

B. CALICO REPLICATION EXPERIMENT
(Designed by Clay Singer)

1) Aims and Purposes:

a) To examine the workability and physical characteristics of the stone materials recovered from the Calico deposits, primarily the different varieties of chert and chalcedony.

b) To attempt to replicate various tool and artifact forms recovered from subsurface deposits at Calico.

c) To discuss and analyze specific technological aspects, characteristics, and features of the Calico assemblages and the artifact materials.

2) Procedures:

a) Experienced knappers will flake and otherwise work with various stone materials from Calico, including (a) transluscent homogeneous chalcedony, (b) mottled heterogeneous chalcedonic cherts, (c) opaque jasper, and (d) any other available materials.

b) Knappers will attempt to reproduce various tool and artifact forms after thorough examination of specimens from the deposits, with discussion of techniques and procedures.

c) A complete set of notes, photographs, and recordings will be made of all proceedings and later transcribed and edited in preparation for publication.

d) All flaked and worked materials including debitage will be systematically collected and stored for further analysis.

3) Questions:

a) How were flakes removed? Types of hammerstones or percussors used, including weight, dimensions (shape), material, and condition (e.g., wear pattern).

b) Type of rest or anvil used?

c) How were blades removed? Direct or indirect percussion?

d) How were microblades made? What techniques were used to manufacture burins?

e) How was the retouch produced?

f) Can we consistently and confidently distinguish between deliberate retouch, use-wear retouch, and post-depositional damage patterns?

4) Problems:

a) Missing elements and things not yet identified within the deposits, for example (a) spherical hammerstones, (b) quantities of organic material, or (c) discreet assemblages from easily identifiable occupation surfaces.

b) The unrefined nature of most of the artifacts and tool forms - pieces often seem heavy and thick on profile. Tools manifest minimal thinning or deliberate marginal retouch.

c) Most artifacts are not in pristine condition -- some are freshly chipped or broken and reglued, many pieces have crushed and rounded edges (natural), and most are coated with a thin layer of clayey or scaley material, and sometimes a layer of calcite crystals.

d) Some non-artifacts are undoubtedly included in various tool categories and must still be culled from the collections.

e) The nature and validity of the bipolar industrial tradition or technique at Calico.

Primarily, the format was designed to offer a structure to this knap-in – a structure based on problem solving and the sharing of solutions to specific aspects of stoneworking. Secondly, it helped to provide a seminar-like atmosphere for those who came to observe. Thirdly, the format was fundamental to the development of the experimental site. In regard to the latter, each session was staged in a separate area on the site in order that the by-products of each session would not be contaminated by previous or subsequent sessions.

SATURDAY MORNING: BOULDER REDUCTION

The first session got off to a late start. Navodne (Rod) Reiner arrived early to help out by talking to the visitors and inviting some of them to try their hand at flintknapping until the knap-in officiallly started. The guest stoneworkers included Gene Titmus, Jeff Flenniken, John Fagan, Bob Patten, Betty Goerke, J.B. Sollberger, and Errett Callahan. Don Crabtree was scheduled to come but a sudden illness prevented his attendance. Local knappers included Rod Reiner, Steve Carter and Bob Turrill, all from San Diego, Calif.

A crowd of about a hundred people was on hand to observe the event, many being archeologists from California and other western states. After the introductions and warnings about flying glass by the writer, Errett offered a brief synopsis of his background in the field of developing experimental sites in Virginia and Demnark. He spoke of the necessity of keeping records of what was done and the material left behind:

> "When we do flintknapping and we do not make records of it there on the spot and supply records to the state authorities, then we could get into ethical problems. Of course this could lead to confusion with the archeological record, and this has created some tension with archeologists in the past. This is what we want to try to alleviate by going about this in a sort of scientific manner, which involves, if nothing else, record keeping."

The boulder reduction session focused on a 300-pound boulder of obsidian Rod had collected a few years before near Burns, Oregon. The guest knappers looked it over, assessing the best ways to break into it. The boulder was then set on a mound of dirt (Figure 2) to help stabilize and cushion it as well as to dampen the shock of the percussion blows. With Jeff sitting on top of the boulder (protected, somewhat, by a buckskin), Gene

Figure 2. The 300-pound obsidian boulder resting on a mound of dirt.

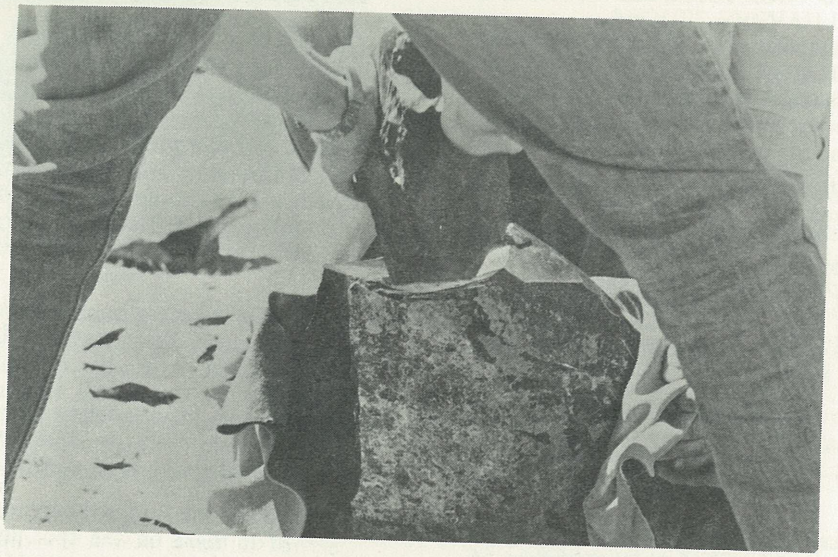

Figure 3a. Jeff Flenniken delivering a blow with a basalt maul. (Photo: F. Budinger).

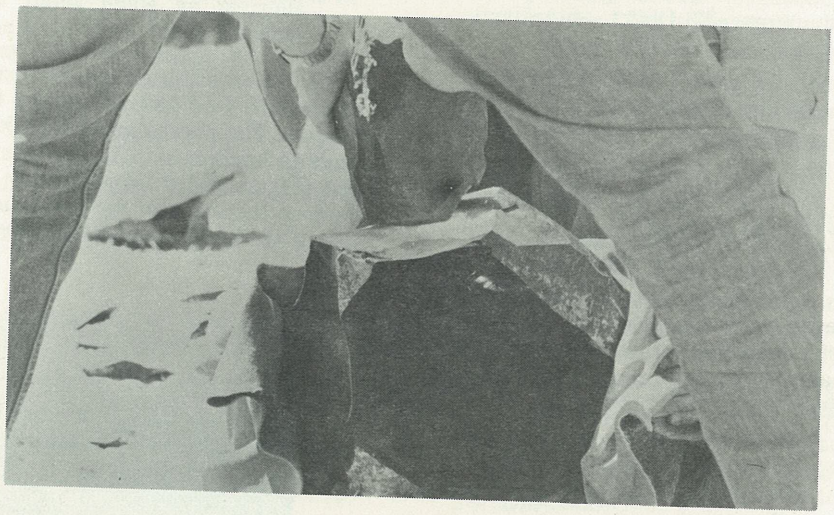

Figure 3b. And the result. (Photo: F. Budinger)

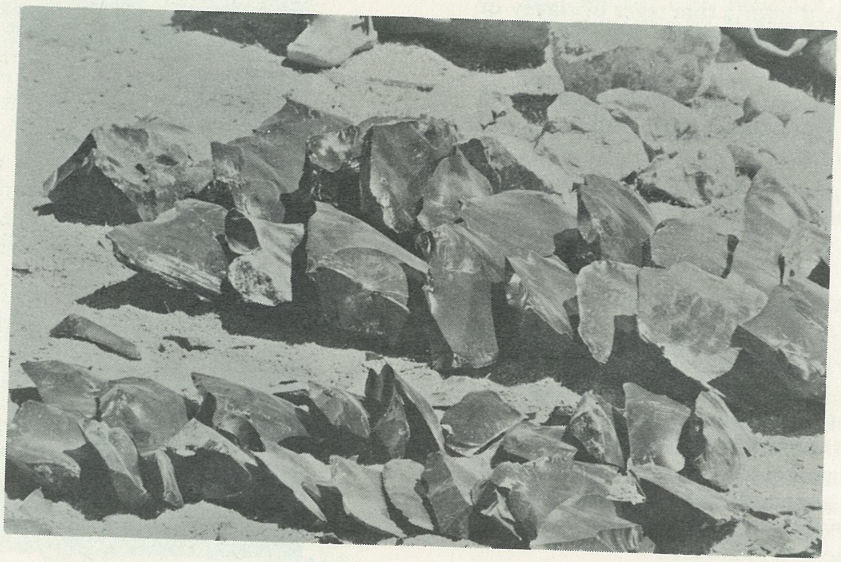

Figure 4. The plates produced during the boulder reduction session. (Photo: F. Budinger)

provided a brilliant display of knocking off large cortical flakes (plates) up to 45cm long. After a while, he and Jeff traded places. (In Figures 3A and 3b, Jeff is shown removing a large plate.) Later Errett, Solly, Bob, and John tried their hands at it.

To further emphasize the mastery of these knappers, it is important to note that only mauls of quartzite and basalt were at their disposal instead of preferred softer stone, which was unavailable.

From the removal of the first plate to the close of the session, the spectators were buzzing. Many had never witnessed such an exhibition (the writer included). At the end of the session, 45 plates were lying on the ground alongside the core remnant (Fig. 4): 20 massive plates (20-45cm), 25 medium-to-large plates (15-20cm) and a 35cm core remnant.

After the session, several questions were asked by the visitors. One question related to early man boulder reduction systems, to which Errett responded. Briefly, he stated there are probably many early techniques that are still unknown or that have yet to be fully investigated, such as the varieties of techniques utilizing fire. Then he related an observation (more or less an aside) he had made while working in Denmark:

> "If you take a beginner who hasn't done any flintknapping and give him a core and say 'go to work', you'll end up with gravel; you won't get any plates like the ones here. Over in Denmark, at the end of the day when the adults left and the children, who had never had any instruction, came and worked, inevitably they would pick up a piece, put in on an anvil and seek to destroy it. Always this anvil stuff, almost as if it is genetically programmed."

SATURDAY AFTERNOON: FLUTING AND BIFACIAL THINNING SESSION

After lunch, we cordoned off another section of the knap-in site in which the second session could be staged. Errett had suggested that all of the participants space themselves so that the by-products of each man's work would not overlap with another's. This was meant to provide some experimental control. The participants were asked to limit their techniques to those representative of bifacial thinning and Clovis/Folsom productive systems. In this way, the tools -- broken and whole -- and the refuse would in turn be representative of the techniques and ends which were the focus of this session.

The session began with Errett offering an overview of the multitude of techniques by which channel flakes can be removed from bifaces. Included in his discussion were techniques involving direct percussion and indirect percussion, pressure, many variations of lineal edge and tip support, and lever devices.

J.B. Sollberger had brought a number of Folsom preforms to be fluted with his newest lever flaking device, and was asked to describe and demonstrate it.

Figure 5a. Solly discussing the lever fluting device as Betty Goerke looks on. (Photo: F. Budinger)

Solly:

> "What I have here is my latest experimental device. The main clamp and membrane are tied together with little notches cut in each side of the clamp to immobilize the preform (Fig. 5a). To reduce the harshness of the clamping device, there are strips of leather in the grooves so that the leather grips the lineal edges of the preform instead of the wood. This dampens out any strong contact forces or "spot" areas.
>
> To prevent the flute from overshot or end-snip – that is, the flute flake comes down some length and then turns in taking the whole end of the preform off – you must have some sort of tip support to prevent the tip of the point from bending back as the flute flake comes off. You can reduce overshot by tying the tip support so that it is an integral part of your clamp. And to insure you do not have any movement when it is under fluting stress, you inlet a little round limb or peg in the tip support board as well as the clamping device. In this way the tip support cannot move forward or backward. As the force pulls the flute flake off, the preform is absolutely immobile.
>
> The only other problem, then, is hoping you use the right amount of down and outward force that will fit the particular preform.
>
> I wanted to experiment with leverage because I thought it may have had potential usage in the prehistoric. This is about my umpteenth type of leverage device that I've adapted to blade-making and bifacing of arrowpoints, darts and spears. It's useful as a fluting device also.
>
> A deer antler tied to a limb is placed through the opening in the lever. About half way down the limb is a notch which hooks onto the lever, while the lever is notched at the end and placed under the tip-support board (Fig. 5b)."

Figure 5b. Setting it up. (Photo: F. Budinger)

The clamp was stabilized between the chair and Solly's leg. With the antler tine placed on the channel flake platform and the limb hooked onto the lever, a gradual amount of pressure is built up by applying weight to the lever (Fig. 5c).

Jeff asked about the success rate of this technique – that is, those points fitting the actual Folsom dimensions. Solly said he did not have any control data from his results yet, but felt it was near 75% to 80%.

Gene Titmus brought a vise used for holding the preform in place during the removal of the channel flake. Figure 6 shows Jeff applying indirect percussion to a point he had just made. Gene knelt on the back of the vise to stabilize it. When the vise was being set up, Jeff jokingly said, "Boy, this (the vise and punch) has got all the abo stuff -- radiator hose, clamp, copper punch, wing nuts." Earlier, Jeff had been asked if he thought the Indians had used vises. He replied, "No. What I'm saying is, I don't think they used them. I think they were holding

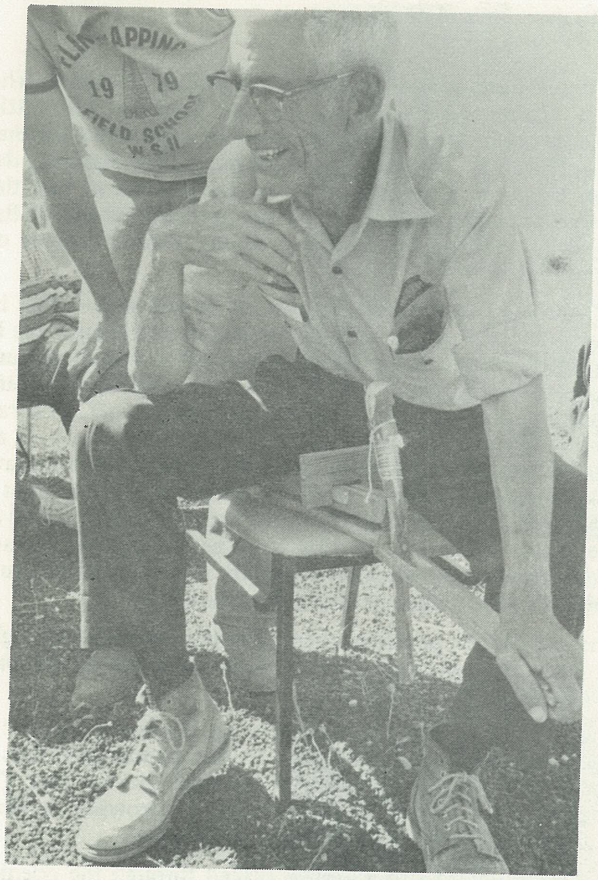

Figure 5c. The lever device in action. (Photo: F. Budinger)

them in the hand; the person who's holding it, though, knows just as much about the technology as the one doing it. The vise serves as a pair of hands; that's all it is."

Jeff had only prepared the face to be fluted. It was pressure flaked to enhance the possibility of even release of the channel flake. After the flute was produced, Jeff told the visitors that the other face had not been set up "so that in case the first flute was screwed up, or assymetrical, or whatever, then you can re-orient your point, which they did sometimes 180 degrees"

Next, Bob Patten demonstrated hand-held direct percussion with lineal edge support. After beveling the flute's platform, the preform is tightly gripped around the lineal edges with a folded piece of leather. A sharp, precise blow is then delivered by an antler billet (Fig. 7).

Errett showed us examples of his Clovis replicas hafted to different types of foreshafts. He then demonstrated three techniques of fluting. The first two utilized a sort of hand vise constructed out of a U-shaped or, rather, forked limb. The preform was placed horizontally between the two limbs, the tip lodged against an antler block set near the crotch of the limb to prevent end-shock. The limbs were then squeezed against the lineal edges of the preform by tying leather strips around them. (Figures 8a and 8b illustrate the use of this hand vise during percussion flaking and pressure flaking.)

Then with the help of Gene's vise, Errett introduced his "sitting" technique. A T-shaped crutch tipped with copper was placed on the basal platform of a preform gripped in the vise. He sat on the crutch with both hands underneath him holding the middle part of the crutch. With his hands controlling the gradual build of his weight, he was also able to direct the path of the forces. When enough "in" (or rather "down") force had been generated, he jerked the pole forward to produce the "out" force. Though novel, this technique produced admirable results.

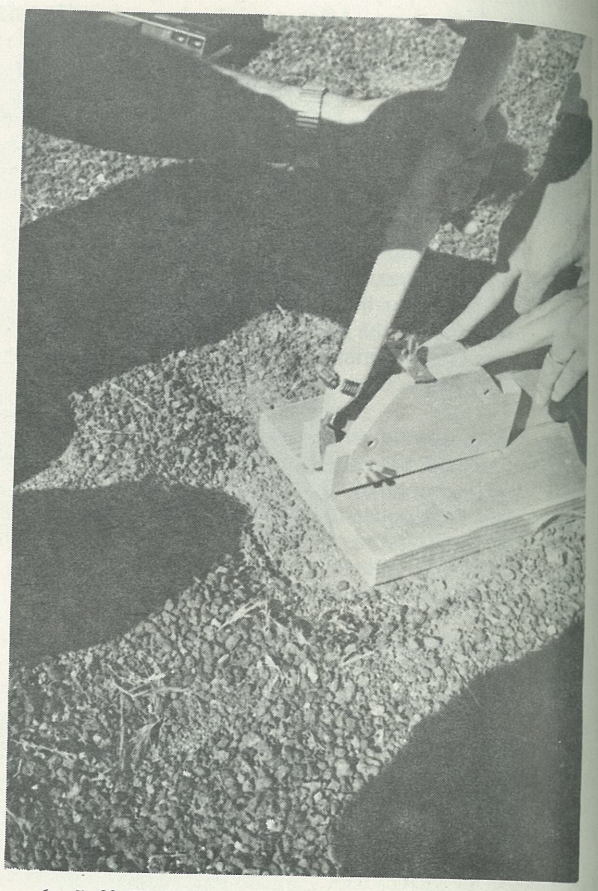

Figure 6. Jeff Flenniken using Gene's vise to flute a point via indirect percussion.

John Fagan (Fig. 10) produced a Clovis point that suffered an overshot on the second flute. He was careful to leave all the debitage in place and not add any further refuse to that specific station. Thus, John left behind for future study the debris of Clovis production from an obsidian plate down to the second flute, along with the point and his records, which were both collected.

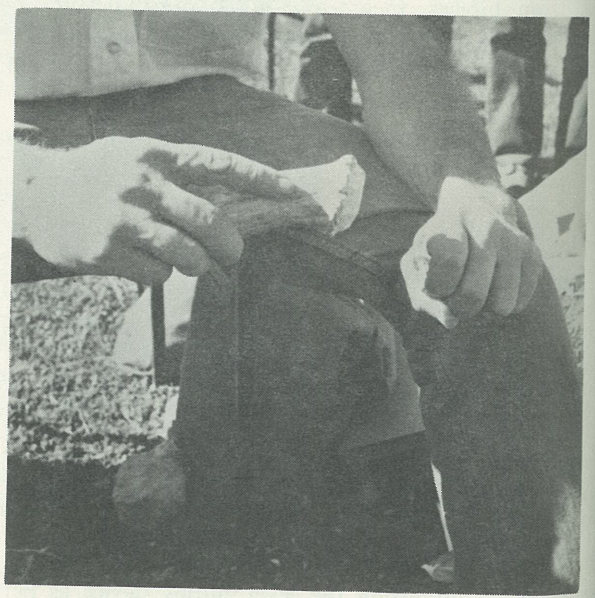

Figure 7. Bob Patten about to remove a channel flake.

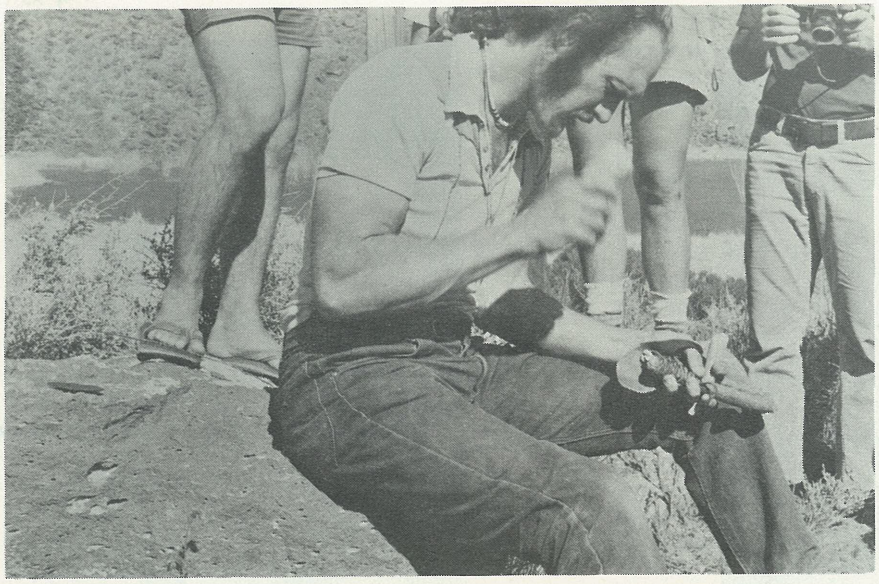

Figure 8a. Errett fluting a point held in his forked limb vise by direct percussion. (Photo: F. Budinger)

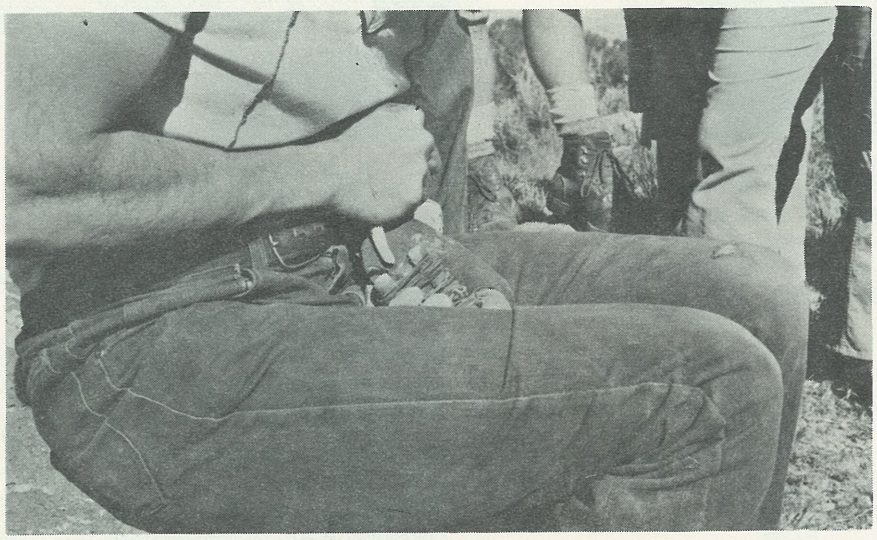

Figure 8b. Using the same vise, Errett pressures off a channel flake from another point with a shoulder crutch. (Photo: F. Budinger)

TOOL REPLICATION SHEET
Lejre/PRC 80

Name Errett Callahan — Sheet No. 1.

Unit No.	Date	Type	Material	Tools Used	Techniques	Manu. Time	Qual-ity	Size	Value	Signed?	Disposition	Form
80EC 13L	19AP80	Folsom-like point	Georgetown flint, Williamson County, Tx. Grade: 3.0	Heavy moose billet, tine flaker, antler tine stop, forked stick	Direct percussion 70%, Pressure 30% Fluted by direct percussion in forked stick w/ tip support.	1 hr.	3-4 poor thick	7.25 x 3.1 x .6	—	(ink)	Little Lake Duck Club	
80EC 14L	19AP80	Clovis point	Leona chert, Bell County, Tx. Grade: 4.0	" "	" "	1 hr.	5 broke	11.1 x 4.3 x .8 - 1.0	—	(ink)	"	

Figure 9. Errett's record sheet.

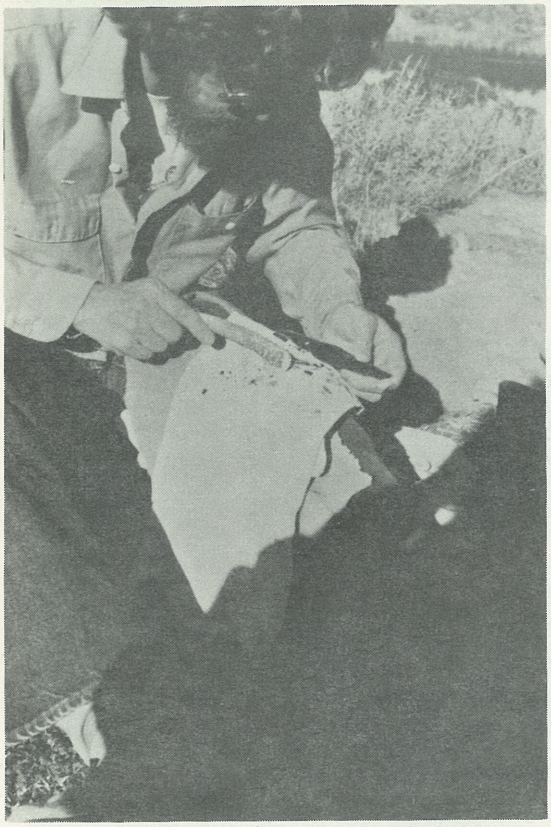

Figure 10. John Fagan working on a Clovis point.

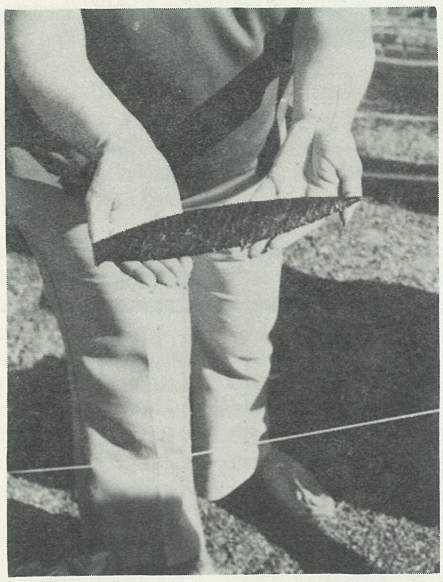

Figure 11. An obsidian "dagger" by Jeff Flenniken.

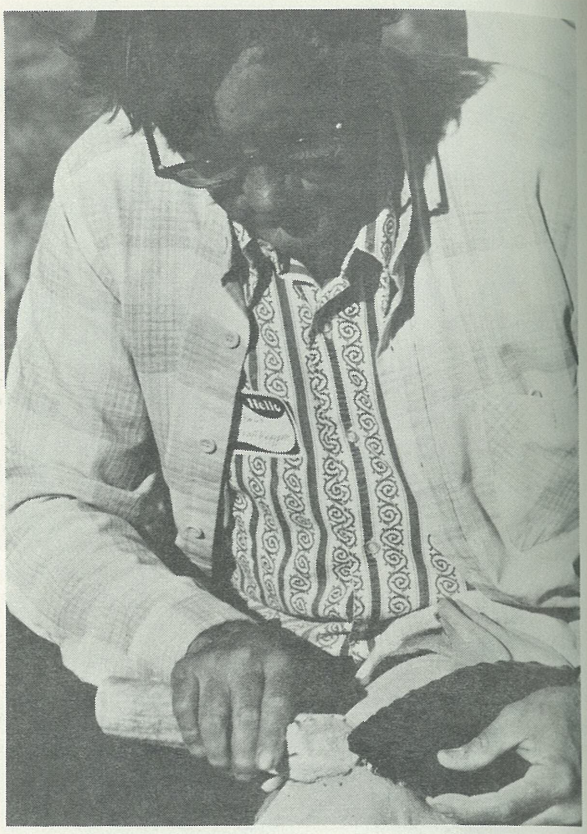

Figure 12. Gene Titmus bifacing one of the larger obsidian plates. (Photo: F. Budinger)

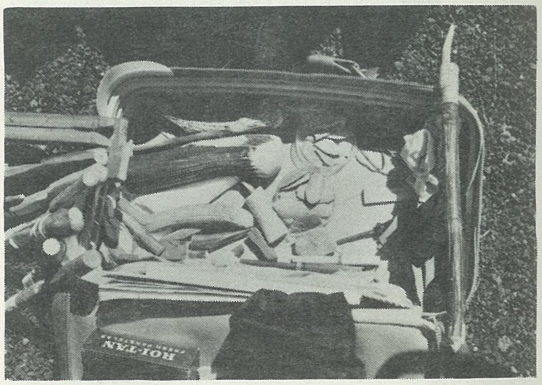

Figure 13a. Solly's tool kit.

Figure 13b. Errett's tool kit.

SATURDAY EVENING

It was planned to have informal discussions that night after dinner at the Little Lake Hotel. However, the management had arranged an anniversary party for the owner and his wife, so most of the group either moved outside or joined the party. Many topics were covered that night but unfortunately were not recorded.

SUNDAY MORNING EARLY MAN TECHNOLOGY/ CALICO SESSION

The next morning, the guest flintknappers were asked to evaluate about 200 specimens collected from the Calico Early Man Site located near Barstow, California. They were brought by Clay Singer, who has been studying the collections for several years. Since the wind was blowing pretty hard that morning, the specimens were laid out inside the boathouse (Fig. 1, background). About an hour was spent by the knappers looking them over and discussing the nature of their depositional context (Fig. 14). Afterwards, each was asked to offer his or her opinion of the Calico samples.

John Fagan:

"After examining the archeological specimens from the Calico site and experimenting with the raw material from the area, it was my feeling that much of the collection consisted of items which had been flaked by natural processes. Several specimens exhibited flake scars common on thermally fractured stone and resembled starch fractures and pot-lid spalls. These particular flake scar patterns could not be reproduced by the knapper and were considered to be natural. Many specimens exhibited flake scars with bulbs of percussion which could be reproduced by the knapper. However, percussion flakes can occur in many natural situations, particularly where there is substantial movement of geological deposits which contain flakable stone. Patterns in the flakes suggesting human selection and activity were also lacking. The presence of several large flakes and battered flakes in the collection, all of which can occur under natural conditions, cannot be used to conclude that humans had been involved in their production. Therefore, since geological information indicates that the Calico site has undergone considerable mass movement, and since there is a lack of patterning in the flakes and flake scars, it is reasonable to suggest that geological forces and not humans were responsible for the production of the Calico "artifacts"."

Gene Titmus:

"Well, I have the same opinion. Most of it could have been produced naturally or by man. There's not enough there to say that man did this or he didn't. There's starch fractures in there that occur naturally. Some of the flakes in there can occur just as if we produced them, with different pressures and all that. There's not enough evidence to say yes, no, or otherwise."

J.B. Sollberger:

"To me, I see about two or three problems. One is the character of the stone itself; the way it breaks is not smooth and sharp of the nature of stone that man usually selects to make tools out of. Now if this was a case of "have to" – that is they had to use this stone – and they lacked a formal tool typology, then there are a number of these items which we can say are possible tools. But considering the stone and the fact no formal tools can be positively recognized, the ones that seem to be tools could have been produced by nature or they could have been produced by man. The sum of all these questions – the lack of formal typology, the nature of the stone – if they had a formal typology it seems unreasonable to me they would have carried away all of the formal tools and left only the debitage and wreckage of stone.

If we look at it from another standpoint of cultural level and assume we have some people so far back in time that they had yet to develop formal tool typologies, this might add further unresolved questions. To be serious about that approach, I feel like we need to find a man that we can associate such a low typological tool kit with. We have to find a man of that low cultural status to put with the tool kit. Normally in later periods, you find a tool kit that is sophisticated, varied, and has a high technology, and you don't need the man to prove that it's man-made. However, these tools here seem to need proof of the presence of man. But I wouldn't close the book in my mind on it until I'd had a lot more experience with the material and some conception of the tool requirements of the man who may have made those things."

Jeff Flenniken:

"In teaching introductory flintknapping classes for the past five or six years now to people without any background in flintknapping at all, I've never seen anything like this created. I think it's natural. Talking about specifics in terms of technology and physical attributes, there are no contact

Figure 14. Bob, Clay Singer (with cap), John, and Jeff discussing the Calico specimens in the boathouse. (Photo: F. Budinger)

points, no ring cracks, no bulbs of force (positive or negative), and no prepared platforms. There was one piece in there that did have a positive bulb on it, that I have seen numerous times, to make an analogy, in Arkansas at the novaculite quarries. There are thousands of quarries there that were exploited aboriginally and also quarries exploited commercially that the Indians did not have access to. The Arkansas wetstone is produced there. And when they chop off these blocks and they go rolling down the hill, there's all kinds of debitage created in the colluvial situation which is very much like – from what I understand, having never been there – the Calico Hills. You get very well-developed cones periodically from rocks rolling down hills. When one rock rolls into another rock which has a flat surface and creates a cone, it's the same thing as direct freehand percussion. You don't even get a whole lot of that. There seems to be a discrepancy among people here as to just how far things have been transported. But I think just about everybody I've talked to in terms of Calico Hills, there has been some transportation of lithic material – either by water or by gravity pulling it downhill. So when you put all these factors together, I don't think they're artifacts.

The next factor that Solly talked about briefly, you're looking for someone 100-to 150-thousand years old. And if you want to look to the Old World, these people were doing sophisticated things. They're not just walking around bashing on rocks hoping like hell something comes out.

Like I said, I've never been to the site. Prior to this I'd only seen half a dozen or so pieces of rock that had come from the site. I have conducted a lot of experiments with edge damage created naturally as well as human induced by your feet - walking over stuff or a number of things. These edges are fragile. If you've got transportation by nature, they're going to get dinged up. Gene brought up the suggestion that there's no continuity throughout the material in terms of technology or morphology. They tell us in cultural anthropology that human behavior is patterned, and people have argued about that over and over again. And even given the limitations of unskilled people, there's still patterns to things. It's not there.

So that's my opinion in five minutes of looking at rocks I've never seen before. And I'm not familiar with the physical properties of the material. But I would venture to guess they are not artifacts, not humanly induced."

Errett Callahan:

"Well I have visited the site several times when I lived down in Riverside. And I was much more convinced that these were artifacts then than I am now. I think because before I was looking at a lot of material that was coming off the surface which were indisputably artifacts. The other materials buried deep down inside are another story all together. This is the first time I've seen all of that together without mixture of the two.

I have to agree with Jeff pretty much down the line, but I would look at it somewhat differently than what he and Solly are doing. I break the tools down into two different types of flake removals: there's the force that created the flake, the unit itself, as it was removed from the larger piece or split off from an equal sized rock; and there's the force that removes the little pieces from the edges. These forces did not have to occur at the same time. Just like these we are making now – they could have been knocked off thousands of years ago geologically and then man, or woman, could have come along and thought it was a good piece for cutting and used it for cutting. The damage on the edge, whether made by man or nature, could have occurred at different times than the initial fracture. On the edge damage I do see bulbs of percussion and other features whereas I might not see it on some of the large lithic units themselves. But what I saw as identifiable flake scars could have been produced by ways that modern knappers know about - all of which can be duplicated by nature. To discern whether they were made by cultural forces or natural forces is another thing altogether. It is extremely difficult to read in this case because the edges have been damaged so much. All of the things I saw, with one exception, could have been done by natural forces.

Then there are other kinds of forces which could have created the flake itself, and there are many of those that could not be produced by any method I know. They could have involved heat or millions of pounds of pressure, things we cannot replicate. I don't see any patterns there.

As far as the "forms" are concerned that Solly was talking about, I look more at the edge than I do the form, i.e., whether it's a triangle, end scraper, a graver, or something like that. It is less significant to me to look at the form than the functional portion being used, whether it be used for cutting, slicing, mincing, dicing, or whatever activities they needed to perform. You would tend to see a pattern along the edge, for instance, if the edge indeed was the part of the tool that was used, whereas you may not see any pattern to the outline of the form. The form of a tool generally, we would assume, would be a response to the needs of that particular environment. I can very easily assume that we're going to have what might be called "crude" forms in this particular environment here, while the same people may have been making "refined" tools several thousands of years before in Asia, that is if these particular tool forms made them better adapted to this specific environment and their sets of needs.

Nevertheless, given that fact where I am looking solely at the working edge – chopping, scraping, piercing, etc. –, I would expect to see certain patterns I did not see in there. For instance, we can break things down into bifacial implements and unifacial implements. Unifacial implements are among the easiest things that can be naturally made. A person walking on a flake can do it, elephants can do it, rocks tumbling down a hill can do it – there are many possible ways to produce this type of flaking.

Now about bifacial implements. What you have seen us doing over the past couple of days is that equal numbers of flakes may be taken from this edge as from the other edge. The spacing of the flakes is going to be regular, there's going to be some sort of pattern. Well, they weren't necessarily after these straight line edges, but what you do not expect to see is a series of flakes taken from one face, another series of flakes taken from another face, and then switched back to the former face again – as would happen if the rock was caught in a series of floods or otherwise exposed to another natural forces. Or if they were reducing bifacially, what I tended to see in there was a large flake taken off here and a couple of small ones and another large one up there. In other words, the variation in the size of the flakes along the edge was considerable. With cultural items I tend to see more uniformity in which one flake scar replicates itself right across the board in a uniform fashion. Now that should hold true to various degrees whether you are working with the fine parallel flakes, like on the dagger you saw Jeff making yesterday, or you are working with a hand-axe with large scooped-out flakes. You would expect to find that the flake scars which are on one face of a hand axe would replicate themselves on the other face. I did not see this kind of pattern. The patterns I saw were "non-patterns"

Most of what I saw could have been done naturally, with the exception of one piece that looked like a burin. But it is possible, too, that this could have been done naturally."

Bob Patten:

"I think Errett's got the right approach there. If you look at the stress lines of the artifacts, you find that there's no organization that is apparent. If the aboriginal people were breaking these rocks to begin with, there should be some

kind of organization because of the rock and the available edges. Just the morphology of the parent stone should have created some kind of a patterning to the stress lines on the resulting flake. But you don't see that. It's more like what you find out if you'd develop the fracture lines that are already existing in the rock and pull them off, you'd have something that looks a lot like the specimens being called artifacts. But then you can take that same flake and trap it between two rocks and you get that same kind of flaking that is off the vulnerable edge. It's rare that you see a flake out there off an edge that is not vulnerable to that kind of trapping action between rocks. I think that the natural ways these fractures can be produced must be examined much more closely before we try to link it to man. You are going to have to look at both sides of the equation; you cannot just ignore one. And I think the case is still open and will remain open for quite some time."

Betty Goerke:

"Well I was interested just in blades. Some of the blades looked like they could have been done by man, or by woman, only, I think, if the bipolar method was utilized because there were not any bulbs of force; the bulb of force was diffuse. So I see many replicative experiments with the raw material that you find at Calico might be profitable."

After the knappers had investigated the specimens inside the boathouse (but before the above comments were stated), I had asked them if we could attempt during the next session to duplicate the forms they had just looked at. Most responded that they did not know how to produce, or rather reproduce, these forms given; they appeared to be the results of natural forces. Thus the experimental session designed by Clay Singer came to naught. This point will be dealt with later in the report.

With the conclusion of the statements concerning the Calico specimens, we proceeded to develop the third and last subsite of the Little Lake experimental workshop. About 100 pounds of chalcedony blocks and small boulders were brought in from the vicinity of the Calico Early Man Site and served as the raw material during the session. The knappers were asked to experiment with early technologies, i.e., pre-bifacial thinning techniques, and to use medium to hard hammerstones. The participants were again asked to separate themselves so their workshop refuse would not overlap. John Fagan utilized a variety of techniques, including the use of a lap anvil rest. He produced large flakes and rough preforms which could be taken down into hand-axes or bifaces. Bob Patten produced a hand-axe, leaving it behind in the refuse pile generated from the reduction, along with the hammerstones he used (Fig. 18). Errett experimented with the material to see how it broke and, among other things, left behind a Levallois blade, its core, and the resulting debitage (Fig. 19).

During the session, Solly and Jeff had a discussion concerning bipolar flaking and several aspects of the nature of lithic fracture. It is to be regretted that the whole discourse was not captured on tape, but a portion will give the reader some insight into the type of discussions carried out when master stoneworkers from different traditions get together and talk. As previously mentioned, the discussion started off concerning bipolar flaking which both Jeff and Solly have investigated separately. (Fig. 15).

Jeff:

So, what I have done is to take into consideration the human approach - my approach, Don's approach. I'm not a physicist, neither are Don, Gene, or the other people around. But then you talk to somebody who is, like Are Tsirk who has a Ph.D. in Structural Engineering. He's about to finish his Ph.D. in the Mechanics of Flintknapping. Are knows what is going on. He can sit down with words this big (he spreads his hands apart) and tell you why a flake comes off. Not that I understand it, but he knows what he's talking about – strains, stresses, bends, and all these kinds of things.

A term that frequently comes up in Crabtree's discussions is "shearing". And there's all kinds of confusions about it. Well, when I checked Don's ideas of what shearing is, went over and talked to people in mechanics and got their ideas of what shearing for metal and other materials is, and got Are Tsirk's ideas both from engineering and flintknapping on what shearing is, it's amazing how it all came out the same. Not bipolar. But yet shearing is a major activity within a bipolar technique.

Most people think of bipolar – you put the core on the anvil, smash it, and pick up all the good pieces. This is true. But bipolar is also taking that maul and hitting the core a number of times. If it travels all the way down and meets the other cone, it's bipolar, where you've got forces like this. If it [the flake] terminates out right there [above the distal point of contact with the anvil], like most of them do, it shears; it never hits the anvil. That's Physics, continuum mechanics, engineering, plus a touch of all the people who

Figure 15. Jeff and Solly during their discussion Sunday morning. (Photo: F. Budinger)

are doing it – all thrown into one big recipe, stirred up, and that's what came out at the end.

Solly:
Well, there's several little details that don't get in print. Let's say, assume no fracture exists here and we strike here at a good platform. We initiate a ring crack, a bulb of force which is converted into a planer fracture, and we come off down here with what we call a plate. Now, when we apply the force up here, we cause the particle compression starting in some corner of a cone, or bulb, or whatever you want to call it...

Jeff:
Tensile stress.

Solly:
All right. That volume is depressed.

Jeff:
Exactly.

Solly:
Maybe a hundred-thousandths of an inch or less. And as it depresses, you initiate a void at the top. You can't continue or control the fracture without opening a void between the flake and the mass.

Jeff:
It's the crack.

Solly:
Well it's a crack, but it's a void in another word. The crack has void. It has space in between. You're depressing the flake volume in a shear force, you're opening it in a tensional force, and you're guiding it with the compression in particles in the flake below the fracture crack tip front. The amount of pull that you pull out determines the curvature and the length of the flake. Now you can have a flake that twists and hinges left from the right edge. You can have it twist down and out on the opposite edge. The force features show this on the better grades of flint and chert, and probably on obsidian to such a degree that it gets confusing.

Jeff:
If you get compression rings that are well prounced and it is flat, then it's probably bipolar.

(The next twenty seconds or so of this dialogue were muffled by people walking near the microphone.)

Solly:
All right. Now explain that crinkle and crunch.

Jeff:
The flake is probably breaking....

Solly:
First, it's over time, isn't it? It's not instant.

Jeff:
Well, we're talking about a fraction of a second. Yes, it does happen over time.

Solly:
Say about 1250th of a second.

Jeff:
Something like that.

Solly:
Every one of those little crunches forms a force line, doesn't it?

Jeff:
What about pressure blades?

Solly:
They're there.

Jeff:
No, I'm talking about the bending.

Solly:
Same thing. It's got to bend. It's either got to be pulled away at the platform or buckle outward.

Jeff:
I don't think so. I don't think it has to bend.

(Photo: F. Budinger).

Solly:
Well you say it is pure shear then. What you are saying then is that you don't even have to have tension.

Jeff:
No, I'm saying that ...

Solly:
Well you can't have tension fracture without an opening.

Jeff:
If you have tension then you've got compression. You can't have one without the other. If the flake bends, it's compression on one side and tension on the other.

Solly:
That's correct. But the top half has more pressure.

Jeff:
And what you are saying is that it's still attached at the bottom, so when you're pushing down, it's bending.

Solly:
Right.

Jeff:
I'll agree with that. For a portion of time, however short it is, if you push down it is going to have to bend at the top before it's freed at the bottom. That's a fact. I'll agree with you there. All right, let's go from there.

The discussion continued a while longer. Gene joined in, adding that it seemed Solly and Jeff were talking about the same thing but that their terminologies were different.

Noon was approaching fast and several of the knappers -- Jeff, Solly, Betty, and Bob -- had to prepare for the long trip back to LAX to catch their respective flights home.

After lunch, we had an open session. Visitors talked informally to the knappers and some tried breaking some rock themselves. Errett and Gene worked together, discussing salient points of pressure flaking, among other things. John worked on one of the larger obsidian plates. Rod Reiner finished his project of making an obsidian knife and hafting it to a wooden handle (Fig. 16). Rod had also brought some of his atlatls and demonstrated their use to the visitors.

At 4:00 p.m. the Little Lake Knap-in was officially over, and the property was "given" back to the Duck Club, who had so generously allowed us to stage the event in this very beautiful spot on the earth.

****

"CA – INY – 1600"

Little Lake is today a spring-fed lake. During the Pleistocene and early Holocene, it was part of the Owen's River System which flowed through Little Lake, Lake China, Lake Searles, Lake Panamint, emptying into Lake Manly (today known as Death Valley). A great deal of attention has been given to the Little Lake region by archeologists over the past 35 years because of its wealth of prehistoric cultural resources covering a known span of 5,000 years. Extensive petroglyph sites covering the age of the atlatl to that of the bow and arrow can be found here and support the feeling you have as you walk around, that this was, and is, a "special" place.

We had decided to register the knap-in site with the state archeological authorities so it could never be confused with the multitude of prehistoric sites in the area. Bill Sidell, a California State Historical Preservation Officer, was contacted and asked about registration of an experimental site. He informed me this was the first time he had ever been asked the question, since no experimental site had ever been registered in California. It was decided to record the site as one would other archeological sites. Further, it was decided that the knap-in be staged in an area that would not contaminate the prehistoric cultural resources which could confuse future investigators.

The choice of the knap-in site was the southern end of a small knoll located near the northern shore of the lake (Fig. 1). According to Dr. Richard Neuman, a long-time member of the duck club, this portion of the knoll along with the entire northwestern shore region of the lake was once a public campground run and owned by William Bramlette. During this time the campers could fish, row boats, hold picnics, and have barbeques. The southern end of the knoll had been a playground for the children upon which swingsets and other things to occupy their attention had been placed. It was during this "campground era" that the boulders covering the knoll's surface were moved to the top of the knoll and the surface graded and flattened by bulldozers. Cinders from Red Hill, a prominent cinder cone north of the lake, were then brought in and laid down on the graded surface. Another, though minor, impact to this knoll was the construction of a powerline supplying the boathouse with electricity in which several of the poles supporting the powerline were placed along the ridge of the southern portion of the knoll.

In 1974 a fault opened up in the southern end of the lake, threatening to drain the small quantity of water it contained. In their attempts to prevent this, the duck club members brought in heavy drilling equipment to drill for water and pump it back into the lake. This operation took place on the southern reaches of the knoll, north of the boathouse, where the pump still stands testifying to the near disaster averted by the duck club.

The coverage of the intrusive cinders over most of the experimental site will serve as a stratigraphic separation of any prehistoric materials, if indeed any have been buried beneath the surface of the neo-archeological workshop. In the event this site is buried in the future, this "strata" of cinders will serve the same purpose -- however, burial of this site will probably not occur until a large scale pluvial/glacial episode occurs this region again.

The lithic materials that were reduced during the knap-in were all non-local varieties. One chunk of Panamint basalt (used as a maul, see Fig. 3a & b) and lithic materials from the Calico Hills are the closest representatives, geographically speaking, and neither source has been represented nor reported among the Little Lake sites as far as I know. Below is a list of the lithic materials deposited on the knap-in workshop site at Little Lake.

Basalt: Panamint Valley, CA
Calcedony: Calico Hills, CA
Basalt: Calico Hills, CA
Felsite: San Diego, CA
Quartzite: San Diego, CA
Quartz: San Diego, CA
Mahogany Obsidian: Davis Creek, CA
Black Obsidian: Burns, Oregon
Mahogany Obsidian: Burns, Oregon
Brown Chert (heat treated), Battle Mtn., Nevada
Bluish-white chert: Battle Mtn., Nevada
Ignimbrite: Idaho
Flint (two varieties): Lake Belton, Texas
Flint: Fort Hood, Texas
Flint: Georgetown, Texas
Quartzite: Virginia

Fig 17 shows the activity areas within the site and the flaking stations. Area C contains several antler fragments in the northeast sector and some pieces of wood from Rod's knife handle production. The foreground of Figure 1 features the boulder reduction area and what is left of the 45 plates produced during the Saturday morning session.

A site report was submitted to Daniel McCarthy of the Archeological Research Unit on the campus of the University of California at Riverside. Mr. McCarthy listed this site under the category "Historic" and assigned it a number, CA–Iny–1600. So the site is officially registered in the State of California.

REFLECTIONS

This part of the report is dedicated to the saying, "Hindsight is always 20 x 20". That is, several problems came up during the course of events and ought to be discussed.

First of all, it was clearly evident that time would not allow us to complete all that had been proposed in the format. Each session deserved a much longer period to be covered thoroughly -- preferably, at least a day (if not a week!).

Secondly, the early man technology session had been designed around duplicating/replicating the Calico specimens supplied by Clay Singer in conjunction with his experimental outline published in the Spring issue of F.E. (3:1; p.6). This issue was planned to be out several weeks before the knap-in. However, circumstances prevented this and, thus, the knappers did not have a chance to examine it until they arrived at Little Lake.

After the guest flintworkers saw the specimens, they were asked how they would go about replicating them. Several responded this would be exceedingly difficult given the lack of ordered information on the pieces; that one could not arrive at any valid conclusions concerning the natural or cultural nature of the specimens, since the techniques that would have to be experimented with include those that nature can duplicate in the context of the Calico deposits.

However, Ms. Goerke's suggestion that bipolar flaking be carried out on the material from the Calico deposits ought to have been undertaken by at least some of us.

Third, if an event such as the one held at Little Lake is ever staged again, it ought to be filmed. We tried many doors, but since we had not the money to fund such a venture, the doors remained shut. It was truly a shame, given the talent and the knowledge represented among the group of stoneworkers who attended the workshop.

In relation to the establishment of a neo-archeological site, it may be best not to regard this site as a truly experimental one, but rather as an "experimental" experimental site. For this site to be regarded as an experimental one, in the full sense of the term, each flake concentration ought to have been linked to:

a. the tool, or end-product, produced;
b. the tools of production, i.e., types of hammerstones, billets, etc.;

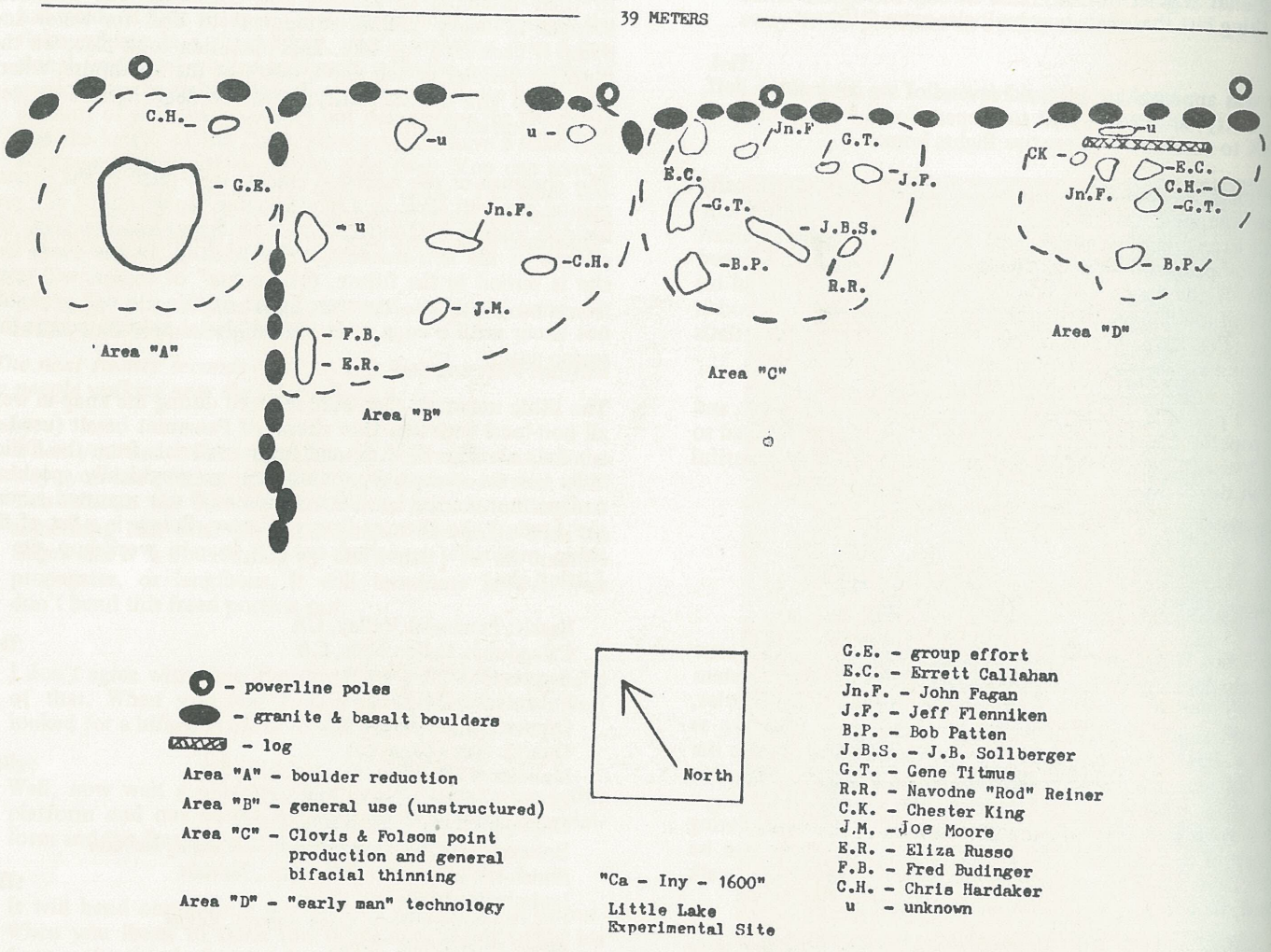

Figure 17. Map of the Little Lake knap-in site.

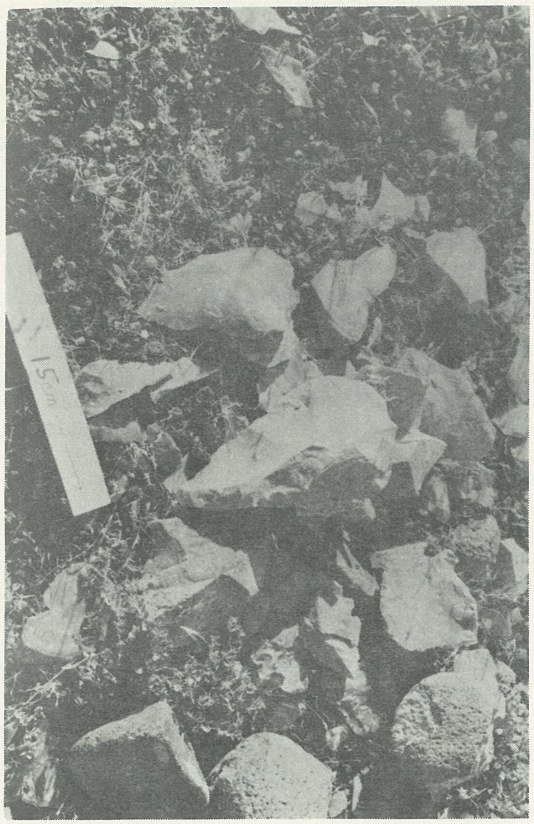

Figure 18. Bob Patten's handaxe, the refuse pile, and the hammerstones used for its manufacture.

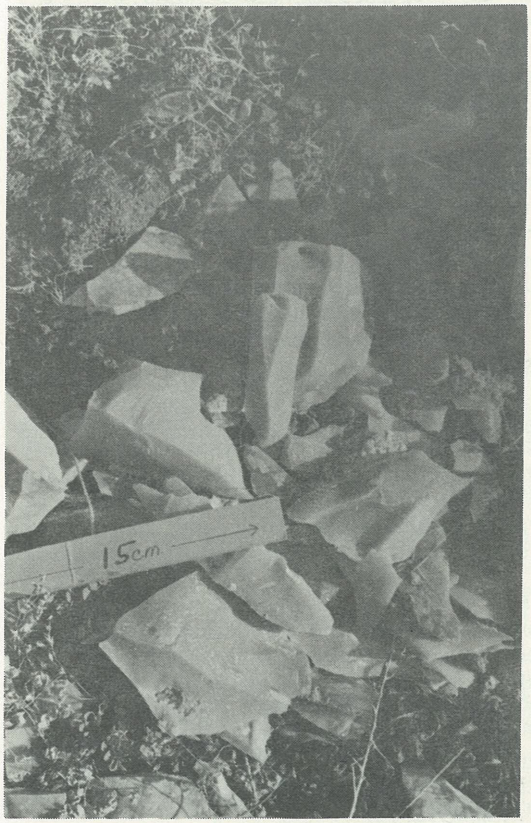

Figure 19. Errett's Levallois workshop.

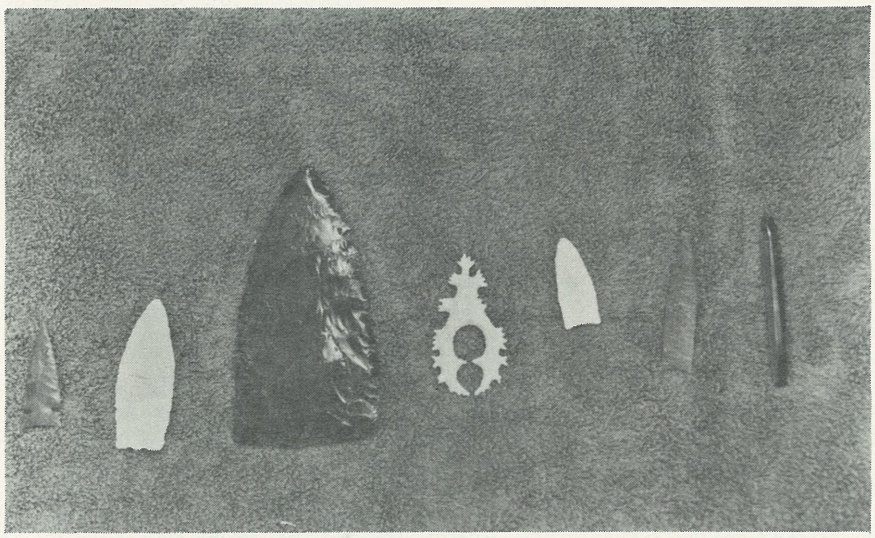

Figure 20. Several of the "artifacts" made during the knap-in.

c. the modes and techniques utilized during the development of each tool and each concentration, preferably separated for each change in technique;
d. breakdowns of time spent on each item; and
e. a photo record of the development of each concentration and each tool.

Such an aspiration was beyond all possibility in just two days. Perhaps if the entire focus of the workshop had been the development of an experimental site, we may have found ourselves closer to the mark. However, since this was also a seminar designed to introduce and inform the many visitors of a number of lithic reduction systems as well as a vehicle to bring together several of the best knappers in the country to share what they have learned and to pick each other's brains, this was impossible.

Despite its lack of *complete* documentation, the site that was generated by the activities of those two days contains a wealth of information. The activity areas did not overlap and the techniques utilized during each session are now well represented in the flake concentrations left behind, and in some instances they contain the tools (or end-products) themselves.

In looking back at the subjects covered, the number of lithic reduction systems undertaken, and the electricity and enthusiasm which accompanied the wealth of knowledge that was shared during those two days, it was really quite impressive how much was done with so little time. The guest knappers gave 110% and left no doubt they were masters of their art. Thanks to them, a neo-archeological lithic workshop has now been established in California which can be available for those interested in lithic analysis.

In closing, a vote of thanks go to the following people for making the Little Lake knap-in a success: Jacqueline Nichols, who spent many months planning and coordinating the logistics; Sue Schroeder and the volunteers who helped to manage the program; the Little Lake Duck Club for their generous support; those who came to observe and learn; and, of course, the flintworkers themselves. Finally, I am grateful to Errett for his guidance in planning the structure of the neo-archeological site, and Fred Budinger for generously supplying many of the photos used in this report.

–Chris Hardaker

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COMMENTS ON THE LITTLE LAKE KNAP-IN

1. General Observation/feelings/criticism
It was for me the highlight of my life – a pleasure long to cherish and remember. Criticism: I can only blame Father Time for allotting us only a weekend. I saw the tiredness from the logistics, planning, and just plain work that was done by Jacqueline, Chris, and the Foundation. Thanks to all of you for that effort.

2. The attempt to structure the work into sessions to explore boulder reduction, blade-making, fluting, etc., was ideal. Titmus and Flenniken did a really masterful job on that 300-pound boulder. It would have been better if time had permitted some explanations in the fracture theory on why the force was so applied, why the boulder had to be bedded solid, and why – on, on, and on.

3. Problems concerning the format
I see none – except "time" prevented full in-depth discussions.

4. Directions for future knap-ins and subject to be discussed.
That question can only be touched upon. The range is beyond any possible listing. We could well repeat the Spring of 1980 knap-in but complete the "whys" under Item 2 with answers. We should discuss someday the validity of our constructs of Clactonian, bipolar, and other flaking methods. That is, move out of generalities into being specific.

We need to tie flaking methods into fracture theory. We need a fracture theory in which we can visually read the fracture feature formations that are recorded on the two faces of each fracture. We need to ask why Callahan's Virginia Indians and my Texas Indians did a so much better job of flaking quartzite than we modern knappers are doing.

We don't need a competition, say, between Flenniken and me, to see who can make the better Folsom. We do need to find out why our best is not as refined as the Indians' best. I suspect such answers may not be so much in personal skills as they are in techniques and methods, and our lack of a common lithic fracture theory in which we can find judgements.

5. Personal observations of what occurred.
Under this item, I must ask -- What is the role or debt or obligation between specialists meeting to illuminate on scientific questions and a general attendee audience expecting a show? Personally, I love the enthusiasm and the kindred spirit of the attendee group. However, how does one efficiently mix a "show" with serious research? I would suggest we do them one at a time. That is, meetings should be all fun OR meetings should be damn serious business –– all business.

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1. My general impressions of the Knap-In were that it was successful, well planned and well organized. There was enough variation and diversity in the program to keep everyone interested and the exchange of ideas between knappers and observers was valuable. It was particularly rewarding for me to be able to meet and work with some of the best knappers from all over the country.

2. The structuring of the knap-in into sessions dealing with specific concerns and problems was extremely valuable, for this allowed us to cover a wide range of topics in a rather short time. Of particular interest to knappers in general are the methods and techniques used by other knappers. The organization and structuring of the program allowed for each individual to demonstrate particular techniques with ample time for discussion and questions.

3. The structure and organization of the program through a prepared format proved valuable and led to the success of the entire knap-in. With any meeting, however, there are numerous logistical problems that must be anticipated and solved and the people in charge of the Little Lake Knap-in did a fantastic job. This knap-in I'm sure will be used as an example for the development of future sessions.

4. I feel that future knap-ins will benefit from the example set at Little Lake, for the development of a specific program with specific problems being addressed will add both structure and economy to the meetings. Once critical topics have been covered, free time should be made available for the knappers to socialize, compare techniques and tool kits. Perhaps future knap-ins can be organized to allow for both informal, small scale meetings between knappers and formal, organized sessions between knappers and observers.

5. I was particularly interested in the treatment of individual work areas as areas for future study. I feel that this idea can be developed to an even greater extent and with the cooperation of the participants can provide a laboratory for future studies of lithic technology which could be used to investigate questions of concern to archeologists. The detailed

structuring of the flaking activities and work areas can be designed to obtain specific information for specific problems. We are producing future archeological sites of which we are in control of numerous variables and thus should be able to offer solutions to many archeological problems.

The examination and evaluation of the Calico materials and the subsequent experimentation with the raw materials from the area was a valuable use of the expertise of the modern knappers. I view this exercise as one of the ways in which the knapper can share his or her experience with others to help solve problems of concern to archeologists and hope that there will be more of this type of cooperation and sharing of information at future knap-ins.

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I believe that the event was educational and useful. It presented skilled lithic knappers to the general public in a first-hand manner. Their techniques of demonstration were satisfactory; however, they themselves often got in their own way. This also caused the observers to have their view obstructed.

I would recommend that another similar event be held perhaps annually. This event should not only be geared toward a participant/observer format but should be amended to allow all those with an interest to participate in the lithic reduction/modification process. This would make sure that the "outgroup" felt they were learning more and would eliminate some of the feelings which were expressed to me that this was nothing more than a few good-old boys swapping a few trade secrets, to the exclusion of the very interested public.

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I believe trying to structure the Little Lake Knap-in into sessions exploring different aspects of stoneworking was the right approach and should be continued in any future gatherings. What the flintknappers can contribute toward solving the problems of archaeologists is our main objective and that should be our goal along with exchanging ideas and solutions among ourselves.

We are in the infant stage in holding Knap-ins, and it will probably take several sessions before we can really make things work out to where everything comes off smoothly. At Little Lake the format was much more than we could accomplish in the short time we had. Probably only three or four different subjects should be attempted in one day - of course this would depend upon how extensively we wanted to cover them.

I also feel that the flintknappers should be allotted time to themselves to cuss and discuss different problems, discoveries, or whatever. There are usually professionals at the knap-ins who have a particular interest or problem, so maybe a time should be allowed for this type of questioning.

At Little Lake, where we had a considerable number of spectators, things got a little hard to control - mainly because of the interest of the observers. One way to control this a little better would be to have someone explain things as we are doing them, and at the end of the session show our results and allow questioning.

I have several projects I am working on that I would like to suggest for future knap-ins – the square-handled Danish dagger and the Dorset point are a couple I'm interested in at this time. Maybe we should find out some of the problems the archaeologists are having and try to include them in our format.

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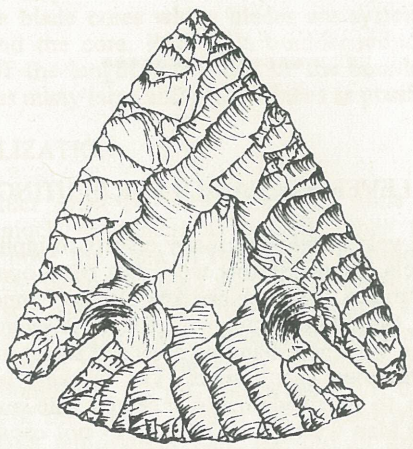
Well...I can't say that I didn't enjoy the place and relish the event. But I can say that I was very disappointed in the manner in which the knap-in was handled or staged, or whatever.

'Mad dogs and Englishmen' is what immediately comes to mind -- all those people standing around for 8 hours in the Sierra sun, and then climaxing their day with deep-greased chicken (foul). Perhaps I should review what I enjoyed most at Little Lake. The scenery was incomparable and the site was quite interesting too; the wildflowers were brilliant, and the air was refreshing.

I learned a thing or two about lithic technology and was very pleased to be able to watch some of the best stoneworkers in the nation do their thing. Unfortunately, most of their thing is making bifaces; it was like a flute-in at times, but primarily a fete de biface. If the archaeological record consisted primarily of bifaces I'd probably have nothing to say, but we all know this isn't so. The record is dominated by flakes, and that's what I went to Little Lake to study. Last July I provided an outline for part of the knap-in, but I don't believe that any of the knappers ever saw it, and there was little attempt to follow the outline that was provided to the group assembled on Saturday. Why wasn't a program and/our outline sent to participants beforehand?

From a scientific viewpoint the whole thing lacked controls. There were as many as seven different experiments happening at one time, and virtually no systematic data recovery program was evident. Nothing was quantified, nothing was measured. The experiments cannot be replicated.



Perhaps my greatest disappointment was my inability to come to grips with the situation, too much of an overload for my one ear and little brain. I had hoped to be able to sit down and bullshit wit da boys' for an hour or two, at least. So much for expectations.

This is the age of 'high' technology -- why wasn't anybody there making a videotape or a film of the knappers in action? With scenery like that for a backdrop I'm sure you could have interested someone in such a project. The article on Davey's Lake China Mammoth find was still fresh in the minds of the press and public, we should have kept them stimulated!

But what the hell, I enjoyed myself and saw many good friends. I learned much as well, and have a few nice slides too. Would you like a set? Sorry, I took nothing but mental notes. No copies available.

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I found the Little Lake gathering to provide the same benefits as at Casper although the organization differed. The really important benefits turned out to be little tidbits of information gleaned from the byplay of knappers both in formal session and after hours. With such a short time and so many topics to cover it would be something of a small miracle that a major impact could be immediately realized. Particularly the boulder reduction, but also the other sessions acted as a catalyst so that since March I have expanded the Titmus obsidian boulder reduction method to tough cherts, improved my baton use to control outrepasse, developed a more portable Folsom fluting device and defined the major variables of Cody projectile technology.

For future knap-ins I would like to suggest honing in on a particular aspect of general interest, such as boulder reduction or fluting, to give individuals a chance to observe, discuss and try the methods of others. The experienced knappers would be able to draw each other into unexplored techniques and the interchange would educate the novice. Publicizing the topic of focus would be helpful in that attendees could be suitably prepared to pursue a subject in depth.

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LEVER-MECHANICS FOR FLUTING

The past 25 years have seen many efforts to replicate Folsom Type artifacts. Some of this work has been open, scientific research (Crabtree 1966) (Flenniken 1978) (Tunnell 1977), to name a few. Commercial knappers, too, have seemingly always been with us, but their diamond saws and secret modus operandi are unknown and suspect. The workers in replicative efforts seem to be divided into 2 camps. The majority holds that Folsom Man was not all there yet - not capable of using levers or holding devices in flint working.

I hold that Folsom Man was Homo Sapiens Sapiens and that a simple lever and preform holding clamp was fully within his capabilities. May I note some examples: the digging stick lever for vegetables, animal burrows, and quarrying probably date back to Homo Erectus. Snares, dead-falls, etc., all use lever principles. Clamping devices are reflected in the hafting of scrapers, knives, hoes, adzes, and yes - projectile points. Clovis Man's well fashioned mammoth bone shaft wrench (Haynes and Hemming 1968) could well replace the lever I use for fluting. You must agree that the Atlatl throwing device is a lever. So, where do we stand at present?

I hold that replication must not include metals in any form. That the good to better Folsom points have a maximum thickness under 3.5mm, and their thickness between the flute scars should range just over and under 3mm (Wilmensen 1978:157). The final shaping/retouch scars should sometimes be spaced at 11-15 per cm. I am not aware that any one has *consistently* replicated these qualifiers - even in equipped laboratories and using metal tools. If I am correct, must we consider that Folsom Man was smarter than we? Alternatively, we can consider that we have not yet rediscovered the true Methods and Techniques that produced the *BETTER* Folsom points.

My failure to consistently produce the "Better" points has led to fracture studies on the reaction of lithic stones to flaking forces (MS in preparation). These studies have convinced me that the "Better" was fluted by pressure applied by a simple lever - using antler tipped tools. Many of these advantages have been detailed by Crabtree (1968) for fracture-uniformity in producing prismatic blades.

My clamp with attached tip-support will frequently produce the *CLASSIC,* between-the-flute-scars longitudinal section that Crabtree detailed in 1966. This cannot be done on preforms currently touted as being THE Folsom preform specifications. (Any challenge should be accompanied by empirical evidence. I provided mine at the Little Lake Knap-in.)

Flenniken (1978) has presented certain views on preforms; however, see Sollberger 1977, then consider – Are preform failures necessarily representative of successful work where the preform was not aborted?

In conclusion, I feel we are at a crossroads: Yes, the cruder forms of Folsom are being replicated by several methods and techniques, but this is not being done consistently with the Classic Artifacts. As individual researchers, no one's work can yet be rejected. Meanwhile, are we justified in downgrading Folsom Man's mechanical ability before we, in the present, can equal his product?

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REFERENCES

Crabtree, D.E.
1966 A Stoneworkers Approach to Analyzing and Replicating the Lindenmeier Folsom. *Tebiwa* 9 (1):3-39

Flenniken, J.J.
1978 Reevaluation of the Lindenmeier Folsom: A replicative Experiment in Lithic Technology. *American Antiquity* 43 (3): 473-480

Haynes, C. Vance Jr. and E. Thomas Hemmings
1968 Mammoth Bone Shaft Wrench From Murray Springs, Arizona. *Science* vol. 159. No. 3811: 186-187

Sollberger, J.B.
1977 On Fluting Folsom: Notes on Recent Experiments. *BTAS* vol. 48: 47-52

Tennell, Curtis
1977 Fluted Projectile Point Production as Revealed by Lithic Specimens from the Adair-Steadman Site in Northwest Texas. *The Museum Journal* XVII: 140-168. West Texas Museum Association. Texas Tech Univ. Lubbock, TX

Wilmsen, Edwin N. and Frank H. H. Roberts Jr.
1978 Lindenmeier, 1934-1974. *Smithsonian Contributions to Anthropology No. 24.* Smithsonian Institution Press, City of Washington.

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WORKING OBSIDIAN AND PREHISTORIC FLUTING TECHNIQUES

Obsidian is non-crystalline, brittle, and not elastic. This state is a geological fact, not my opinion. It does not resume its original shape when bent as in percussion flaking -- another geological fact. Errett says obsidian is easy to work. This is true, if you know how and are working on a large biface. But long, thin, wide bifaces of obsidian are the most difficult to make of all artifacts of any stone! Ask any good knapper who works obsidian **a lot.**

Fluting, I think, was done quick and simple. Gene Titmus and I (at the field-school this summer) made Folsoms by holding them either free-hand or with two finger-sized sticks (as a vise). Both techniques work. Gene is now a believer of simple fluting techniques. Solly's device is interesting, but why make a simple process complex!

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LARGE OBSIDIAN BOULDER REDUCTION
by Gene Titmus

Each boulder offers a new challenge as to how to reduce it and realize as many usable flakes as possible, and every problem that might be encountered will not be discussed due to the volumes it would take. I will deal with basic principles in hope that they will be of value. I will use "flake" rather than "blade" in the terminology even though some of the flakes removed in boulder reduction could be termed blades. The definition of "large boulder" can mean different things to different people, depending upon their experience at quarries. What I will be discussing are boulders that are too large to be held by hand on the leg and weigh up to several hundred pounds.

1. BOULDER SELECTION

Naturally, the boulder should be as free of imperfections as possible -- such as cracks, flaws, and incipient cones. An angular shaped boulder is the best choice because it usually will have an angle on it that will allow you in some manner to remove the first flake or a platform preparation flake. A round or egg-shaped boulder poses the problem of splitting it in half to get it started, and this is quite difficult --- particularly if you are working with a 300-pound piece of stone. Your hammerstone would have to be massive, and the cone would have to be split from excessive force of the blow to achieve the halving (Figure 1A). I have relatively little experience with large round obsidian boulders, so I will only say that if you achieve the halving, each half offers you very good right angle striking platforms to remove flakes (Figure 1B).

2. PLATFORMS AND ANGLES

It is optimum if the boulder has an area on it where there is a right angle, and preferably a dorsal ridge associated with it (Figure 2A). Actually, an angle of about 5° to 10° less than 90° in relation to the platform and the boulder face is more desirable because the hammerstone catches this angle more readily without slipping when the blow is struck (Figure 2B). This 5° or 10° can be compensated for by tipping the boulder back if necessary. An angle over 90° should not be used for the platform as the hammerstone striking angle cannot be adjusted to compensate. With a platform angle over 90° a large incipient cone can be set up in the boulder when the blow is struck. If the blow is strong enough, the boulder will break as illustrated on the inner cone shear line, and a considerable amount of the boulder will be lost (Figure 3). Crushing and shattering on the outer margin can also result from using this type of platform.

To explain a little further on angles: When a blow is struck against a piece of silicious stone, a cone with an angle of approximately 45° is set up in it (Figure 4). The basis of all flake removal is based on the cone and its angle. To successfully remove any flake, the cone angle must be utilized. The cone angle must be adjusted, either by the hammerstone striking angle or outward pressure, so that the cone angle gives a shear line of approximately 90° to the platform of the core and its face. The flake is detached along the shear line (Figure 5). If there is a dorsal ridge on the face of the boulder as in Figure 2A, the ridge will guide the flake as it is detached and set up two more ridges from the negative scar that can be used to guide future flakes. The natural form or shape on the face of any core or boulder will guide the flake as it is detached. Almost all flakes conform themselves to the facial feature of the core.

If the boulder shape does not have the angle necessary for the removal of the first flake, usually there is an angle where it is possible to remove a platform preparation flake. The preparation flake is removed along the dotted line in the illustration, leaving a platform area that can be used to remove a flake along the long axis of the boulder (Figure 6). Rarely does boulder shape allow that it may be set up like the Mexican pressure blade cores where blades are systematically removed around the core. Rather, in boulder reduction, flakes are taken off the length and width of the boulder trying always to get as many large and usable flakes as possible.

3. IMMOBILIZATION

The boulder must be immobilized in some manner to prevent as much movement as possible when the blow is struck to remove the flake. A two-person technique may be used with one person holding and one removing the flakes. In a one-person technique, one may immobilize a boulder for flake removal by digging a pit several inches deep (depth of pit depends upon what is necessary to secure the boulder), setting the boulder in the pit, and heaping dirt up around it. The heaping of the dirt up around the boulder will not interfere with flake removal; in fact, the dirt or sand seems to dampen part of the shock and vibration set up by the blow of the hammerstone, and fewer flakes are broken in removal. If the force of the hammerstone blow is of the exact magnitude, the flake will be left standing in the dirt barely away

from its negative scar. Better results are achieved if the boulder is set on a yielding surface. A hard surface seems to intensify vibrations caused by the hammerstone, and an opposing wave of force caused by the hard surface travels back toward the platform. This opposing wave of force makes the obsidian act very unyieldingly, and the hammerstone tends to bounce off like a ball, leaving an incipient cone or irregular fracture. In any case, using a pit and piling dirt or sand around the boulder, whether it be a one or two-person technique, has almost always provided good results.

4. HAMMERSTONE AND FLAKE REMOVAL

The hammerstone should be of a soft material such as limestone, a slightly decaying granite, or any rock that is yielding and crumbles slightly when a blow is struck. A cylindrical shaped hammerstone, which has at the end used for striking one portion leading, works very satisfactorily (Figure 7). It can be held easily with both hands, and the leading portion helps assure where the hammerstone will make contact with the platform. This type of hammerstone allows you to better see the platform area. A large round hammerstone blocks the vision.

The weight of the hammerstone can vary considerably from more than the weight of the flake you propose to remove to about half its weight, although the larger the hammerstone the less hammerstone velocity is needed. What one should try to achieve is a slow gentle blow with follow-through that will start the flake crack at the platform and let the weight of the hammerstone complete the removal of the flake. Using a lighter weight hammerstone requires a blow of greater velocity, which sets up more shock and vibrations, and flake damage and breakage go hand-in-hand with increased hammerstone speed.

The shape of the flake that is to be removed will be controlled by the facial features of the boulder and where the hammerstone contacts the platform. A flake will tend to conform to ridges and high areas, and flake width will be restricted by low areas next to ridges and high areas. Flake thickness and width is controlled by how far back from the margin the hammerstone makes contact with the platform in relation to the highest point on the face of the flake that is to be removed. The margin can be moved back as in Figure 8A by removing all old negative bulb scar overhang, and hammerstone contact can be made very closely to the actual margin and still produce a thick and wide flake. Figure 8B illustrates overhang not removed; and, to produce a thick flake, hammerstone contact would have to be well back from the actual margin.

It is best to remove any type of overhang of the margin because if you should happen to strike by accident too closely to the margin, the flake will not be removed, and crushing and other damage may result such as multiple cone cracks angling back toward the center of the boulder. Slightly grinding the platform area will help strengthen the hammerstone contact area and also help give better purchase to the hammerstone when the blow is struck.

The principles of large boulder reduction may be used for reducing almost any size stone --- the main difference being in the method of holding.

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Fig. 1A

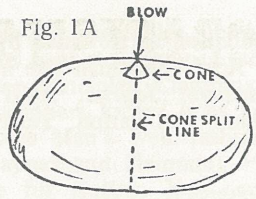


Fig. 1B

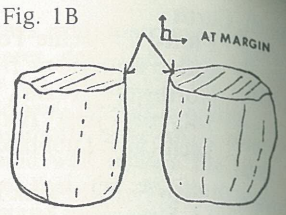


Fig. 2A

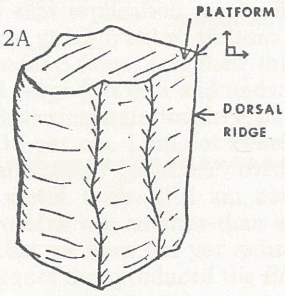


Fig. 2B

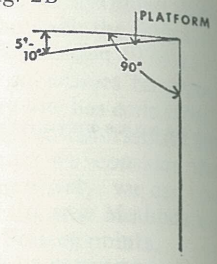


Fig. 3

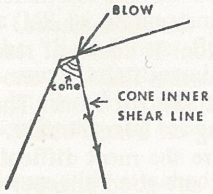


Fig. 4

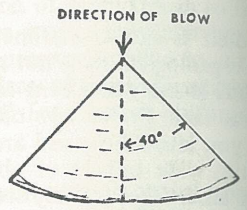


Fig. 5

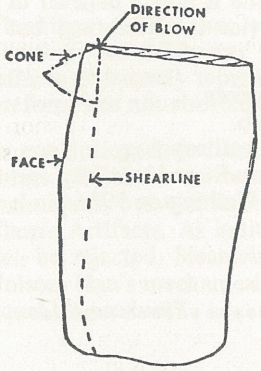


Fig. 6

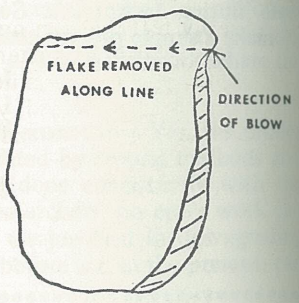


Fig. 7

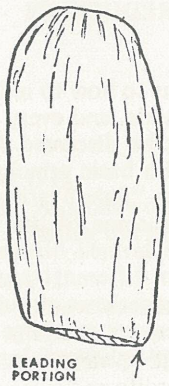
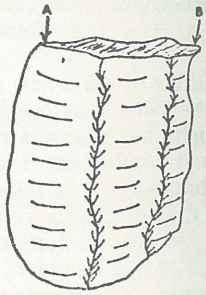


Fig. 8



CRAFTSMAN ... BO MADSEN

This is the conclusion of a two-part interview with Denmark's foremost flintknapper, Bo Madsen, which was taped by Errett Callahan on October 7, 1979 during a knapping session at the Lejre Research Center in Denmark.

E.C.: What are the specific ways, in your experience, that knappers today influence one another -- like gross borrowing of techniques or subtle change of platform strategies, or whatever?

B.M.: That's really interesting: to see how knappers learn from each other, to see the process of learning and adaptation to techniques, and so on. Investigating in knapping today would be a great thing in the process of how man adapted to a material. We have a sort of repetition of the whole grade of work done in the New World and the Old World during from Upper Paleolithic down to the Lowest Paleolithic cultures. I really see a lot of schools working. For me, the American school is one school -- I know it probably contains a lot of schools, but I've not seen so many. In France we really see schools: we have Bordes and Bordes' students forming a school, and Tixier is another school, I think. Both Bordes and Tixier work with blade making in flint -- Bordes works in a specific way and Tixier works in another way. I think Tixier really made a lot of discoveries about the real type of Upper Paleolithic blade production. I don't know how economical his technique of *sous le pied,* under the foot, is, but certainly it's a really incredible sort of discovery he made there. I'm very much influenced by the French method. I visited Bordes and I visited Tixier; I worked very much with Jacques who is a student of both of them.

I really feel that I'm not attracted with glass or obsidian -- I don't like the material so much. I like the hard flint and of course this limits you very much. There could be a lot of experiments if you used obsidian -- sort of shortcuts to the understanding of many fracture problems. It would take years to do these in flint; but you could do it in obsidian in, I think, less years, maybe in a year. For example, with pressure flaking, many times I spoil my hand. I had to stop for a month and couldn't experiment further because I nearly broke my wrist, damaged my hand. If I were to use industrial glass or obsidian, I think I would get the idea about how to continue work and so on. For experiments, I think glass is great. But if you are going for percussion flaking and you want to make some kind of maximum reduction, you have to work in flint.

E.C.: Does the above give you any insights into the communication or diffusion of knapping ideas of the past, or do you think this is just a contemporary behavior trait?

B.M.: I'd like to perform an experiment with language and knapping. An experiment something like starting some young knappers with no verbal instructions. Just let them sort of look at another work, using very delicate kinds of preparation. I don't think they would discover it, if they didn't have a language, a very developed language. When I look at some of the Neanderthal work, some of the very flat, triangular cordiform types of handaxes; I mean that really needed a verbal instruction for preparation and position and so on, else you had to experiment all the way through to get those results. You had to use five years of experiments before you were just able to make a basic tool. So, of course, it's a combination of a lot of imitating that is supported by a language and by expression which could be interpreted as a language. I think it would be fun to experiment with some basic handaxe production -- Middle Paleolithic handaxes, Early Acheulean, and so on. To see how fast people could learn it without any instructions. Well, specifically around the Danish, or any kind of large, specialized tradition. You have a lot of specialized traditions in the U.S.; much more specialized than I think most Europeans were. For example, some of your Paleo-Indian traditions -- I mean that's something, really. That's a large complex that could tell a lot about behavior.

E.C.: What are other ways that you feel that your findings could benefit archeology, archeological methodology, and/or theory?

B.M.: Look at all the recent published material in the States. I see that we are something like 20 years behind in Europe,more or less; even though we had some knappers here. We have a need of a good definition system of waste flakes, for example. We really need to reveal the reduction stages in the work. None of that has been carried on. We still carry words like "good blade technique", "bad blade technique", without defining anything about the technique or the raw materials used, and so on. We really need a lot of imitative experiments, and we need a large amount of studies concerned with waste flakes, simply to study and classify the debitage. I've been playing a little with myself trying to work with hard and soft percussors -- hard hammerstones and soft hammerstones -- trying to distinguish between the different bulbar types and so on. But I know there are problems and I see that it's difficult to distinguish. For example, on the waste flint of blade production, we could determine a lot more than we are today. I think there are a lot of archeologists that need a basic lithics course, just some basic experience. There are a lot of archeologists that don't know anything about fractures.

E.C.: On the other hand, what are some ways in which you make use of archeology in turn to improve or affect your knapping?

B.M.: Well, I spent hours just going through collections before starting. I've been looking at so many thin bifaces and so many blades on sites I have excavated. It influenced me in the way that I was never satisfied, not at all satisfied. I don't feel I made any real good work in bifacial work for example. My pressure work is still, I think, beginner's work. And my blade making, percussion blade making, it's just about middle in Ertebølle culture. It is not at all reaching any level that you could call good standardized blades. I really have to check a lot of collections. I sort of study some collections, start some knapping, work one year or two years, or one month or two months, and then go back to the collection. And I understand a lot more about the preparation, the scar pattern, and the reduction stages and so on. And basics we really need to know how much time it took to make. For example, a square axe,the middle size Neolithic type; it seems it took something between two and six hours. That's between Jacques and me, we've been doing that. But I think in some cases, if you develop a standardized system, you could make it in an hour, more or less...one or two hours.

E.C.: Yeah, looking for that system. That's the problem.

B.M.: And then there's, for example, the polish, the grinding sort of work. That's another thing. That's been investigated by a nobleman last century in Denmark. He found that it took something like a hundred hours

polishing a middle size axe. Maybe there could be made some investigation to shorten that amount of time.

Besides that, I'm very concerned about the amount of raw material. This morning we were discussing the Bromme culture of Denmark, the Late Paleolithic. We have a lot of sites spread around that have been found during the surveys of the last five years. We started with three or four; now we have fifty to one hundred., I think, all dating back to 12,000 years ago. We have some sites we call large sites that contain less than a kilo of flakes. They contain something like four or five tanged points, twenty broken blades, twenty burins, a lot of debitage -- something like a couple thousand flakes, all of them cortex flakes and so on. I would like to know how many nodules the knappers used. I think they used just a few. I think they stayed just a few days, and just worked the flint some -- I don't know, two or three days and used say ten kilos of flint in the campsite. I've been performing some experiments with just taking a nodule of flint, something like a couple of kilos, and just producing a complete tool kit of one site. I mean, it takes me a morning, three or four hours, to produce twenty tanged points, blades, scrapers, burins, and all that. And I have the typical debitage, the typical duplicates. We need some sort of constant variables. So maybe my experiments are completely wrong and completely determined by my background, my frustrations and so on. But anyway it gives something to start from; it's a starting point where you can check the experiment further.

E.C.: What contributions, if any, do you think could be made by flintknappers working outside the mainstream, so to speak, of contemporary lithic technology?

B.M.: I remember reading a book by an American anthropologist ... called White, I think; a book written in 1947. He explained something about what we call innovation among archeologists, new discoveries. I really think that new discoveries have to be made outside the mainstream. That's an extremely important thing. If you look at some of the real famous mathematical scientists, some of the physicists, many of these thoughts and experiments were made out of the mainstream. You have many of the un-understood geniuses working outside. I think it's very important that you are not educated in a sort of tradition. If you want to make some new discoveries, you have to be out of the traditions. As soon as you learn, so soon as you get standardized, you get more and more narrow-minded. You get older and older, you get more and more leaning back on the old techniques. "I've tried all that, you know", and "You tell me that, but I know it's not possible". So you have to be either young or you have to be very far away from, for example, archeology, some kind of flintknapping school. So I'm really interested in meeting new Danish flintknappers that've been experimenting, let's say, in secret for some years.

E.C.: How can flintknapping lead to better anthropology?

B.M.: There are two ways. Flintknapping gives a lot of specific information on specific sizes, qualitative sizes and quantitative sizes. You can tell about bulbs, you can tell about scars and fractures, you can tell about flint types, cortex types, the amount of time, the amount of flint, the amount of work, the amount of persons participating in the work, and so on.

But also it has something to do with the more abstract level, the understanding and education for example. You could use flintknapping as a way through to giving an understanding of Neanderthal man, for example. Let's imagine you had to teach some children about Neanderthal man; if you use no knapping tips, show a lot of slides, and talk and talk and talk, they will soon start sleeping. But if you present them with a little flint, they'll have a try themselves. That's something they will never forget. It is a learning-by-doing technique -- that's very important. There is something about flintknapping. It gives you the possibility of activating people. Even though you are a no-good flintknapper, you can still activate people. I mean, just produce a blade or something. I have often made experiments, something like a prepared blade core; I have a young boy or girl detach a blade. I make the preparations and show them how to make the movement. But it's great when they do it. they really feel very close to the original situation. It's difficult to explain this to them.

E.C.. How has your native land influenced your direction?

B.M.: We have a long tradition of flint in Denmark. I mean, many names, many site names, many family names consist of flint somehow. We have a long tradition in that. I must mention that we had a flintknapper here some years ago. He's unfortunately dead now. That was Anders Krawh. And we had gun flintknappers, men who chopped, chipped flint for the roads, and so on. In the "tales", also, we have a lot of flint; it was said that the witches exploded into flint pieces.

Well, I was given a polished axe-head when I was five or six years, I remember, by my father. Later, when I was eight, I sold it for a book. So I was not very interested at the time. But of course, there was flint everywhere. Our garden consisted of a small mesolithic flint site. I was offered an excavation job during my holidays when I was fourteen years, and fortunately it was on a site with a lot of good flintwork. It's everywhere.

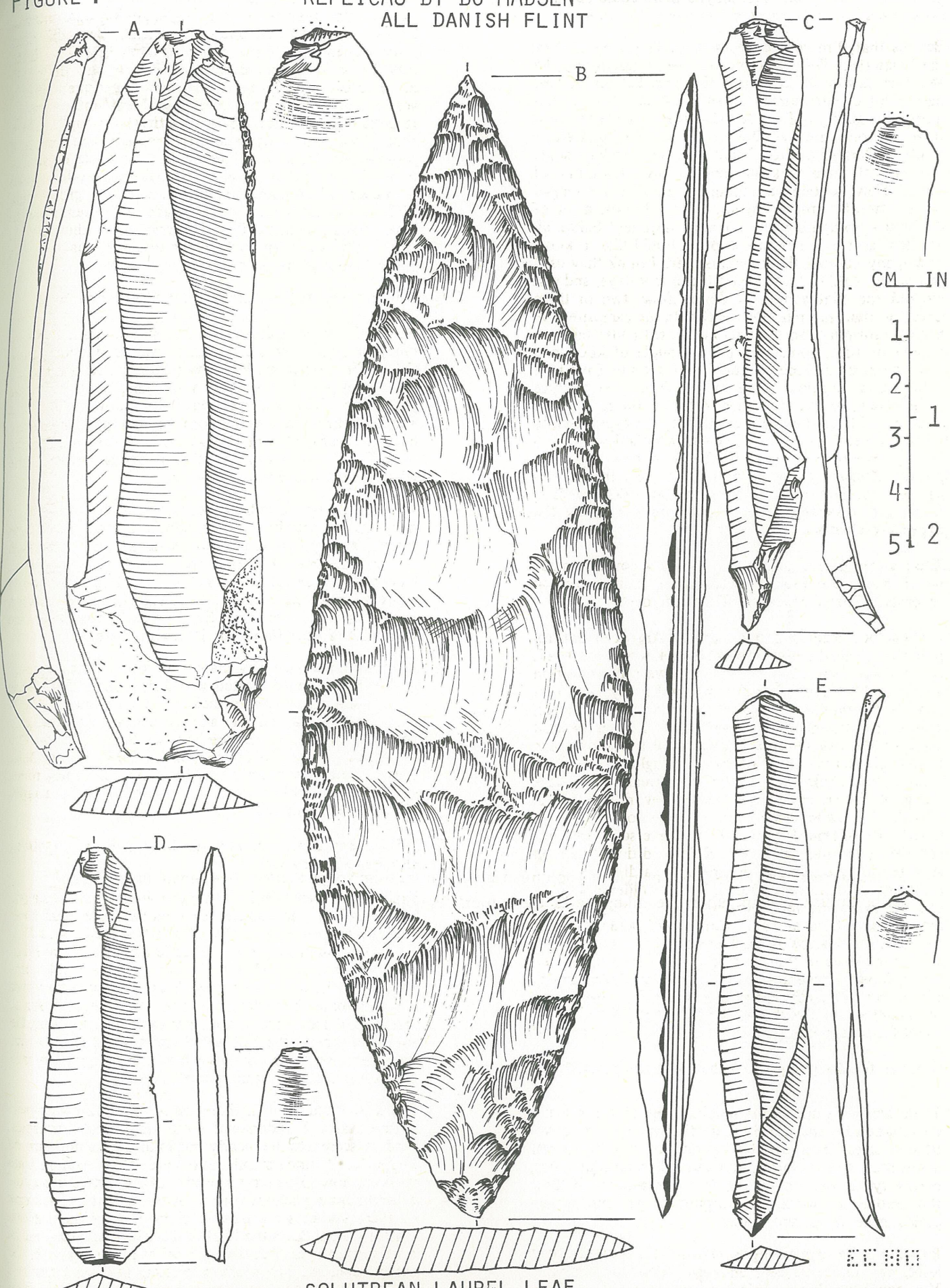
You asked me once why there were so few flintknappers in Denmark, and I started wondering then. You were right. I mean everywhere there is flint -- down at Mons Flint.Stevns, and Falstar, and so on; and in northern Jutland you see extreme amounts of large lumps on the fields just put out on the side of the fence more or less. I don't know; it's maybe because we have such nice, good worked tools and so on. People sort of, perhaps, got too humble to start on it.

E.C.: What other closing comments do you have, anything else you'd like to say?

B.M.. Yeah, well I first heard about your work two years ago. I saw one of your pieces, that basalt laurel leaf that Bordes possesses in his collection in Bordeaux. And I've seen a few other pieces by Bruce Bradley. And I've seen a lot of photos of Crabtree's work. I was deeply impressed by the work; especially, I was impressed by your biface. I remember when I saw it; we were studying it together, Jacques and I. We were discussing the middle Solutrean, about the last detachment series, and so on. And then there was this black basalt piece lying on the table sort of looking at us. "Hey", I said.

I'm astonished to hear there are so many flintknappers in the States. I understand there are several hundreds. And it seems to be nearly exploding, the number of knappers. I understand you have three generations working now. You have a master like Crabtree who had a flintknapping school with a lot of students, and some of these students are now teaching a third generation. And, I mean, that's the kind of situation that was real in prehistoric times. You have a kind of hierarchy with the master creating new masters teaching new students and so on. I think the American anthropologists will be very well equipped during the next few years.

FIGURE 1



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