

(Bordes working flint with hammer
Crabtree working obsidian with soft hammer)

Crabtree:

I have two flintknapping terms for these breaks, one is a step-fracture and the other a hinge-fracture. The hinge fracture has this dip as the flake turned and went out on that side and so stopped there; but the step fracture has broken off short. It's stepped off with usually a little air space underneath but still adhering and it carried through and broke off short. That's the purpose of a step fracture to go in and meet the termination of the flake from the other side. The hinge fracture can be used to produce flakes that will be worked into scrapers and that sort of thing. (Chipping continues)

I'm aligning my blow with the ridge underneath the arch so the flakes will meet in the center and produce an ovate arch

I'm squaring up the flakes so that we have a center both ways and it will have a rounded contour. My fingers are feeling this underneath. You don't see them or what is actually happening, but you do feel it. It's like working in the dark. Like the first time the boy shaved in the mirror - everything came out in reverse. These are difficult to do because you have a dip and you must come in underneath on this side in order to carry the flake through to that side. This is one - the edge is just a little further. These are short. I have changed angles so I don't go back in and hinge and get a step fracture on that side. I was following the ridges, through. You can't strike this way, or you lose the tip. My fingers are supporting the tip at the same time.

Alan
Smith :

What did you mean, Don, you couldn't strike this way? You couldn't strike which way?

Crabtree:

You can't strike out toward the tip. You'll lose it. So you keep the force coming back in towards the central part of the mass of stone. There was a thinning flake to take this through here on this side. I have a little ridge. You see now we have a little more regularity for striking these ridges on this side. Here, now I may lose the tip, but it's a thinning technique and I find by using a slight Levallois technique that it works better. But I find I need a little pad, a little support, on the underside. Here, I can show you what I mean by shock. I drag the tool here. It's quite different from Dr. Bordes's technique. This is taking too much shock to do this. I'm afraid I'll lose the other end of it but we don't particularly care. I've got a little too much platform - a little too round. But it will stand a lot of shock. With this type of platform, even obsidian will stand this much shock. If you leave a little hump out at this here, it helps the accuracy. It is distorted. I got a double flake, but it illustrates a thinning flake.

Tixier:

Did you say this was a Levallois technique?

Bordes:

We use the same technique, yes.

Crabtree:

But maybe a little different.

Bordes:

In the striking, yes.

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Crabtree: It appears to be a bipolar break. We have a little ridge on the center here which we have to eliminate.

(Flaking continues with occasional edge shearing)

Alan Smith: Are you trying to flatten it out now, Don?

what does this have to do with the paper

Crabtree: Yes.

Tixier: (French)

Bordes: Oui.

Crabtree: I was surprised that Dr. Bordes holds his artifact in the same style at the edge as I do, but he uses a different indirect blow with the hammer than I do, which has been very instructive for me. And with practice, I think that I will have a great deal more control than by using a flat edge of the antler. I got it! A bad one! It crushed. If I had polished that a little bit I could have taken that one on through here.

Bordes: Asks question - unintelligible.

Crabtree: No, it's a little harder. I think I'm not used to the hammer - I'm over exerting myself.

Bordes: Ya, I know. Don't use it to try to knock off the end.

Crabtree: It's just a beautiful tool that you have here - this percussion tool.

Bordes: But you have to use it more.

Crabtree: Here, just to demonstrate the sort of thinning in these areas. We'll make a Solutrean here.

Bordes: And from that they went on by pressure?

Crabtree: Yes. This is sure a sorry blank. We'll try it anyhow. I'll get this ridge off by using pressure. I can remove some of these knots and this also has a curve but by pressure we can eliminate that.

Tixier and Bordes: Converse in French

Crabtree: Well, I got some bad ones, but that is how one learns by studying the poor areas and just how to eliminate them. For demonstration, sometimes it is better to use sawn blanks. But this illustrates the mistakes as well as the correct way.

(Further chipping)

I am preparing the edge so it will bite into the tool, whereas if I leave the leading edge sharp, it will crush. And once you have crushed the area you have created step fractures and you have to reestablish a flake from the opposite edge of the artifact. There, I crushed it - see. And it will just keep

hypenate

on crushing unless one prepares a new platform and gets underneath this crushed part.

Bordes: This blank is terrible!

Crabtree: Well it's really better for demonstration than a real good one because there are just steps and stages that go into the preparation that you never see in the final finished artifact. Notice the direction in which the flakes are coming back in. These are crushed but I'll try to pick these up on the other side to thin that down. But the pressure is always away from the tip and the pointing technique you'll see different styles. You can't press out this way away from the base without breaking the tip. There are about three or four different ways to flake the tips. So if you just flake in this manner, it will result in a double bevel. Then when the flaking is pressed from the tip to the base, some flakes will be beautiful and straight like this, then others will be at a slant. But you'll always find a difference in the change of direction in flaking right at the tips. And there are about three different techniques that are used for producing this. Now I am working backhanded and actually left-handed and it is not my normal technique. When I hinge these off, I meet the hinged flakes on the opposite side and its starting to thin it down just a little more. You normally would not think that you would thin by pressure, but it is possible to do this. You see by using this pad, the flakes crush. But by supporting the artifact with a little piece of leather, or something, under the back you'll sometimes save your flakes. But it will give the flakes a little different character and you have to watch here that you don't get too much pressure on that side or it will pop in the center. But, actually, you don't give it as much pressure with your fingers because while you are doing this it will cause it to break. But it will work. And now maybe I can leave a flake still adhering to the artifact to show how the material bends. This may prove my contention that one has a muscular reaction that allows him to feel the material bend and to stop the flake at the desired place. I mean there is that much flexing and bending in the material. Some materials are intractible, but there is a certain amount of elasticity in all materials. For instance, a glass cutter will score his glass and sometimes you can watch the crack move ahead with the scoring and actually see the crack slowly open. Twenty-five years ago the Massachusetts Institute of Technology did some spark photography on glass breakage and they measured the speed of fracture with this photography. They threw a baseball at a window which was supported on all four corners. The striking caused it to balloon out and it pulled in on the sides and the cracks opened up at the rate of a rifle bullet. But, actually, under different circumstances, the opening of the cracks could be measured in parts of seconds. So it depends on how one breaks glass.

Alan Smith: Did you mean to say, Don, at least I understood you to say, that flakes had a different character when you used a pad?

Crabtree:

They do have. They will feather out and also they give off a different sound which is very important to the worker. I hear a popping sound - not a snap. But when I apply inward and downward pressure, I am forcing a mass of material ahead of the pressure tool and someplace I must stop the flake or else it will remove the opposite side of the artifact. But, with the pad, it's faster and it will feather out the flake. By feathering, I mean that the flake terminates with an infinitesimal edge.

Alan
Smith:

And you can tell by a flake whether a pad is used or not?

Crabtree:

Well, if the pad is used, the flakes will go across the median line and must be stopped before they reach the opposite edge. Then they will be met by flakes from the opposite side and will stop as a step-fracture and not a hinge-fracture. You see, the flake will break off short with a sharp edge break or a step-fracture. As you lift the flake off that makes a sharp right angle break at the end of the flake rather than a hinge-fracture. Flakes are usually crushed or broken when using a pad - but there are certain characteristics on an artifact that can indicate use of a pad. So, I don't really think you can tell from just a flake. You see this flake was bent out. From here you can't bend it out because your pad is in the way and so this is typical of a leather pad technique. Some types of artifacts are covered with these little scales, these little micro-scales, of little step-fractures while others have none. And some techniques show the flakes met in the center with a step-fracture. But that leaves the artifact with a slight concavity, particularly with thin artifacts, the flakes will meet in the center. But there may be many individual characteristics and behavior patterns of pressure flaking - each will be distinctive. With this particular group, one could not set any hard and fast rules that would apply to all artifacts. One must study many groups to see if they all have similar characteristics of workmanship. But certain big, wide collateral flakes must meet with a step-fracture in the middle. If they have hinge-fractures, they will be slightly concave in the middle of the artifact. It is better to get a step-fracture in the center than meet it from the opposite side - then you will get a perfectly flat surface. But with a hinge-fracture, it sometimes goes too deep into the artifact and must not go off the other side. Oh, I forgot, we were on T.V. - we were supposed to be doing a demonstration. But these different methods of holding come up while we are working along with different flaking techniques. When I am working at home, I will try to put down some notes on fracture for interpreting purposes. That was a rebound there. This holding style that I am using now is my normal way of holding when I am knapping. The other holding methods are changes and it takes me longer to do the flaking. But the step-fracture produces a more refined flaking so let's try another one.

then

Dougherty: Where do you put the tool? Right along the edge here, sort of like so - right in the middle?

Crabtree: Uh, huh. If you'll notice I leave this razor-sharp on the edges. I mean this is just as sharp as a razor, yet, no crushing. So I take off the edge with the platform and that leaves a cutting edge. Now, here, this will break down to that point there so I'll move the tool just back of this line of operation here and then I'll apply inward and downward pressure but if the pressure isn't applied right, it will hinge again. But I hope to pick it up on the opposite side, but sometimes one ends up with a mass of stone in the center. Now, the only way to overcome this is to come through here and meet that. I'm trying to get this knot out of the middle here and I'm taking fairly heavy bites with the tool. The desired thickness of the flake determines how far in one sets the tool. See, that removed the heavy mass in the center. This is now distorted and can be finished as a knife instead of a spear. If I continue this technique now with this distorted flake, it will just be more concave than it is now.

Dougherty: When you set the tool, you go along a little ahead of this hump here and then push down that way - is that right?

Crabtree: Yes, that's right. I will move the tool in so that it is directly in line with this groove with the force. Now, with this flake, if I were going to take off another projection here, I would move ahead and set my platform right here to take a flake off here and use that ridge to guide the next flake. But you start at one point or the other. These were not symmetrical flakes, but were distorted. Notice the even flaking on some of the samples here. This guides and controls the symmetry and regularity. If you have a series of precision flaking, it is because it was regular from start to finish. They must be evenly graduated all the way with the same spacing, for each time the tool has to be set exactly in line. If a pressure tool with a longer handle is used, then there is no quiver in the wrist. Dr. Bordes uses a longer handled tool and the percussion method of striking and delivering the blow to the edge of the artifact at right angles to the longitudinal axis which gives the same results as when I tilt the artifact but still following the same ridge pattern. There are certain advantages to using this technique, for one can follow the flake directly in line with the ridge. So even a longer handled tool can produce flatter and better controlled flakes. However, I am used to a handle that is shorter and am a little awkward with the longer-handled tool. I think a longer-handled tool gives more precision and regularity without the wrist movement.

is longer handled tool hypenated or unhyphenated?

awkward

Henry Irwin:

(French)

Crabtree: Well, let's make the flaking curve over the artifact and meet it on the opposite side. This will demonstrate the bending of flakes. See this little flake still attached to the artifact. I can move it just by the pressure of the fingernail. It might be a little easier here if we could pick up this ridge. Here is a little step-fracture. We can scrape down this edge to make a platform. I'd like to do a series

of flakes off the edge of this artifact to show how the worker can leave a razor-sharp edge. This is a dulled edge now and it is nearly worthless as a tool. So I will resharpen the edge by removing a series of flakes, taking the platform with the flake and a sharp edge will result without crushing. I am applying inward and downward pressure and directing the force toward the base to keep from breaking the tip. By the sound, you can tell the type of flake removal and the pressure tool is moved ahead over the next ridge. I know, from practice, the position of the ridge even though it is underneath and I can't see it. I know where the flake is going, so I don't have to turn the artifact over after each flake removal to see what happens. I'm changing the direction of the flaking pattern to a slant now.

should this
be hyperated

Alan Smith: Have you done this enough so that you can really remember the underside?

Crabtree: Oh yes. I can tell what happens just by the sound and the feel. But if I hear it go "crunch", or if it makes a noise like a mouse crying, I know there is something wrong.

Alan Smith: You can actually visualize the under surface?

Crabtree: Well, I visualize it by feel. Most of this is done mentally, actually. And to get the flakes to meet together exactly in the center is like trying to touch the tips of two needles together blindfolded. Because the angle of flake removal is so critical that to make them meet in the center by just feel, rather than sight, creates quite a problem. I am amazed at the degree of precision of some of the aboriginal points. With great precision they removed long, thin flakes only an eighth of an inch wide and they carried them to the center. It's simply amazing. I've forgotten the surface character of this artifact, so we'll have to have a look here. I am trying to establish a little projection. The finer the projection and the more preparation, the easier the flake is detached. However, this is a long one and it went clear across and off the other side and took off the opposite edge. There isn't much that I can do with this now.

Epstein: Did you say that you can smell it?

Crabtree: No - but I do feel with the hand. I don't use my sense of smell, but I do hear.

Wheat: Did you ever try to chip oil shale?

Crabtree: No, I haven't.

Wheat: You could use smell there.

Crabtree: You could smell that? Well phosphate rock smells a little too.

Bordes: Well, when you work flint with a stone hammer and you miss your blow, you smell it. There is a kind of crushed flint and you smell it.

- Wheat:** There is some cherty limestone that you can smell too.
- Crabtree:** There are many hazards to flintknapping. I have had to change one of my techniques because of the cut nerve in this finger. I used to catch the flakes between my fingers but once a flake crushed and went into the finger and cut the nerve. Now, I have to use this different technique, which allows the obsidian particles to fly in the air and, at one time, I developed a cough from breathing this type of stone dust. If, for my pad, I use cloth instead of leather, it collects the dust residue and will cause a cough. Over a prolonged period of time, it is possible that a flint worker could get silicosis. It might be one way of identifying one of the stoneworkers in burials. There may be an accumulation of ~~silicious~~ ^{siliceous} dust in the lungs from doing this kind of work.
- Bordes:** With obsidian, yes.
- Crabtree:** In the strong sunlight you can see the dust fly in the air. This technique of using a rag as a pad to protect the first and second fingers gives a whole new character to the flakes. I'll try to demonstrate this technique. You get quite a bit of leverage, but you lose strength in your fingers for they must support the artifact. But you can develop a flaking curve and catch the flake between the first and second fingers. The pad should be soft between the fingers and supported by the thumb and the flakes are being removed at a diagonal. You can feel them very well and for some reason the character developed by this technique cannot be duplicated by the normal palm-supported technique. I don't know - I get a true and better flake and it is straighter by using this technique. Then again, I've used a crutch for removing large flakes and I notice that some aboriginals, no doubt, used this method for large artifacts. If the artifact is supported on a rest, or a block, you end up with a whole bunch of step-fractures, all the way along. Without a crutch, but using a rest, the flakes have no place to go and these little flakes go into the artifact causing step-fractures. The rest method was, no doubt, used for knife sharpening and retouching. This technique causes a beveling of the edge similar to artifacts found in the Mississippi Valley showing they have been retouched and then retouched again, causing excessive beveling. When they are resharpened like this and the artifact is supported, it creates a distinctive edge character. But it is not adaptable for making other than very thick arrowpoints. I have noticed that some of the diamond cross-section pieces have this same support character with the flakes sharply feathered out. Hand-holding will not produce this character for there is too much rolling of the flesh and you do need a solid support like this piece of rubber or some heavy neck leather or something like that. This feathering out shows a definite support method. There is shock, but the hand rolls on thru and actually you are controlling the flake with your left hand although the right hand is a little more fixed. Butler and I tried out several students on flintknapping and each one had a different technique and each holding method had merit, but each method gave a little different character to the artifact.

For instance, Dr. Bordes doesn't feel comfortable using this holding method so he has a different style. Perhaps the aboriginal child learned from his father and so we have different holding methods. I recall seeing a collection and every artifact in the bunch looked like it had been made by the same man yet there were big ones, little ones, and all types. They all had little step fractures but well done. It appeared that one worker had produced all of them yet they were all found at a buffalo jump. So these things seem to be somewhat characteristic. Examining different collections, different groups, will, no doubt, show up the variations because we can't make an analysis with just one point - we need an assemblage. For instance, look how many different styles and techniques we find in Clovis. It would be interesting for someone to do a little paper on Clovis techniques and the variety of fluting, edging, grinding, surface character, etc.

Wheat: Bill Rousa did a little paper on that. It's published in the Ohio State Archaeologist. He recognizes about three styles of fluting techniques.

Crabtree: Is that so. I haven't read it, but it sounds interesting.

(Interruption in Recording Time)

(Lunch, no doubt.)

Crabtree: What do you think of this, Dr. Bordes? This is no preparation. He may have been going to take another series and decided there goes the buffalo. Let's take out and we'll fix this later. Because it's just not quite right. ← has?

Bordes: Ya, ya.

Wheat: Maybe they used it as a drill - for a pipe or something.

Crabtree: Well, but it's like it is unfinished.

Bordes: Ya, ya, but let me tell you something. It looks to me like the man was not very clever. Because yesterday when I tried my pressure I got exactly the same edge and I could not go further. It was too wide and I could do nothing, so I just left it and began my percussion. But this one is a wrong one you know. And it could be because the man was not very good - you know it strikes me.

Crabtree: But on this side he was able to control the pressure very well.

Bordes: Ya, ya, all right. But you know on this side, if you remember, I did fairly good pressure work and when I wanted to go on the other side, I couldn't. I got exactly that. So I will say that he was a man that was learning.

Crabtree: Well, some of these techniques require backhand work and it's almost like using a left hand. I mean it is awkward to use one position and then turn around and change direction of flaking. Your muscles are just not keyed to the different technique and you use different muscles for your own technique. Therefore, you are not as accurate. Like with writing - we are used to a table support and it is hard to

stand up and write with just hand support. This artifact of Dick's indicates that the worker hadn't finished the one edge. Maybe he had sufficient weight for that particular type of projectile point and he didn't want to take any more off of it and he wanted a balanced set - so he left it. Maybe he felt the point was good enough as it is for penetration so he may have decided this is good enough.

Bordes: Ya, ya, ya. But on the other hand they were certainly a paradoxical people. Some people were very handy with their hands - others were not so good and people were learning you know. What can you say - maybe they were children learning to work flint and so some of the flint which looks rather crude ~~are~~ just beginners work. Could be that too, or it could be that the man was in a hurry - he was just starting and he wanted a spearhead to kill something and would fix it after. Why not.

Tixier: Because of his wife?

Bordes: No. Never underestimate the power of the women.

Crabtree: Notice the tears and the flake character. Why certain flakes were certain shapes and then a comparison of the slight crushing of the edge. You can see a part of a platform preparation still left on these right here.

Bordes: There is one thing I shall try. To work obsidian with a soft hammer.

Crabtree: So there is not so much shock.

Bordes: Ya, ya, ya. Perhaps. The best thing to work obsidian by percussion would be to find something that is a little softer than this. Not much, but a little. I know I work with box wood for a very long time. The best box wood hammer is just about like the worst of antler.

Crabtree: Let's use a wooden billet on this and see the difference.

Bordes: Let's see, I will try with wood.

Crabtree: Good. Very good (Lapse in recording time)

Bordes: You know this part of tool, the edge is just crushed but the crushing becomes a part because this is a tool now and then also because I am not too much happy with this anymore and that is exactly why I throw this out. I would like to hold it here. It would be better to hold it like that, but I could say that perhaps it would be good to keep this in that shape, as an example, because I am not sure I can go on now.

Crabtree: Like a preform. It doesn't have the appearance of a regular preform.

Bordes: No,no,no,no,no. That's something else. You know I am now very sure that the man, a man you know who was very handy with a wood hammer and enough obsidian could make things almost as regular as the one you have made by pressure. Not the small one but the wider retouch. I am fairly positive of this because, look, and I have no technique with obsidian.

Ah, that's an idea, you have some idea, and if you have some time, you'll notice this interesting way of retouch meets the center. But certainly I have seen Egyptian and some Egyptian knives, you know, that met in the center.

Dougherty: Don, could we get you to try one more blade with two different people doing it.

Crabtree: Well, if I could get some way to save some of the flakes or blades. This wood billet I have may be a little hard, it may be a little rugged.

Bordes:= I would not like to say anything against Crabtree who does such a beautiful job of pressure flaking, but I guess somebody who works flint or obsidian every day by percussion could get things almost as regular as the big ones. I don't speak of the small ones or the crazy chips and so on. But regular forms and ordinary knives or projectile points you can get by percussion almost to the point of pressure when someone is really trained.

Wheat: What differences would show up on the points on these?

Bordes: Well, not much to someone clever. Technically when you are really controlling your percussion you take out long, long flakes with a very small platform and it looks very much like pressure.

Wheat: But there is a difference in the way the flake turns loose. That is in the pressure - the pressure builds up slowly and then it's released suddenly and on the percussion it's hit suddenly.

Bordes: Ya. But all that is a matter of the ratio between the hardness of the hammer and the hardness of the material. The hardness of the material you are working. If the hardness is about the same, you know there is not much apparent between pressure and percussion.

Wheat: Well, this is what I wanted to know.

Bordes: Not much. There is, for instance, any of the tools made by Crabtree you can see very easily it's made by pressure. But in some other case like a lot of Laurel Leaves in France - well, I am not enough of an expert.

Crabtree: The large one that went around here that I did - that is percussion.

Bordes: Ya, ya - no question. We will look at them at the Museum Thursday morning. We'll look at the Solutrean work and you will see that some were made by pressure - no question. The shouldered points and Willow Leaves. Most of the Willow Leaves were made by percussion, no question. But on some of the Laurel Leaves - who knows.

(Stone chipping continues)

Crabtree: Yes, that's good.

Bordes: When you have a good hammer, it works good. This one will

be a little more out. You can take clear across. I am fairly sure that most of the Solutrean Laurel Leaves were begun like that. But not too much of a shock.

Tixier: (french)

Crabtree Oh, that's good.

Bordes: The only thing you have to do is each time to strike correctly. I don't do it any more good but you see that's the general idea.

Crabtree: That's a good thing to bring out here.

Bordes: Let's see. Always when you want to demonstrate something you miss it. And perhaps with this tool and technique it makes it look like you are doing it like that and were not even looking. And at the time you were looking at it there. God damn! If you pick up a lump of flint and you try to work it first you can't work it well and the, if you work flint by percussion with your hand cut - that's bad.

Alan Smith: Then there is a little difference then, whether it has moisture or not?

Bordes: Pardon me.

Alan Smith: There is a little difference whether it has moisture or not.

Bordes: Yes, there is a small difference. This one crushed much more than the other.

Tixier: Ah! May I see the bottom seat?

Crabtree: Just a minute and see whether we get a different flake character here.

Epstein: You use hard wood - you mean it is worn down here?

Crabtree: Yes - it needs to be a little softer.

Dougherty: Are you going to file it down a little?

Crabtree: Well, it needs to be bruised so it will hang on.

Dougherty: I see - soft huh?

Crabtree: This is a hard piece here.

Alan Smith: Can you do better work, Don when you work fast?

Crabtree: No. I just don't want to take that much time here. One should take more time to study each flake removal. However, I am feeling underneath with my hand. But there is so much to cover in just four or five days that I am working fast. This is flat and it's going to be a little difficult to get a ridge established to guide the flakes. This flake is thin and it may have a few internal strains. On the cortex there are little bruises indicating movement or where it has been

pounded a little bit indicating internal strains. I'd like to examine the flakes removed by the billet. If I get the same platform character then when the edge of the artifact bites into the wood billet and the flake detaches from the artifact, the character will be identifiable. It's the length that requires this much striking. I'm afraid of this end. Can't get these pulled loose here.

Alan
Smith: You seem to hold your billet at quite a different angle in relation to the piece than Dr. Bordes does.

Crabtree: Dr. Bordes strikes into the body of the artifact and has much better control. I think there are a lot of advantages to this billet. Because you'll get perfectly flat flakes with a billet but I find that if I drag it on the edge of the artifact, I get better control and it lessens the shock. I'm not used to the shock that I will get from this billet.

Alan
Smith: I didn't mean to suggest that you change, Don.

Crabtree: No, no, I understand. The impact area is critical. I'm not getting the edge character that I want.

Alan
Smith: I merely wanted to check my observation.

Crabtree: Good - that's good. What I really wanted you to see is this. The wooden billet pulls this edge away and leaves a little different flake character. I'm not quite doing it right for demonstration of the use of a wood billet but it will show a little different edge character than a harder striking tool. The stone will dig in slightly into the wood and pull the edge away and leave a sharp edge. This is just an example of an artifact produced with a wood billet. It's not a good flake; it's not quite what I'd like to show as billet struck. I just hit in too far. Because the tolerance from this distance must be accurate on the edge, but it shows a little edge character.

Tixier: Your stick is too heavy.

Crabtree: Yes. This is not the best stick.

Tixier: This is good for hand ax.

Crabtree: The billet needs to be shorter. I wonder if a piece of harder wood would work better on flint. To bring out the character a little better with the harder wood.

Bordes: You won't get this corner like that. Oh, you can with wood, but with a different angle.

Crabtree: No, you see, it's too hard on my thumb.

Bordes: Like that. So you shall try with stone here.

Crabtree: It crushed on that side.

Tixier: Ah, there it is - ^{bladlets?} blades. Yes, that's good.

Crabtree: I had a flat side and I just flaked this one out to a ridge.

Bordes: So, Alan Smith, you are the chairman?

Alan Smith: Oh, yes - I hope.

Bordes: So you direct the discussion.

Alan Smith: Well, let's have Don tell us something about the thermal treatment.

Crabtree: I will try to explain something of my initial interest in the treatment. As a boy I would find discards and flakes and it was like stealing flakes from the Indians but they always seemed to be of the best flint. I knew that their flint was a little better than any I could find, but I did not know why. I noticed pot lids and overheated pieces of flint and they were always lustrous and shiny and in one particular area where there was chalcedony flakes they were waxy beautiful flakes but the material in situ was a fortification agate with banding which is very tough and it was difficult to pressure flake. Yet, the Indian had made beautiful bifaces and arrowpoints and it was of this material - still it looked different than the raw material. So I tried heating the stone and I got a change of color and I got pot lids from overheating. But I did discover that the heated material worked easier and better after the treatment and it changed in texture and color. The yellows will change to reds where oxygen is present. Sometimes there is no color change but there is a texture change and refractive index seems to have changed as well. In 1939 we had some tests run at Batelle Institute. The electronic microscope was used and we checked some altered material from Flintridge, Ohio. It was some material that I happened to have on hand. They found that molecularly there is a nuclei and around this radiating crystals, after the heat treatment, these are reduced which is against most of the laws of molecular theories. When metals are cooled or annealed very slowly, or heated slowly without chilling suddenly, the crystals will increase in size and length and we get flexibility. With stone, by the slow heating and cooling we have a similar change, but a little reverse of the metals. But with certain quartz family minerals, some will alter by this heat treatment. This is Harrison County, Indiana flint and it shows an over-heating and this is the resulting pot lid. This is an Indian flake from Montana picked up on the surface showing the altering. Notice that I removed a little flake on this side and it shows the change. What the age of this is I don't know for it is on loan to me by Lou Napton from Missoula. The technique shown on this flake is unique because of the very tiny striking platform. I hope you won't mind that I took an extra flake off the side here to show the change back of the color. This was the original texture after it was heated. This was the surface texture prior to heating. This was apparently a discard perhaps because of this hinge fracture. I'll pass this around to show the difference in texture between the original facets and the worked side. It shows a reversion back. What the rate of speed of reversion is, I don't know. However, the hardness of this material is still the same. Because they heated some pieces for pressure work doesn't mean that they heated all of them. Most of the drills

~~(Loren in Reading)~~

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are not of treated material. They wanted to retain the toughness of the stone. When you find these awls and drills they are generally untreated. I'll pass around another one in association. This was unheated material showing it can be worked but it's much easier to work after it is altered. This is unaltered Harrison County flint. The artifact with it has not been altered. But you can see a slight change. I think there are two flakes on one edge. This edge right here shows a slight change after it was heated. But if your material is of good enough quality there is no necessity to alter. In 1940 when Dr. Shetrone came to France, he sent back several tons of material similar to the flint that Dr. Tixier brought here and I was lucky enough to get some of it. This is some material done by pressure and this was about as good as I could do with pressure work at that time. This is an old point of that material and this is unaltered French flint.

Tixier: Without treating?

Crabtree: Yes. This one is without treating. These pieces are treated on one side. This shows how large a flake can be removed by just hand-held pressure after the treatment. This one here was from a sawn blank but just to demonstrate the thinness and the length of flakes that can be removed and how much control can be gained by altering. With untreated material you get little micro-flakes because it is extremely tough. There are quite a few potlids on the outside of this one and the flakes of that one single core seem to be much brighter, but that was only a single example so there wasn't sufficient evidence to be sure of the treatment. Thermal treatment is apparently very ancient in the Americas, because the Folsom was, no doubt, altered, and the color changes are apparent even in Clovis. Yet, again, with other groups of people it is not in evidence at all even in the Americas. So one wonders what the distribution of thermal treatment really was. Not too much research has been done on it so far, and it will be interesting to find out at a later date what the extent of thermal treatment was and how far it reached into time. This is an artifact from Oaxaca, Mexico - a white jasper or white agate point - that had been altered for one of the original facets of the material was still adhering and I could see the difference in original texture and that altered. Sometimes on the backs of the artifacts you may find some surface that has a hinge fracture, or a little miscalculation so that the whole surface was not removed. And, if it wasn't all removed and there is a change in lustre of the chipped surface and the original facet, then it is quite evident that there was altering taking place. What really helps is an artifact that has the outside of the flake on one side which is very coarse and granular and on the underside the material will be very shiny and lustrous. Usually, in trimming a core after it was heated, the outside was removed and then one can see the difference in luster between the original and the inside treated material. But with a single flake, it is almost impossible to tell and it is better to have an assemblage of flakes before one decides definitely about thermal treatment.

On the outside of some of our jasper nodules in the States, like some of the French material, right at the cortex you'll find a combination of silica gels (opal) with a high content gels

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of water and cryptocrystalline silicas which is actually opal, or a combination. Now opal just is not suitable for artifacts because it is unduly brittle. It is soft, and you can scratch it with a file and the finished artifact would have little strength. It cannot be treated for with any heat change it goes all to pieces. By the way, this artifact is one of opal showing opal can and was, at times, worked. There are, no doubt, some points made of opal but many of the points are made of white treated jasper and have almost the same refractive index and luster of opal and, therefore, can be confused with opal. But there is one type of jasper that I can't get altered. It comes from a site near my home and we call it Breneau Jasper. There is something I am doing wrong in the heating, for the Indians were able to alter it. However, they were very skilled in treating materials, it was a science with them. They were even able to alter large blocks of stone and they knew how to raise the heat slowly and how to cool it slowly. The larger the block, the more slowly you must heat and cool. But small flakes could be altered in a few hours. By that I mean half a day. At home, I start heating in the evening and the next morning the stone has cooled down sufficiently to work. I cover them with fine blow sand so it fills in all the cracks and lets the heat soak in evenly all around.

Epstein: Don, does it look as though the Indians were accustomed to heat treating the blades or preforms or something of that sort, or do they do the whole nodule?

Crabtree: Well, in some cases you find evidence of treated cores. Of course, the Hopwellians heated the whole core and it had a much sharper edge. The finer they could make the material by altering, the finer the texture, the sharper the edge. Like this flint here = which is not shiny - it is not nearly as sharp on the leading edge. You'll see little striations, I mean little saw-tooth marks - but obsidian or a glassier material produces a sharper edge because the fracture breaks out to infinity. If you have little granules in the material, the flake is not going to be nearly as sharp and smooth as if it were a very fine-textured material. Most of the treated evidence that I have seen has been in preforms that have been altered. Or they would take a whole series of flakes and thermal treat them and then rework the flakes. Then, again, you'll find fairly sizeable treated flakes that had to come off a core after it was heated. However, I have not found the core.

gather

I'm not an Archaeologist and, therefore, I'm not out looking. I would rather stay at home and chip the stuff than to go out and look. When I was a boy, I would go out hunting and if there was a blowout in the blow sand I would gather, of course, what I saw on the surface. I was after chips and flakes as much as artifacts. This is a treated piece that Dr. Bordes was working on. This is very good evidence of alteration. We have removed a great deal of the surface, but on this side you can see the contrast between heated and untreated material. This is the untreated ^{side of this} material as it occurs in its natural state. It is very tough material and it has been treated now and is quite workable. I'm sorry, I meant to bring an untreated piece to show the difference in character. But we'll pass this one around and there should also be an artifact somewhere here of this material. This hasn't been heated enough but this is pressure worked. You can see that this treatment changed the material and produced a better stone than this original piece. But in its natural form it is extremely tough. You can hardly take a flake from it, but this had a better alteration. This is evidence of over-treatment. I mean it got too hot on that edge, probably was too close to the element and this piece popped out.

Epstein: Do you feel that the temperature was too high or it cooled too quickly?

Crabtree: Well, not necessarily. It could just be that one edge was exposed or got too close to the heat. He must have had great control to have altered as large a piece as he did. And he understood almost exactly how much heat was necessary because there is a wide variety of the water content in stone and the degree of temperature will vary with each material. Now, for instance, one type of chalcedony, which has a replacement of silica ~~gel~~, will not stand very much heat. However, if properly controlled, it will alter beautifully and be very waxy and lustrous and almost jewel-like. While the agate nodules formed in the vesicles of the ancient lava rocks apparently have micro-crystals forming from the outside toward the center, leaving these patterns. These are called fortification agate. These will stand much more heat than those formed by a silica ~~gel~~ deposit.

continues on page 16

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lanceolate

There are no lines or patterns in the silica ~~gel~~ type of chalcedony. But there is even a wider variation of chalcedony. A friend in Montana said he didn't think anyone could ever flake Montana agate. He said he saw artifacts, but it appeared that they were of another material rather than Montana agate. He was quite enlightened when he found that Montana agate could be worked after it was treated. He hadn't developed his notching technique because he couldn't get enough pressure inside of the notch, but I expect now he will try it on the treated stone. So he felt that they made ~~there~~ ^{their} artifacts all ~~Lancelot~~ lanceolate in shape because they were of flint and agate and the stone would not allow the pressure needed for the notching technique. There is a little story that goes with this artifact. This is a genuine ^{CLOVIS FROM IDAHO} - not one I made. But this is, apparently, a type of Solutrean flaking. At one end of the Camas Prairie in Idaho, [✓] the Clovis and some of this very beautiful work was done. This will give you an example of the thinness of some of these great big chalcedony disks they made. However, this piece, apparently, wasn't heated by the same people that made the Clovis, for we found this in another site of a more recent occupation, at the other end of the valley. They had salvaged this material, apparently, from an ancient site and brought it to their camp and did a little retouching after they had heated it, which is an odd thing. With this one, you might examine the edges, and notice that whoever did the work originally did the flaking on stone in its normal state.

Combiert
Cambier

Asks question in French.

Phil Smith translates:

Don, what are the major temperatures that you use in this heating?

Crabtree:

I'm finding now over a long period of time that 450°^F will work on most materials. But it must be built up very slowly, I mean, it shouldn't go over 200°^F initially, for at least an hour. At 200°^F for an hour and then raised to from 400°^F to 450°^F. However, it will stand up to 900°^F

Epstein:

When you put it in a pot, can you tell us something about how you do this?

Crabtree:

I use my wife's deep fryer. Just recently I discovered this great invention. Now she's lost her deep fryer. Prior to that, I had used a ceramic oven, which will go up to 1500°^F or maybe 2000°^F. And the breaking down point of this material, or a translucent agate like this, is around 1200°^F. At 1200°^F, it will all turn white. You may have found examples of this in your sites. Prehistoric man was able to build up that much heat in his pit, for you will find flints that have been entirely decomposed by heat. They used charcoal, possibly, or maybe by fanning it, or something like that. But at that heat it breaks down into little cubes and it entirely disinte~~r~~grates and appears to be like porcelain. You can heat a translucent chalcedony, and at 1200°^F it will disinte~~r~~grate and go to pieces.

Epstein:

More clarification. Do you, for example, do you just keep the pieces in the pot or do you put sand in there?

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Crabtree: I cover it with sand. With the sand it retains the heat for a number of hours. I put it in the oven early in the evening - raise the temperature to 450°F., and then I turn the thing off at 11:00 p.m. By morning it is still warm, but you can reach in and get it without being burned. It's workable then and can be handled. But if you open the oven door before this lapse of time, the air touching the stone will cause it to pop and crack.

Epstein: Even in the sand?

Crabtree: If it is near the surface or exposed, ^Bbut as I have told my wife I need a stethoscope. I could then sit by the oven and turn up the heat and listen and when I hear the first crack I turn the thing off. Like this. Then I would know if I was heating it too fast. Perhaps they had their ear to the sand and did the same sort of thing.

Wormington: Is there any advantage to working while it is still warm?

Crabtree: I can't see any difference. Here is another one. A few flakes have been removed on the outside, ~~here Cynthia~~. There is a slight change of texture not very much color change, but it is much easier to work. This is extremely tough. This one edge is all that has been exposed by removal of a series of small flakes.

Irwin Williams: This flake was struck off, then heat treated, and then retouched.

Crabtree: Right, just on this one edge, just to test it, and see the results. This is some petrified wood that is Indian-heated and worked, which is a good example of Indian work. Here is another piece of petrified wood showing the changes.

Joe Ben Wheat: Don, do you know who McCormick is? [?]the guy down in S.E. Colorado who make \$ Folsoms?

Crabtree: No.

Joe Ben Wheat: He's been making them for years and selling them around there. He works his flint hot. He takes it in an oven and heats it just in a pan in an oven till it is just hot enough that he can handle it with gloves but too hot to handle it in his bare hands and then he takes his stuff out and makes his points. He says it works almost like heating cheese, and what he uses as a fluter, you might be interested in, too, is a iron bar which comes up under the arm and it's about the length of the arm, curved like this, and the end turns out and the end comes over like this down into almost a screw-driver-shaped point at the end and he holds the piece to be fluted against a log, or something like that, and then he, of course, has a little tip up there and a platform and just one sharp blow like that. But the interesting thing to me is the suggestion that this is the shape of an Elk ~~hammer~~. *antler*.

REEL 2

Crabtree: Well, that's something. That's remarkable. He supports the point against something. Well he has to support the point. I know that is one of the techniques that I hadn't used because I have broken hundreds of them till I saw the polished tips on the Folsoms that Marie has at the museum.

Coe: *Alan Smith* Don, does it make any difference if the temperature fluctuates a little bit?

Crabtree: No. I think not. With the sand it wouldn't make too much difference. If it is covered with sand, it retains the heat sufficiently so it doesn't make any difference.

Coe: *Alan Smith* I was thinking of the Indian and his fire and the probability that there was some fluctuation there.

Crabtree: I don't think that it really makes any difference, if you don't heat excessively or build up the heat too fast and let the stone cool too fast. But the larger the block the more slowly the heat must be raised and the more slowly they must be cooled. I was trying to get a Folsom out of the French flint and the platform collapsed. But that has been a heat-treated piece. And this is a piece of quartzite. I can see a little change in texture but, prior to heating, it is very difficult for me to pressure flake quartzite. Yet, I know that it was done. I started examining it under glass to see the replacement of those little sand grains. If they are brecciated, the sand is a stream sand, rather than a beach sand. The beach sand quartzite has a great deal more toughness than the stream sand quartzite. If it is extremely fine, it seems like the little grains are cemented with, possibly, chalcedony. You see this little matrix composed of chalcedony, if you examine the quartzite with a glass, and the finer it is, the easier it is to work. This particular piece of green quartzite is fairly coarse. There is a lot of variation in quartzites and it would require analysis to actually tell the workability of this. Quartzite is quite variable because of all the varieties of stream sands and the types of cementing and bonding agents. Here are some that are heat treated, showing different styles of work, however, they are all from the same material. Some are heated just a little differently, some are a little more lustrous, possibly. However, they are all from the same block of material. This is some more, but this was heated near the surface and the oxygen was present, however, these haven't changed color. They are all off the same piece of stone, these four. Well, that is about all that I can tell you other than I am looking forward now to getting some nice blocks of flint, heating them in my deep fryer, and making some of these prisms. They'll be interesting things to compare the differences in sharpness between the jasper and agates and flints with obsidian blades. I'm sure they won't be quite as sharp as obsidian but they will make some interesting tools.

Dougherty
Phil Smith: *was* Is that core heated before you took those little blades off?

Crabtree: No. That core is natural. It's the natural Harrison County flint. This material here, but that was unheated.

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Tixier: It was flaked out by pressure.

Crabtree: Yes, same sort of thing.

Epstein: Pardon me, but at this stage of knowledge do you have any idea what the temporal or spacial distribution of the heat treatment is?

Crabtree: Haven't the slightest. Haven't any idea at all.

Tixier: I am sure there are some people in the Sahara which used this method, I'm sure. They treat it, they have flakes and then they retouch. It was found by Dr. Kosand from Libba and I will write Dr. Kosand and he will send you some tanged arrowheads. And only the bases, the stem is worked by pressure retouch. *All the same...*

Crabtree: Well, I thought when I get home I would cut some uniform size tabular slabs with a diamond saw blade. If the slabs or flakes are not uniform size it creates a variable in temperature control. I want to have a uniform tabular selection and at least carry on temperature experiments up to as far as my deep fryer will go. Then we will heat the tabular forms in different stages of temperature and then prepare thin sections and check exactly what is happening with this heat treatment. One can reserve a portion of each slab for control purposes so we can increase the heat to the breaking down point of this experiment on heating and we might know a little more about some of the materials of the quartz family minerals.

Daugherty: Don, ~~how long to~~ send some examples of that stuff up? We can check the index ~~fraction.~~ *refraction*

Crabtree: Oh, would you? Wonderful. I don't have any fluid or anything like that.

Daugherty: We have. We have the whole works.

Crabtree: That would be wonderful.

Daugherty: If we could get that extra little step in.

Crabtree: Oh, fine, well I'd certainly be pleased if you'd do that.

Tixier: I'll have to write to my friend about heat treatment.

Crabtree: Dr. Swanson was going to send ^{six} 6 copies of the Tebiwa with his heat treatment article. A very short article. I don't know whether you got them or not.

Bordes: I may have some.

Crabtree: Oh yes. But Dr. Swanson said he would send ^{six} 6 here.

Bordes: I did not receive them.

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Crabtree: I see, ~~fine~~.

Bordes: I got two.

Phil Smith: Do you think that the very high solar temperatures, ~~you may select~~ the Sahara, would have any effect at all on the flakeability of the flint? *in a place like*

Crabtree: *→ I don't know.* Yes. I suppose over a long period of time, particularly if it was a dark rock, it would absorb the heat. It, no doubt, would get up to nearly 200°F. And over a long period of time could cause this change to take place. I mean it is certainly a possibility, that it may do that. But a hundred degrees or something like that. I know some of these on the surface in our area have got to that heat and they have still stayed the same but it would have to be an intensive solar temperature in order to ~~do that~~. *make the change.*

Phil Smith: In the Sahara you very often find pieces of flint arrow stone which does have this pot lidding on the edge. Of course, that is a high temperature - high heat.

Crabtree: I see. It might be. Well, carnelian was one of their favorite for several thousand years before the time of Christ. And carnelian doesn't come in a carnelian color, normally. I mean to find it naturally. It comes as yellow agate and has to be altered to make it into a gem stone. You don't find carnelian very often accidentally, unless there has been a forest fire or something like that that has gone over. Or maybe some underground thermal temperature that may have altered the color of the stone. Natural carnelian is a very rare stone and yet you'll find these beautiful carnelian points and also they liked it for jewelry.

Phil Smith: What color is it?

Crabtree: It's yellow and the yellow changed red. You see you can't induce hematite into the chalcedony and it is the hematite that makes it red. The iron salt must penetrate in a soluble form. Hematite doesn't penetrate the stone as hematite and this is what causes the red or carnelian color. Other mineral salts will cause the sardonyx and you'll get sard and that sort of thing. And there is a change here, I don't remember what the natural color was but I end up with sardonyx. This wood appears to be one of the forms of sard. ~~I get Sardonyx and this sort of thing.~~

William Irving: Do you think that it is very difficult to make notches and points without heat treatment?

Crabtree: It's much more difficult.

Irving: Does this apply to most materials?

Crabtree: Yes. Other than obsidians. Basalts and quartzite have altered slightly but it's mainly the set group of silicious materials. Some of these very granular things of silicified clays. There is not much evidence in change of these tabular forms of that sort of silicious thing.

Daugherty: How about things like opalized wood and things like that? Will that change?

Crabtree: Well, the opal just won't stand any heat at all. But agatized wood is very good. This is a piece of agatized wood - two pieces, in fact that the Indians have changed. I didn't change those but you see the changes have taken place.

Alan Smith: We didn't hear Bill's question over here.

Crabtree: Oh.

Irving: I wondered if notches that are used on arrowpoints are difficult to make on all materials that have not been heat treated or are somewhat more tractable than others.

Crabtree: Well, it certainly helps to have the material altered. It is much easier to flake and to notch treated material than it is untreated. Because the nearer it comes to obsidian - or a glass-like quality which is an ideal material for pressure work - the easier it is. The more glass-like the material, the better control one has. Heating, apparently, makes the granules, if one can term it that, smaller. The more flexibility the stone has, the better because the toughness is due to the intertwining grains of these nuclei that have bound together with the quartz crystals and they must be sheared in two.

(Lapse in recording time)

William Irving Collection

Irving: This material is related to the Norton Complex. I don't know how closely related but it is fairly closely related to that. Now the Penuk Complex is closely related to the Denbigh Flint Complex. It has all of the diagnostics. This collection here is not fully representative but it is the best I could do on short notice. You see here some antler that has been cut by the grooving technique with these burins which you see here. We don't have any evidence of wedges used to cut the antler but there are some small polished adzes in this site which perhaps were used for this purpose. They weren't used for chopping the antler at any rate. Up above the burins, you see burin spalls. There were as many as twenty burin spalls knocked off a single burin. Some of the burin spalls were retouched at the terminal end to use as small engraving tools. Now here you see one of the most distinctive sets of implements, the very small side blades, the side hafted blades, biface with very fine parallel retouch often with serrated edges. You can tell that they were side blades because they are asymmetrical. One edge has been sharpened, the other edge is in mint, or new, condition. The edge that was held in the antler haft is in new condition. The outer edge has been resharpened many times. Small tools, such as this size, are by far in the majority in a site such as this, however, there are some larger ones such as this bifaced implement here. This uniface whittling knife, biface knife here, and possibly a lance head. All of the large tools in this complex are end hafted. They're stuck in sockets. Only

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in the later periods in Northern Alaska do we get large side-hafted blades. Microblades are very common in the site, as you can see, from this representation here. They are all made of carefully selected material which is not common in the area. It may have been ~~xx~~ carried in over a very long distance. Now down at the bottom of the table is material from the Norton Complex. Unfortunately I don't have very much of it here. It is stratigraphically later than the Denbigh Flint Complex and the Punuk Complex at Punuk Point. This material here, most of it came from one of two houses which was stratigraphically above the Punuk Complex. You notice that the technique of retouching in the small bifaces is very different from that on these bifaces. At least that's my impression. Also this technique appears to me to be quite different from anything represented in the large tools up above. Perhaps we could stop here and wait for comments before we go on to the next material which is much older. This material, I think, the Punuk Complex probably dates from the third Millennium B.C. The Norton Complex from the first Millennium B.C., I believe. The other, at the other end of the table, is much older.

Crabtree:

I would like to have Dr. Bordes take this over. I'm not too familiar with the burin complex. It is strange to the Americas. With the flaking we might do an analysis of one of these from the Punuk with the Norton Complex. We might take the best example and make the comparison between some of the others and this particular one. That is, regarding the type of retouch, the thinning and the regularity of this type of parallel flaking. The length ^(1?) much greater ^{is?} than the width of the flake. The overlapping starts from the edge of the artifact and the flakes have been carried across the face to save breaking the opposite side. You will notice there is very little chattering. They feathered out with just a minimum of step fracture at this end. They did meet the other flakes on the other side. They have well controlled edges. The flakes are well spaced along the edge and the bulbs of pressure are not particularly deep. There are a few hinge fractures on this side but they have been picked up on the other side. In order to thin the tool, the pressure thinning technique was used. You will note that the material is extremely fine-grained compared with one of the basaltic groups. Look at this type and make a mental calculation of the tip of the tools used for this pressure retouch. Evidentially they had to keep re-sharpening the tip of the antler pressure tool to keep it in working condition.

(Lapse in recording)

REEL 2

Crabtree:

We have little short shell-like fractures here with deep bulbs of pressure. But, it is unique to ^{do} a pressure retouch and a serration in the same operation. This one shows more of a random technique without any regularity of flaking. They did use the same technique in their serrations in order to leave this, but it has much more pronounced bulbs of force. They moved their tool ahead, and they haven't followed the ridge in order to guide the flake with the precision they did on the other sets of tools.

Erving
Phil Smith:

Could that be due to a difference in the material?

Crabtree

The material is slightly more granular, however, the texture remains almost the same. It's a little different in character of workmanship than you find on the other one. They hadn't sufficient control as they had on the first bipoint that we mentioned. Part of this looks like a retouching and it ^{may} ~~maybe~~ be a resharpening operation that they used. It may have been resharpened and utilized as a knife. With the burin points and scrapers you might point out in which order you would like them analyzed. I'm just not quite sure, but some of these scars could have been from function, as the flakes are removed without a great deal ^{of} ~~more~~ precision. This scraper is interesting. Notice how they would curve the flakes over and terminate them at the edge. It's not too common with a scraper technique to have this regularity of flaking. However, this has been abraded slightly from use, but it is a well formed scraper from a single flake. Notice the point of force at this end. It's quite small without any overhang left on this side as the flake was detached. Of course, it is hard to tell the original length of the flake, but it was much longer than it is now. It may have been made by resharpening a much longer flake in order to get this character. There seems to be very little ^{compression in} ~~pressure work in~~ this material, however, it is a very fine grade of dark jasper. This one is another type of a flake scraper. The same sort of a

REEL 2

flat pressure tip on the two of them. These are identical in preparation, almost like the indirect percussion ^{technique} ~~sort of thing~~ that we were doing a few minutes ago. I mean it is quite comparable. But they have a little better platform preparation on this side without the long overlap on each side of the burin flake as this would spread and carry on through. Some of ~~the burin flakes~~ ^{these} and microblades are quite reminiscent of the Hopwellian type of blade. In some cases they use a ^{single} ridge and sometimes they use a double ridge. You might sort out some of the proximal ends of the pressure points ^{which} ~~that~~ are very characteristic of the Valley of Mexico ^{preparation.} It appears there is a little polishing done on the end of this flake for a platform. But this is very distinct. Notice how they have cleared their pressure point on both sides of the platform so the flake is more easily detached. From the precision of the flaking it appears that pressure may have been used in this case. I don't know whether one could set an antler tool to this side and strike with this degree of accuracy and precision, I would lean a little toward the pressure technique rather than the percussion on this side, ~~Because of the shock of the tool,~~ ^{you} you can't distinguish between this section of the obsidian blade and one from the Valley of Mexico. You can see the directions of the little striations on this side from the tearing of the flake from the core. But it is just a single section and we don't know what the length of that one was but it appears to be almost like the Valley of Mexico core.

Irving:

Don, access to.....(inaudible)

Also here are drawings of cores from which the microblades probably came. I don't know whether you can say anything about the drawings. I'm sorry I don't have the cores themselves here.

Crabtree: Well, the cores are quite distinctively different from the Valley of Mexico cores, and they are typical Hopwellian ^{types} ~~sort of things~~ ^B because these are rectangular cores, ^{cube} ~~tube~~ shaped, ~~so~~ they could keep following across the face of the core like the experiment we were doing on the long tabular block of obsidian with the same sort of a technique. But they are vertical with the face, apparently, rather than leading back in underneath and preparing a slant this way. These are vertically downward from ^{the top of the core.} ~~this sort of thing.~~

Irving: There seems to be two sub-types one with the platform at a 90° angle and the other with a platform at anywhere from a 35° to 40° angle.

Crabtree: Are they all of obsidian?

Irving: No.

Crabtree: The flakes that were removed vertical from the core, would there be a difference in the types of the pressure points or platforms. Do these flakes and the jaspers indicate two different techniques?

Irving: No, I don't believe so, I think there might be a chronological difference rather than a technological one.

Crabtree: This group in here ^{is} ~~has~~ quite..... ^{different.}

Irving: That is quite different.

Crabtree: I'll turn it over to Dr. Bordes now.

Bordes: Well, I have some comments to make. On difference - well, it is quite a new culture for me. This type of tools I don't know quite well. First thing, have you any idea of the use of these microblades?

Irving: Not very much except that I believe that they were used in a manner similar to the small bifaces. They were probably hafted in a row in a groove along an antler arrowpoint, or perhaps a knife. In another collection very similar to this, many microblades have one edge removed by a sort of a burin blow which made one edge square. It's almost like a backed blade but not made by

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retouch.

Bordes: Well, they show a little special use, anyway.

Irving: Not very much.

Bordes: They are almost fresh. Another thing about the percussion of these micro-blades, they are very straight. But I don't think quite possible to make them by percussion. I shall try this afternoon to show you ^{if} ~~that~~ it can be done. And, of the cores, some are ~~certainly~~ cores only these, you know, look very much like some kinds of ^{carinate} ~~carinate~~ scraper. Could be, you know, that they are at the same time, cores and tools.

Henry
Irwin: Could be.

Bordes: It will be interesting to see of these little retouch on the drawings are made by utilization or made on purpose.

Irving: I think there is occasionally [?] abrasion on the obsidian cores. It doesn't show up on the cores of chert or jasper.

Bordes: But obsidian, of course, ^{is} ~~if~~ very brittle.

Irving: Yes.

Bordes: Because if it was found in France it would be classified as a ^{carinate} ~~carinate~~ scraper. But this blade, of course, you say that the part which was inside the wooden shaft - was it was fresh and the outside has been sharpened time and again.

Irving: I believe so.

Bordes: It is quite possible. Have you found such things in the shaft?

Irving: At Trail Creek, I believe they found such things and at ~~Peweeck~~ ^{FRIUTAK} ~~(ck. spl.)~~ there which is much later. They are very common.

Bordes: Because you know that we have probably things like that in the Upper Paleolithic. Not this type but what we call ^{lyonelle} ~~lyonelle~~ lane la dau and we are pretty sure that they were. Those that we found, you know the problem which is up into the shaft and so that one question I ask.

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Irving: Many of the small bifaces are asymmetrical when they are in mint condition. And those, I believe, were also hafted in the side but it's not definite in any one case.

Bordes: Another thing which is very strange are your burins. They are out of this world as far as burins go. It seems to have been a very strange way of making them. They can be burins, of course, but it looks as if they took some small flake with a kind of end fracture most of them, going there, and used that ~~in its technical form~~ ^{as a striking platform} to take off the burin blow, or else they made this kind of end by bifacial retouch before striking the burin blow which is something quite strange because it is ~~characteristic~~ ^{completely different from the techniques} of the Upper Paleolithic in which you find ~~where~~ ^{there} as good a ~~technical~~ ^{striking} form as possible to take off the burin blow.

Here it is a very queer striking platform. Or perhaps they did it after. I don't have light enough! No, no, no, it was struck on this end - this ~~valuable~~ ^{chiselled} striking platform - very strange.

Irving: Excuse me, but looking at the whole collection of 175 of these burins, you find, well, there is one burin blank with no spalls knocked off. It's simply a triangular flake retouched to this shape, a trapezoidal flake. And the retouch is already there on ~~the surface~~ ^{this end.}

Bordes: Ya, ya, ya!

Irving: But they also did subsequent retouch on some of them.

Bordes: But most of them have this ~~same~~ ^{strange} preparation which is ~~different~~ ^{completely}. Here is one which is more right of burins. It's amusing. There has been first a burin blow like that in the longitudinal line and probably after that the burin was used. They made some retouch and perhaps they took it under a burin blow. I'm not quite sure. It's difficult to tell. ~~It could be.~~ ^{It could be a fracture.}

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Irving: There are many broken burins. This is the broken end of a burin, and so is this.

Bordes: Of course. But you have always this strange queer preparation. I will try tomorrow to make something like that. This is the first time I have seen something like that. As for your burin spall - yes some of them have been

sharpened ~~shot~~ really to make something of a small *bores*, *microbores*, *micro-bores*.

Irving: These pieces of antler were cut with burins, I believe.

Bordes: Ya, it looks like. But your small burins - *you know*

Ya, ya, ya, no question. That has been done with a *burin*. But it looks as if there were *rather* other light tools for this little work. Well, it could well,

be that this special preparation is another manner to make a type of *blade*

which is fairly common in the Upper Paleolithic in France which is, I don't

know how to say, or to describe it in English because *a ronde barreau* (*hound barrow, ck. spl.*)

ronde of point of barreau ~~w/Earl~~ or point of barrow and it works like that *en fait* and that could be *same thing* ~~something~~ Different way to make the same to get the same results.

Ah, these are scrapers! Small scrapers!

These are nice.

And these could be Solutrean.

I can show you exactly the same in upper Solutrean.

Irving: These are so consistent in size that I think that they were made to fit almost a *standardized* ~~standarized~~ handle.

Bordes: Ya.

A and this? This one *ah* this is a funny, Solutrean.

Ah, you say that this is a knife.

Irving: I believe so, yea. *These* are other examples that fall in the same category.

Bordes: Why?

Irving: The other examples have much less taken off here. They are bigger and triangular this way. I think that it was held in the handle this way and sharpened down to this little point.

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Bordes: Ya. Here is a burin blow.

Irving: Yes. For sharpening perhaps.

Bordes: Ah. I don't know. I think they missed.

Irving: Accidental?

Bordes: Either it was an accident or they tried to make a burin and they missed it. But, let me see. Oh, there is no question. There is another burin blow at the other end. They made a burin out of it - an ordinary burin.

Irving: That I think was a hafted knife, whittling knife.

Bordes: Ya. It could well be. I am not familiar with the Arctic culture. I am following up with something, that's working with flint tools. And what difference what you are working with. If it is to cut something soft well then it pays, to put handle but if you want to work something hard you use more time putting the handle on flint than you would making other tools. So I wonder really if most of these things ^{were} ~~we are~~ hafted.

Irving: Many of these have lots of retouch. No they're sharpened many many times. Always on one edge not on the other edge.

Bordes: Ya, ya, ya.

Irving: Some have grinding or polishing along these basal edges which, I think, may have to do with hafting because of the end scrapers and the burins also.

Bordes: With ^{hafting or with} ~~that thing it was~~ holding, you know. The other doesn't matter, you know. I know that in Artic, the people had hafted tools and I am fairly sure that the Upper Paleolithic and then in the ^{capitalized?} middle had some hafted tools. But you know, the time you spent to put the haft to a thin knife is so big compared to the time ^{your knife} ~~you might~~ can really be of use that I wonder. ^{another} ~~How does it~~ ^{thing} ~~feel~~ about the sharpening of the edge. Of course, it's sharpening in a way, but I will say that nothings cuts as well as a fresh flake without any sharpening. So if I will project the preparation of a.....Ah, what is the word.

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Irving: Make the edge stronger.

Bordes: Ya. To do it. I don't find the word.

Crabtree: Change the angle?

Bordes: No.

Henry Irwin?: Scrape?

Bordes: *Regularize side*
 Rather than to make it sharp and also to change the end of it because with a fresh flake you can cut meat very easily, ~~but~~ as soon as you work on something hard, it crushes and becomes serrated in a bad way and you can do not much with it. With this, it cuts less with the retouch. It's much less cutting. I ~~couldn't~~ *would not* do that you see with a fresh flake, but you can scratch or score the skin without cutting edge. And if you want to work on something hard, well, this was done with a blade, *alright* ~~alright~~ a blade with some reutilization. You can see by the undulations. It bites and then slips, and bites, and slips. When you want something really good, really smooth you use a technique which is different and which I think was used by the Upper Paleolithic. You work that on the side of the burin like that.

Irving: Many of these burins have that kind of use retouch. This one does.

Bordes: Let me see.

Irving: It's pretty hard to see. No. It's not here, I'm sorry.

Bordes: Not this one.

Irving: No. I'm very sorry.

Tixier: The other is burin spall.

Bordes: *Ah, yah - it could well be. Just stop the recording a minute*

Irving: *Crabtree* Yes. Do you see any signs of heat treatment or can you tell?

Crabtree: Without the core, I find it difficult. I find that these are indicative of heat treatment. The other is very fine-grained, ~~with~~ with the core, one could perhaps pick up a facet of the outside of the original surface for comparison. I don't see any of the outside edges of the cores on these particular ones.

This hafted knife with the burin point or whatever, has, of course, a retouch on the outside, ^{but} it appears to be the same texture throughout. This is the entire flake but one would have to study the cores to determine whether there was any difference in texture. I hate to start an argument with Dr. Bordes about the retouched edge of this artifact, but actually, by re-touching you can produce an extremely razor-sharp edge. But this example appears to have been abraded and the flakes hinged back ~~to~~ ^{functional} by function, from scraping ~~and~~ ^{carried out} these little short flakes are broken back inward and ~~they~~ are not full length out to the edge. ~~But~~ ^P by setting the platform ahead each time, you can leave ~~the same~~ ^{a very} sharp edge by ~~the~~ pressure retouch. However, as Dr. Bordes said, for regular cutting, a fresh struck flake is much sharper, ~~a~~ ^{if} a fresh struck flake has more regularity, but hasn't the strength of a pressure retouched edge. ~~By retouching~~ ^P properly ~~you can still leave that~~ ^{retouching will} razor edge. However, it won't have the regularity of the ~~original~~ ^{original} flake itself. ~~But~~ ^{this} it appears ~~there has been heat treatment~~ ^{to have} particularly with this sort of ~~chert~~ ^{chert}. That's almost opal-like in texture, and ^{not} it is not opal. It's one of the hard cherts or agates or ^{SILICEOUS} silicious materials. I think that is all the comments I have on this particular piece other than they may have devised two methods of detaching these burins which is ~~not~~ ^{highly} likely. ~~By~~ ^P percussion on obsidian ^{produces} you get undulations and ~~the~~ ^{these} flakes are extremely flat and extremely smooth on the side. My experience with obsidian and direct or indirect percussion has ^{produced} ~~been~~ a flakes with many ripples from compression. It would be difficult to determine the placement of the tools without the core. But from these broken pieces these short flakes and the size of the platform and the very flatness of the flake on all three sides, this edge and this edge, and underneath, the surface appears to be very smooth and extremely regular. This is not too characteristic of a percussion ~~sort of~~ blow on obsidian. With the ~~using~~ ^{using} pressure ~~we~~ ^{gives} have more strength and there is not much undulation

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in the flakes detached.

Bordes: Here are some percussion small blades.

Crabtree: Yes, You see on the edges of ^{this} blade the slight compression from percussion. This one is thicker and of flint and it won't compress as much but it does have a slight compression. But ~~with~~ the heavier the dorsal ridge ~~is~~ on the flake, the less compression there can be. The thinner the flake, the greater the amount of undulation.

Epstein: Dr. Bordes, where are those specimens from?

Bordes: This, I made them. Just some small blades made by percussion.

Crabtree: This is quite a flat one but it is a bit thick. It's thickness eliminates the undulations. This is a little thinner one and you see a few of these waves but it's not as obvious in flint as it is in obsidian. So perhaps it could indicate maybe two methods of detaching.

Bordes: These are not the best that can be made by percussion.

Crabtree: Right, right.

Bordes: I will try to make better and see if they compare with this.

Crabtree: True.

Irving: Shall we move on to the ^{ANANGULA} ~~Anagula~~ specimens then?

Tixier: I think there were many innocent remarks made on this bladelet and also on this burin. An important thing on this burin, I think, is they were polished. It's the first time I see the two techniques of polishing and then burin spalls. I never saw this even, I think, Professor ~~Hoshisaki~~ ^{YOSHIZAKI} (ck. spl.) show me things like this.

Irving: Possibly, possibly. I don't know of any from Japan. But it's possible that some should show up.

Bordes: No, not from Japan - from Alaska.

Irving: From Alaska more likely. But if they were from Alaska they were probably from the very same site. He has some of my specimens.

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Tixier: Something very characteristic in this burin ^{is} there, ^{is} here, you see, a notch, and this notch was always removed always remade before ^{every} ~~each~~ burin spall. I think this is very important. It's a very complicated technique, you see. Both these bladelets. I've rather nothing to say after Mr. Crabtree and Prof. Bordes, but I think there is one important thing ^{on this one,} we can see the preparation of the core. You see. And I think this preparation was like some preparation - Yes. Here is. The original thing is the under-form by striking the platform and the bladelets. It is very, very sharp. I never saw this but in Egyptian ^{PROTO-} proto-dynastic. There are such cores or ~~the kind of~~ ^{carinated} scrapers with this very, very cutting edge, you see.

Epstein: Professor Tixier, how does the notching compare in regard to the burins of the Norton Complex?

Tixier: I think it's a notch.

Epstein: How well does this compare to the Noille technique? Would you?

Tixier: I think it's just the contrary. In Noille's technique the notch is made to control the end of the burin spall. Here, I think, the notch is made to have the burin spalls longer, you see. I think it's just the contrary.

Bordes: Could be. It could be, but I'm not so sure. It could be.

Irving: It could be to eliminate the jagged edge left over if the burin is to be used later for scraping.

Bordes: No. But the better thing ^{would be} to try and make some of these burins and see ^{if} ~~how~~ it works.

Tixier: The ^{problem} ~~program~~ is what part of this burin was used? And why ^{polish} ~~polishing~~ the two biface and dorsal face ^{why,} where?

Irving: Relatively soft material as compared with the other burins.

Bordes: What is this material?

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Irving: I don't know. It's a relatively soft either volcanic or sedimentary material, but it is used for ^{no} ~~not~~ other artifacts at the site.

Bordes: And this, this polishing could be the result of working, you know. Working like that going inside the groove.

Tixier: Yes, but this one is polished all around.

Bordes: Ah, yes, but you can also ^{use} the side to cut. ^{With a burin, you know,} ~~I don't know.~~ You can do a lot of things with a burin, ^{except} kill your mother-in-law.

Byers: Isn't polishing characteristic of the burin blanks in the Arctic ^{Small} ~~tool~~ ^{tradition} division all the way across to the Atlantic.

Irving: Burins are very commonly polished when they show up in ^{SARQAO} ~~Sark Arc~~ (ck. spl.) and pre-^D ~~dorset~~ ^{type} technique. The same sort of polishing and often more extensive than that which shows up on these. That is sometimes almost the whole implement is covered by polishing and then the burin spalls are removed after that. ~~Is that,~~ ^D does that answer your question.

Byers: That's what I had in mind. This is true in the Labrador ~~burins~~ ^{and the Dorset,} burins too.

Irving: I believe so. Yes, and Hudson Bay and throughout the Arctic ^{ARCHIPELAGO} ~~Archapellego~~ (ck. ^{SARQAO} ~~spl.~~) and in Greenland. In ~~Sark Arc~~ (ck. spl) and Greenland almost all the burins are polished like this.

Epstein: Bill, can one see a direction in polishing here? What I'm thinking of is, some of the materials from El Inga that Bob Bell has. He has a side scraper, concave side scraper, that show ^s definite striations in the direction of the edge; just straight away from the edge, and I'm wondering whether there is any direction visable in the polishing of your burins.

Irving: The striations that I have seen go in all directions. The striations go in all directions on these burins as far as I can make out and there is no complete regularity. They are at several different angles to each other.

- Epstein: Well then another question comes to mind. If possibly they are not the result of use, Mr. Crabtree, do you see any possible connection here between this polishing ~~on~~ the surface, or what seems to be the surface, and possibly the edge polishing that you've been using in working flint?
- Crabtree: Well, Jerry, I haven't examined the burins. I left this up to the people who are familiar with burins and I am not familiar with them and I really didn't examine these. With burin technique, I have had little experience. So I'd rather not make any statement regarding that.
- Epstein: Well, just an idea. I was wondering here whether you use edge grinding as a technique of strengthening the edge so that it can withstand impact.
- Crabtree: Yes.
- Epstein: And I'm wondering here whether this grinding which is on the surface may possibly ~~prevent~~ prevent, or make the burin edge that much sharper because it may possibly ~~prevent~~ just prevent flaking on the other side.
- Irving: That's possible, Jerry, but I'll point out that some burins made of soft material, or all burins made of soft material, are polished on the faces. Almost all the burins made of chert or chalcedony, jasper, or whatever it may be, have edge grinding on most of the edges. But they don't have polishing on the faces. The edge grinding may well have something to do with preparing the platform for knocking off burin spalls, but it occurs on other edges as well so that it may have had something to do with protecting your fingers when using it or hafting the thing. The polished burins, I think, when you examine all ^{ten} ~~10~~ or ^{twelve} ~~12~~ from the site, it looks as though the polishing was a way of obtaining the shape of the tool, but there are other ways to interpret.
- Bordes: The best would be to experiment, and see how we can make these. Well are there questions on this material? Well lets go to the throwing ones ~~and~~...
- Irving: The material at the other end of the table is from the ^{ANANGULA} ~~Anangula~~ (ck. spl) ~~Site~~ ^{Site} in the Aleutian Islands excavated by Professor ~~Baltman~~. *Laughlin*

(rest of statement inaduable)

Bordes:

This is definitely not an upper Paleolithic site even if there are special things. Well about the size of the cores and the size of the blades. It seems like these people have not too much in blades but they went on and on because the cores are small. And it seems they had two kinds of blades. Big blades were struck by either hammer technique or punch technique, perhaps. And also smaller and more regular blades which were struck from a special core and I believe that Tixier knows this type of core quite well in North Africa. The doublets are quite normal. There is nothing special to them except that some seems to have been slightly worked after into a kind of tool. The retouched blades are certainly retouched on purpose. This one is probably just utilization but that is certainly retouched on purpose. Looks a little like Aurignacian or Upper Magdalenian blades. This also ~~is retouched~~. I wonder if this is a fracture or if it is trying to make a longitudinal burin. I am not sure. It is difficult to tell. But if it was to make a burin, well. ~~There~~ ^{is here} are some similarities, some slight similarities, with the technique used on the other side. The striking platform is dihedral and perhaps slightly polished. I am not sure. I would need a better glass than we have here. If it is a burin. It could be a fracture. So the transversal burins they look very much like some from the raw material in France. What we call transverse burin and natural retouch. They made retouch more or less abrupt and took one or two burin blows on the edge and gave some of these burins which are quite normal. This one is slightly on a notch, not quite. More or less. Slightly, I said. This one also you could lose them in a Lower Magdalenian site in France and except for the nature of the material you could not take them out after. The end scraper seems short. One of them is even of the ~~thumb~~ thumbnail variety - like in Azilian or late ^{Azilian} Magdalenean. There is nothing special to them. They are good, nice, small scrapers. Some seems from the picture burin short blades. This could be a burin spall, but I am not sure. It could be also a small blade.

Aurignacian

retouched on purpose

Magdalenian

Magdalenian

Irving:

These are thought to be burin spalls.

Bordes:

Ya, these are. These are burin spalls and short ones. Since they are coming from transverse burins most of them. So they can be longer than the width of a blade, of course. Ya, it's an interesting thing. I guess I have said all I have to say of this small amount of material and I leave to Tixier to say more about the cores.

Is something missing here between the above? and that at start of the following page?

- Tixier: After all, I think it would be very interesting to try to get the relation between raw material and tools. Perhaps all end scrapers or thumb nail scrapers would be made in obsidian and all transverse burins on blades in another raw material.
- Irving: I believe that is almost the case, but not exactly true. This is very nearly true, if not exactly true. Almost all of the end scrapers are made of obsidian. I believe very few of the transverse burins, if any, are made of obsidian.
- Tixier: I tried to make such a work for Neolithic sites of Southwest Sahara. All bifacial retouch was made in green jasper. All microblades and all geometric microliths and all microburins were made in flint or chalcedony, you see. And all polished material in another raw material which is a volcanic one. I think basalt - or something like that. I think it is very interesting.
- Irving: It is. Especially when you contrast the ^{Anangula} ~~Anagula~~ material with that from the Penuk Complex in which end scrapers are never made of obsidian.
- Tixier: It is a different region I think. All these cores and ^{bladelets?} bladlets, they are very familiar. It's very funny for me because it's small cores.
- Irving: Small cores.
- Tixier: Small cores. Ah, exactly, but exactly the Upper ^{Capsian} ~~Capsian~~ technique from North Africa. They prepare their core. The preparation is like that of a hand ax, you see. We call this core "Abone evequevan" - like the hat of a Bishop. And then, they prepare their striking platform with only little, little flakes but these little flakes have the hollow bulb, you see. ^{bladelets?} They pushed out bladlets perhaps by pressure, perhaps by punch, and then they were always refreshing their striking platform, always, always, always. They were turning all around their core. It's something different like this core. They were turning all around and they proceed here and here and here. I think these cores were held in wood vise or some other means like the obsidian cores. ^{bladelet} It's very interesting. And the characteristic of this bladlet is they have edge - very regular edge - very straight edge - and a little bulb, a short bulb but well marked, you see.
- Wormington: Bill, did you, by any chance, have a chance to compare these cores with the pictures of the Siberian cores that I sent to ~~McCartney?~~ McCartney?
- Irving: I have not.
- Wormington: They seem extraordinarily like the material from the Lake Baikal area, and I have sent McCartney a whole series of photographs of the Siberian cores. I think you'll find they are very similar.
- Irving: I've not compared the pictures that you sent McCartney with these myself. I'm not surprised to hear this, however. At the same time, there are many rather trivial variations in core technique which show up between Alaska and the Far East.

And the taxonomy of these things is something that mystifies me at this point. Beyond saying that they have similarity, I can't carry it much farther now. I can recognize certain differences between, for instance, the Sikotz micro-blade cores in Japan and any that we see here on the table. But I don't know how significant these differences are.

Epstein:

I went to the American Museum of Natural History and looked at the material that Nelson had brought back from Tibet. And for what these comments are worth, I could see no difference in the blades themselves. They had minute platforms small at the tip at the point of percussion that they could possibly be. But the cores from Tibet in the American Museum collection were very, very small and very narrow whereas these are quite wide. And, perhaps because they were so very small, the faceting on the platform was much more delicate and perhaps much more precise. But other than in terms of the width of the core, the techniques were very, very similar.

Irving:

Very similar. If you'll pass me down the drawings of the Campus material - the other ones at the far end of the table. These are drawings of the cores from the Campus site made by Yoshizaki and you'll notice that these, too, are very narrow and they contrast to a certain extent with these, both in the platform preparation and in the preparation of this leading or distal edge of the core. They are perfectly consistent. I think these are different from the Arctic Small Tool tradition cores. They may have something in common with some of these Aleutian cores but look much more like Nelson and Barringer's cores from Central Asia, to me, than do either of these. But this is just an impression and it may not be very significant because I still don't understand the permutation of all these features that go into cores. They are very difficult for me to figure out.

Tixier:

I think the first one who spoke about transverse burins is Vignard. The problem is purely in Egypt. Do you think so?

Phil
Smith:

Definitely.

Tixier:

And what about your conception of Vignard's burins?

Phil
Smith:

Yes, they look very much like some that Vignard had.

Tixier:

Did you try?

Phil
Smith:

No, I didn't. I went to ^{NIGER} ~~Niber~~ Valley but I could never find any burins. But they also look like those that McBurney has.

Tixier:

At Ed Dabba - Cyrenaica.

Phil
Smith:

Ed Dabba in North Africa. Now I find that Chmielewski has reported from Poland that they also occur in the upper Volta and Lebanon. So possibly they have a wider distribution than Vignard thought originally. Technologically they appear to be the same.

Irving:

May I interpolate that these transverse burins are, while not identical to the burins from Shirataki and Sakkotso sites

in Japan, they approach those Japanese burins more closely than any others that we have found in Alaska. Somewhat similar burins, different in detail, but still somewhat similar to those that I spoke of just a moment ago. These were recognized by Yoshizaki just recently.

Bordes: I think there is a difference in these burins and those from Cyrenaica. The burin spall is not at all the same. It looks very much like, let's say for instance, Lower Magdalenian than the material from Cyrenaica.

Phil Smith: Yes. Chmielewski has recently suggested that the Cyrenaica burins were produced by a twisting technique rather than a burin blow and he says that he has produced them himself.

Bordes: I would like to see that.

Phil Smith: So would I.

Bordes: After seeing what Crabtree has done, I will never say again that something is impossible. But I would love to see this twisting business. Because I have made Cyrenaica burins and they are not difficult to make but they are quite a different technique than this.

Crabtree: Thanks, Dr. Bordes. There seems to be a little different preparation technique in a few of these flakes showing flats where the burins have been detached. Of this type here, I think two are the flats and the others have slightly different end preparation. This is remarkable work with basalt. The end character has disappeared, but it is extremely tough material - awfully hard to work. But this particular piece shows a great deal of control. But back to the core. This one is a very interesting core because of the edge preparation. It seems similar to the polyhedral preparation. However, he lost the angle on this side here preventing it from being a perfectly round polyhedral core. And each one has, as Dr. Tixier said, the individual platform preparation. But the remarkable thing is this feathering out to the edge without undercutting too badly. A slight hinge fracture on this side. This one is a single facet of the original surface, but it certainly appears to demonstrate the heating technique. Here is one facet untreated and you see the joining flakes after they were detached showing the heating of this side and the change in texture.

Irving: This is the most regular of the small Anangula cores.

Crabtree: I think it is quite obvious the change in texture of this unworked facet in relation to the worked material.

Bordes: Ya, ya. Do you think that these blades have been pushed out by pressure?

Crabtree: Well at least supported solidly here at the bottom so that the blades will feather out. ~~But~~ The support of an anvil is needed in order to get this to clear and get this shearing and feathering out to a straight sharp edge. If the core is not supported, the blades or flakes will curl under the bottom of the core. These ~~bulbs~~ of force are quite obvious
bulbs

and distinctive and it is difficult to tell if the indirect punch was used or pressure or percussion. But the straightness of the flakes indicates support with an anvil. The precision shown on this core would indicate that if percussion was used it would almost involve the use of an indirect tool. However, if one had your ability at percussion, Dr. Bordes, it is possible that percussion could be the method of manufacture, but I feel it would still need the support of an anvil. I rather think it is some form of pressure technique but I would have to do a lot more experimenting before I could determine the difference in the fineness of work done by pressure vs. percussion.

Have to?

Bordes: I agree, but always to experiment.

Crabtree: Uh, huh.

Bordes: Any other question on this material.

(Lapse in recording time)

Irving: These points are interesting. Oh, there are some technological features that are interesting but they are mainly interesting because they probably come from the first occupation of the Barren Grounds after glaciation. And evidence now seems to indicate that the country was deglaciated eight or nine thousand years ago which would bring them into line with their identification as Agate Basin Points. The only material readily available for use there is this quartzite which you see that most of them are made of. These things, I just asked Professor Byers about and he agreed that they might well be comparable to the work-like implements that come from Debert Site and Bullbrook and one or two other sites. Am I misrepresenting you?

Byers: No, not at all.

Crabtree: I am unfamiliar with quartzite and I have done very little work with it. These show an extreme amount of control and the cross section is very regular and double convex. The difficulty of handling this material in relation to other material is because of its containing little granules of sand that have become cemented together giving less edge strength and allowing platforms to crush. Inspection with the glass indicates this is made up of beach sand rather than stream sand. Stream sand is more of a breccia and more angular which makes the mass more homogeneous. I find that the beach sand type of quartzite is a little different in working character. However, these are little round grains that appear to be ~~beach~~ or ~~lake~~ sand, but the thinning of this coarse material, which is extremely granular, shows a great deal of control. To have thinned the artifact to this degree and leave a sharp edge on this type of material is extremely difficult.

beach
lake

Irving: May I identify those? Things that are tentatively called something like Plainview but it's hard to nail them down because the material is poor.

Crabtree:

Now this is something else again. The material of these artifacts appears almost impossible to work and it would certainly take a very expert person to handle material as coarse and granular as this. This is even much worse than quartzite; there is no comparison. It just does not give sufficient edge strength. And with this coarse material, which has intertwining grains, there is not the flexibility that we find in a fine-grained material. The platform will collapse before you can carry the flakes over the surface. However, this shows the ability to carry the flakes over and to meet them exactly in the middle with no step-fractures and no hinge-fractures. It's a remarkable piece of work and it is comparable to some of the illustrations I have seen of El Jobo using the same type of technique and leaving the same worked character. The character seems to be the same as in South America where quartzite was used for this type of Lancelot lanceolate blades. And if these were mingled with the South American blades, I don't think one would be able to tell the difference. Are they comparable in style and workmanship, Marie?

Wormington:

Somewhat similar, I think.

Crabtree:

Now these pieces here are of decidedly different material than the other granular quartz. This looks like a very fine material which would permit excellent control and it appears that they did have control. However, the work on a couple of the others is almost equal to this fine-grained material. It shows a great deal of artistry and symmetry of edge technique.

Irving:

This is different in type from the ^{lanceolate} Lancelot point. It is different in technique, or can you tell from this material? This and this are similar in shape at any rate.

Crabtree:

^{POINT} This one here has pressure going in at a right angle. Flakes are slightly oblique. This one is slightly oblique and ^{APPLIED} between the two ^{POINT} here and here - are the last row of flakes ^{FRANKING - This is} which indicates a technique of flaking on one side ^{with turning the} for a right handed man, and a left handed man will turn the ^{point} artifact over. However, these flakes were removed at the same time, and these were removed at the same time rather than alternating. ^{FRANKING} Because of the regularity of this one, it is hard to tell the difference. ^{POINT} The material is not ^{used on the 2.} sufficiently distinctive to define the flakes and actually ^{point} determine the characteristics of workmanship. But the smoothness and the regularity of flaking shows a little better flaking technique. They were held at different angles to produce this thicker ^{act} material. They had thinned this type of ^{THE POINTS} side-notched down, so they had a routine angle of thinning, which is a little distinctive. The straighter the angle, the more risk of step-fractures. With the steeper angle on this side, the risk is less and it is easier to carry the flaking through. These will carry thru and terminate. But in thinning, the steeper the angle is from the edge, the more chance of step-fractures. This is a very remarkable work in quartzite and this one of Bull quartz - as I call it - is just impossible to thin. This is a little thick but the work is very good and there are indications of basal thinning. In relation to El Jobo, this one does have hinge fractures and step-fractures and it is not comparable, as I had thought.

and flake each side alternately
does not allow sharp definition of the slope same

It does not compare in regularity of flaking and symmetry. That's all that I can determine from this group. The basal thinning and the basal grinding is interesting and the corner notching and the meeting of the collateral flakes. This one also has a slight basal thinning with well controlled flakes. It is very difficult with this type of material to get these long, narrow flakes and at the same time bend them over the surface. Some of these flakes do carry on over which would indicate the ^{palm holder} method of holding in the hands. ^{applying force toward the tip} This one is unique. This shows a reverse, back-hand instead of the natural shoulder pressure to make the flakes meet on the opposite side indicating it was done in the left-handed manner. Unless this was done by a left-handed man. This one also is a left-handed technique which is unusual. This one is quite direct in toward the center but these back-handed techniques indicate that pressure was applied away from the worker or that the left hand was used. Pushing away from the body lessens the leverage when pressure is used and these do indicate pressure. It is difficult to hold the artifact against the thigh - press down with the shoulder and catch the flake between the fingers and, at the same time, force the flake out away from the body. The usual method is to hold the artifact in the palm of the hand and press toward the body which gives a diagonal flake going ~~toward~~ ^{from} the tip rather ~~than~~ ^{to} the base of the artifact.

- Tixier: I pick up a piece and I think this is a bit of ^{lanceolate} ~~lancelet~~ point and now it is just like the so-called Piece esquillee of France of Upper Paleolithic.
- Irving: Is it really?
- Tixier: I think so. I think so.
- Irving: I don't know these
- Tixier: I think Madame Bordes. Madame Bordes should speak.
- Irving: I would be very pleased to have this identification.
- Tixier: Have to see and to say.
- Madame Bordes: Yes. On this side.
- Tixier: Both sides.
- Madam Bordes: This.
- Irving: There is one other example, I believe.
- Tixier: How do you call this?
- Irving: It's a new feature to us and we don't have a name unless Professor Byers wants to suggest one on the basis of his material. These things that are comparable to your Debert and Bullbrook wedges.
- Byers: Will, I think the word wedge is probably useful.
- Irving: It looks as though they will be called wedges.

- Tixier: It looks like Piece esquillee of the upper Paleolithic of France.
- Phil Smith: A couple of years ago I saw those from Bullbrook and last week I saw those from Debert in Detroit. They look very much the same. The kind you find in North Africa, as you say. George Mac Donald - has used the term lozenge for several years. Of course, this is something which will have to be decided by you people, as you say.
- Byers: If their function is wedges and they are known to have been used as wedges, I think wedges is far the better term to use for them. A characteristic of bipolar flaking.
- Phil Smith: Yes, if we could be sure that they were used as wedges.
- Byers: Of course that work of Semenov indicates that the similar forms can be produced in that way. George has produced his that way, experimentally that is. Not the ones from Debert.
- Tixier: There is a problem about Piece Esquillee because I know Piece Esquillee in flint, quartzite and also Sacarroline quartz. But the matter of utilization, I don't know.
- Irving: I've been told, but I am sure that I remember myself, that similar things were found at Star Carr in pieces of antler that had been grooved. Does anyone recall whether that's the case? George Mac Donald mentioned this as a European example of this technique.
- Tixier: A European one?
- Irving: At Star Carr in England. Yorkshire, I guess. The Mezolithic site that Clark is doing his report about.
- Jelinek: Looking at the quartzite material from Quiwate, I'm very much struck by the similarity and control of the material although not the specific forms with the material from the George Lakewell Colonies on the North shore of Lake Huron that Greenman excavated and with, in general, what Quimby calls the Aqua Plano industry which recently shows up in the Great Lakes area as apparently an industry related to the late Plano industry of the Northern plains. Frequently this material is done in quartzite and always, I think, shows the same precision control of the material that you see in the specimens here. This, I think, would tend to link this material in time to the horizon that can be postulated between eight and nine thousand, B.C. or perhaps a slight bit later for the specimens from Quiwat.
- Irving: Thank you, Arthur. I get the same impression from comparing this material with the material from Wisconsin. I'd like to ask Dr. Wormington if this compares with any material that she has from Alberta.
- Wormington: Yes. Quite closely I would say. Not excavated - surface collections.
- Irving:= This is all from surface sites, as well.

What does
Jelinek
refer to
here
is spelling
right?

- Henry
Irwin: May I make a comment. Notice on two of these projectile points bases there are strokes that resemble burin strokes.
- Irving: They look very much like that.
- Henry
Irwin: I wonder how they were not created in their beginning stages of use by the wedge or something. This is the type of fracture that necessitated pounding down on.
- Irving: I'd hesitate to say. There are several burin facets or burin-like facets but what they mean I am not sure. It's hard, at least hard for me, to detect any wear patterns on this quartzite.
- Bordes: It seems from the choice of material that these poor people had not much. And so I think it is quite natural that when they broke a point that they should make a burin on it. It's easy enough and also a lot of time in the Solutrean. On a broken Laurel Leaf they made a burin, or a double burin, or a burin and a blow here or a scraper on a burin and so on.
- Wormington: It's rather interesting, I think, that of the Alberta material all the points of this shape are of quartzite whereas our finely parallel flake points of Scotts Bluff, Eden, etc. are done in very fine-grained chalcedonies. But whenever we get this particular form, it is always made of quartzite.
- Irving: This is also true in Wisconsin where most of the ^{lanceolate} ~~lanceolate~~ points of this general form are made in quartzite whereas most of the Archaic material is made in some sort of chert.
- Wormington: This is quite consistent in the Alberta material.
- Crabtree: This shape of point is adaptable to this material in order to give it sufficient strength - to make it of sufficient thickness and with a tapering edge. If you would try to thin this material down for a narrow point, it will fracture. And it hasn't the strength of chalcedony because of the lack of intertwining grains and so this shape is very good for this type of material.
- Alan
Smith: Should we perhaps move to another discussion.
- Byers: Doug Byers collection This collection is from Debert, Nova Scotia. Doug Byers Collection We have three radiocarbon dates of nine thousand (B.B.) plus or minus fifty years. Other dates will follow and we can't tell how it will come out. It's a typical Eastern Paleo-Indian site with fluted points and non-fluted points of the same shape. The material is chalcedony of various colors and of various textures. It is faulted and faulted chalcedony and, as a result, there is no prophesying the form that the points will take or the artifacts will take. One thing that is characteristic of it, is a great quantity of scrapers. I see that I did not bring any end scrapers with me - there are end scrapers with graving spurs. There are many of these little so-called gravers or perforators. We thought that we had exhausted cores, but I think that those are wedges. They seem to be characterized by bipolar flaking. Burin spalls, I think, are simply spalls that come off of these
- B.P. or B.C.?

Byers:

wedges. Advanced publicity went out talking about micro-blade tradition but I'm sure that this was completely erroneous and these are simply these wedges. The great number of flakes are all retouched for side scraping purposes. Almost no flake is unretouched in some place. Some of the flakes look like blades, but we have found no cores and there are no true blades that we see. There are chance similarities to them. Anyone have any question?

Bordes:

Well, first question. Where is the dividing line between these two ~~sides~~ ^{sites} here?

Byers:

Right here.

Bordes:

Does this belong to this? O.K.

Byers:

Yes.

Bordes:

Well, first of all, the first thing I see here are beautiful Piece esquillee which could come from any, let's say for instance the Lower Magdalenian One from Laugerie Haute. Exactly the same kind. This also is beautiful. What was the use of this thing, ~~whereas as a~~ ^{whether they were} wedges it is quite possible. Another similarity with Lower Magdalenian is this multiple perforator which are very common in Magdalenian One also. Of course it's just a convergence - no. I don't want to have my Magdalenians swimming thru the Atlantic. But it is interesting to see this convergence. And there you have which looks to me as a perfectly good blade retouched on the two sides in a way you can find in the Aurignacian O.K., of the Proto-Magdalenian or even some Mousterian. It's really a good retouched blade. Side scrapers on ~~Flakes~~ ^{flakes} which could very well be Mousterian, as well. Or some in the Upper Paleolithic in the Solutrean too. I must say that with the materials they had they did a fairly good job, because the poor guys were not troubled by material you know. About this big - oh, that's a beautiful Foliate point. That could be Solutrean, too - but not quite. There is a trace of polishing by use on some of the facets it seems. Or perhaps this was a little too out or they took too much out for their taste and they tried to rub it out and were not patient enough. This big fluted point on this side there is fluting, no question. What do you think, Mr. Crabtree?

Crabtree:

Yes, I think so.

Bordes:

But on the other side, I don't see any fluting.

Byers:

There is no fluting on the other side.

Bordes:

I see just a flat face on a flake. This is also, no question, not very well. They should have taken lessons from Crabtree. But, well, they did what they could, poor guys. I could not do the same, so I had better say nothing. They are nice, considering the materials. This one is good material over there. Don't you think so?

Crabtree:

Very excellent.

Bordes:

Very good material.

Crabtree:

It certainly is.

Should this be capitalized?

Aurignacian

- Bordes: And they did not much better with this very good material than they did with this coarse material. That was a fracture and they did nothing. It could have been rather easy to take this imperfection out, but they did not seem to bother with it. It served their purpose as it was. They were not perfectionists, your people.
- Byers: That fracture may have been made by the boy who found it.
- Bordes: No. No. I don't know. I'm sure not. That fracture is old and you have some flakes coming out of it. It was taken as a pressure platform from here. So it's old, you see - this one, no question. Ah, here is an end scraper. You said you brought none, but here is one.
- Byers: Well.
- Bordes: Yes, no question. That's a nice end scraper with retouch all around but that's an end scraper. What else. That - ^{l.c.?} no it's not an end scraper. It's a kind of foliate or scraper with bifacial retouch. That's also a kind of side scraper. You know, that is very funny. We could select some tools here and make some good Mousterian and some good, not complete, but some Lower Magdalenian and a little bit of Solutrean. You know, what is striking in this American Culture is that they have characters which are found in scattered Old World Culture and which you have ~~got~~ right here. This Piece Esquiellee is very good. Well, now that is probably also Piece Esquiellee but at the extreme end.
- Tixier: I didn't describe this in my thesis. All this group of pieces is from Piece Esquiellee. This is not a burin spall I think. First of all there is no burin and it is, I think, the shape of the Piece Esquiellee.
(French)
- Phil
Smith: Yes. Yes. Yes.
- Bordes: When you strike too much on a Piece Esquiellee and use it time and again at the end it fractures not burin like that, but in ^{no capital} Octagon way and gives you this kind of prism. That I can do very easily for you to show you in two minutes if you want. For it is very easy to do.
- Byers: I think these are the exhausted cores that John Whitoff found at the Shoop's site.
- Bordes: I think it is not a core. It is not.
- Tixier: No, it is not a core.
- Byers: But this is what John Whitoff calls an exhausted core.
- Bordes: But they are not.
- Byers: They are these Piece Esquiellee.
- Bordes: Ya, they are, no question about it. Well, what else is to be said, not much. Except the rhyolite.

- Byers: Yes, they had rhyolite for hammerstones, but they did not use it for projectile points or tools.
- Bordes: Well, that's a flake, you know. Could have been used as a crude flake to cut, you know.
- Tixier: Scraper.
- Bordes: Scraper? No, I don't think so. You could make a scraper, but they didn't. And what else - not much except in point of techniques which I leave to Crabtree if he likes.
- Crabtree: This is a unique ^{Point} flake. The fluting flake was removed from this side here. And he was apparently successful on this side. This force line indicates that he had removed this flake first but he made a miscalculation and broke the leading edge on that side and apparently discarded it. ^{not} This is quite obviously heat-treated. Because this is the natural textures of agates and jaspers and this shows that retouching was done before the stone had been altered. *Now on this one* There is no indication of altering ~~on this particular one~~, but the natural form and texture is very typical of agates before alteration. However, ~~this particular one has an original facet left on the edge showing retouch was done after heat treatment.~~ Here is another one showing this flake was taken off ~~at one retouch and this flake later.~~ This flaking was done prior to heat treatment, this was done after treatment ^{which} showing the change of texture. Some ^{of the} ~~are a little hard to define~~ but from the luster it appears that they ~~certainly~~ ^{questionable} have been altered. ~~This is a granular texture with one original facet left on that side.~~ Apparently they were able to control the heating very well for the size of these slabs and big tabular pieces of agate indicate that they were apparently able to heat very large masses. When large pieces of stone are altered it is not ~~too common~~ ^{common} to find ~~even~~ one small facet of the original texture adhering. Alteration is a little hard to identify on fluted surfaces. This one over here, as Dr. Bordes suggested, is pressure flaked. It is quite heavy and quite large and, no doubt, needed an intermediate tool in the manufacture. Because by manual pressure alone, it would be very difficult to detach a flake of this size. This one, as Dr. Bordes suggested, looks like one of the block faults or shrinkage of the natural outside of the block of stone that they have just utilized as an artifact. Sometimes material from gravels gets a natural stream polishing. *treatment*
- Byers: Don, I should tell you that all this stuff comes right out of the ~~Lava~~ lava.
- Crabtree: Is that so.
- Byers: This is not gravel.
- Crabtree: I see.
- Byers: This is from ^{lava} ~~lava~~ filling.
- Bordes: From what?
- Byers: This quartzite, I mean, this chalcedony is filling in the lava in Triassic lava and the direction of the Ice Flow would have carried any gravel from the ice into one hundred fifty ^{lower case}
- what is this word?*

to two hundred feet of water even at the time the site was occupied.

Crabtree:

This one here was the only ~~indication that gave me the idea~~ ^{one that indicated it might have come from} ~~of gravel.~~ I was trying to get across the point that one can distinguish between origins of material. The exterior surface can indicate whether the material was from alluvials, natural fault planes or casts of cavities such as Dr. Byers mentioned. By studying the outer surface you can tell if it was a cobble rock or whether it was rolled in a stream bed and bruised. Usually the distal ends, the overhang, and the cortex will determine the source. Does this array go with them as well? This ~~Felspar?~~

felspar

Byers:

No.

Jelinek:

Mr. Crabtree, these fluted points here, would your conclusions be that most of them were done by percussion.

Crabtree:

I haven't examined the ~~others~~ ^{others} on both sides. But these are not true fluting flakes. They are more of a basal thinning and they do not correspond with the fluting techniques. However, they are characteristic of some Clovis. Later on today I will show you four different examples of Clovis techniques. Some are true fluting that very closely resemble the Folsom. But again you'll find even two or three flakes removed from the base which is more of a basal thinning technique to provide, no doubt, better clearance for the shaft. This basal thinning would also add to the strength of the hafting. If you'll notice the platform preparation on this one. The detaching of this one flake here indicates a little different technique. Instead of the platform being polished prior to striking they appear to be unprepared and, therefore indicate that they were made by direct percussion. Percussion is also indicated because of the undulations on this particular one and they show lack of accuracy in percussion because the flake was not regular and uniform which is typical of some Clovis. But the basal thinning here is good. But it hasn't been done with enough regularity to clear this flake on both sides so the flute could be detached and carried thru to the tip of the artifact. This one here is somewhat the same slight basal thinning but they haven't accomplished fluting. This flake shows a feathering of the edges which indicates a sharp snap of the pressure tool rather than forcing the flake over the entire surface of the artifact. They stopped the flake like the one that Marie had that showed the flakes going up and over the surface and meeting at the edge the flakes from the opposite side and with a great deal of regularity. This is a little different technique. Now this one, instead of being straight in Collateral flakes, or going towards the tip, the flakes are going in reverse. You seldom ever see this back-flaking in our Western United States.

lower case

Wormington:

From the viewpoint of typeology, one of the particularly interesting things about this is the depth of the concavity of the base which is quite unlike our Western Clovis which have a very shallow concavity. And this does seem quite distinctive.

- Byers: The Debert points, I think, are quite distinct from the others in that some of them have a very deep concavity. Some pieces that I didn't bring with me have even a deeper concavity than some of these. For this reason, they are very rarely found complete. Most of them have the ears broken off of them.
- Bordes: Shall we go to the next one.
- Byers: This other collection here is from the Bullbrook Site in Ipswich, Mass. On which we have a radiocarbon date of seven thousand B.C. plus or minus two hundred fifty on three samples. I am not at all sure, in fact I'm quite sure that this isn't the full date of the site. It was a big site like the Debert Site and it must have been occupied for a long time. I think that perhaps this is the terminal date. Many elements in the Bullbrook industry suggests that there was a blade industry but on the other hand we find no cores. And quite obviously it was a flake industry. Again the flakes were utilized for scrapers of all sorts. The fluted points, of which I have a few samples that were loaned to me by collectors, are different from the Debert points in many ways. The bases are not nearly as deeply concave, the flutes sometimes run for a long distance, sometimes they don't. Sometimes there is multiple fluting and almost, I can't say statistically the number of points, but I think the majority of points have multiple fluting. There are those Piece Esquillee. Again, I seem to have left out the end scrapers, except for a few. Many of them have a graver or perforator point on the end. The end scrapers from both sites characteristically have these littler perforators points on one corner in many cases. Not all of them do, but a great many of them do. Broad flat flakes are retouched. Many of them seem to have been worked with a shearing technique as opposed to a retouch. This applies to both sites. This one, for instance. And the use of both edges of a flake seems to be characteristic.
- Bordes: There is one thing on which I don't agree with Dr. Byers. It is this business about no blades. I see several of them in our definition, which is not as strict as an American one. But I am very sure that this can be classified as a blade. And also probably this. That wide blade and this one also. They are wide blades, of course, but they are blades anyway. But you have a lot of flakes that's true - with beautiful double side scrapers which could be also quite Mousterian and with a good retouch but which could well have been done by direct percussion. I don't see anything impossible in that. Looks like. Yeah. Even that. And there are some end scrapers with this little point at the other end which I would hesitate to call a borer because it's so small. It's rather like an epine - I don't know how to say it in English. Yes, it's a saw. Because we call it an epine here. It's too small; it's not even a micro borer. A micro borer - the point would be longer. It's something special. It's a saw. Some end scrapers, Piece Esquillee, of course, and then the points which are better made, I think, than the preceding ones. Here there is a kind of fluting, I think. But they were not very

efficient and here it is double. That looks like what I tried to do sometimes. Oh, those are better. This one is good. The other side they missed. They were experimenting with this it seems. From time to time they did one.

Tixier: Perhaps because of the raw material.

Bordes: Uh, I wonder. I don't know. Ah, here is a try. They even prepared for it. But probably either they stopped or the blow went wild. Now this one also is good. It looks a little bit like a broken Folsom this one.

Crabtree: Very much.

Bordes: This one is good. This is not very much like Folsom - rather like Clovis fluting. They were certainly not very good with fluting but they knew how to do it. They had the general idea, no question.

Byers: I should say that you do not see the best pieces from this site. The best pieces are either on exhibit in the Museum or ~~in the hands of private collectors~~ ^{collectors} and I could not get them.

Bordes: Ah, It's a pity. You have this problem, too.

Byers: Yes. The fluted points from this site include pieces of the equivalent of those from the Naco Mammoth and the Llando-Lekner? Mammoth Sites, and also some from the Lindenmeier Site, but not the long ones with long pointed ears - they are from my site.

Crabtree: There is one here ^{where?} ~~that~~ the edges show indications of the thermal treatment. On the other side it shows the original surface.

Bordes: It could be ^{a burin?} burned, too. It could be a burin. Ya, not a good one and on one such piece and only one, I would not say that this culture has burins. But watch out for that. It could be. Because that's a burin blow, no question. Is it intentional? That another question.

Crabtree: This flake is quite distinctive in the manner of detachment. It's like some in Marie Wormington's collection. Almost side struck blade technique. They used the ~~lateral surface of the distal end of the flake, instead of a single blade struck down the side of a core on a tabular piece.~~ This technique allows removing a straight piece of ^{material} ~~to work on~~ - almost side struck. The fluting of the Bullbrook is certainly a refinement of the Nova Scotia material in techniques.

Byers: I think that this probably reflects the stone.

Crabtree: It could very well be; it could very well.

Bordes: About this flake, I wonder. I wonder if they did not intend to take a very wide flake and it broke. It is quite possible because, you know, if there are many flakes like that, all right. That's an indication of a technique. But you can make a flake like that just like on a core and one can well go like that without any purpose.

Crabtree: If you had an assemblage of this stuff, it would be better. But this one here is something that is a little different. I mean of striking down here and then moving back rather than turning it up on edge to follow this ridge to guide the next flake. And it could have been an accidental thing.

Bordes: Ya, ya. Could well be.

Byers: If we could get the entire collection and analyze it, then perhaps we could say something about the industry. But when I say it is a blade industry, I didn't mean to say it was just a blade industry. There are flakes like we get ~~xxxxxxx~~ in blades and occasionally we get blades.

should this be capitalized? 51

Byers:

I brought them along because they are typical flat, archaic flakes. These are the things that are supposed to resemble Eskimo artifacts. As you can see, they bear no resemblance to any thing that showed. (Blank spot in tape) The ground slights that come up with this material look curiously like the ground slights that come from the Northwest Coast. (blank spot in tape. *This is the late middle period in main and this comes in association with*) These people used Felsite to make finished tools.

what does this word mean?

(blank spot in tape)

should this be Middle Period

Bordes:

What are those little thumbnail scrapers? From which culture?

Byers:

They're from Bullbrook.

Bordes:

Ah, from the one we have seen this morning. Ah, they are beautiful.

Byers:

And here is one of this with this little point on here. *these?*

Bordes:

Ya, this one too. Ya.

Tixier:

Is this a Folsom type?

Byers:

Yes, those are from the Bullbrook Site.

Bordes:

Well, about these big points. It seems that most of them have been made by percussion you are right, with perhaps some little pressure. But I am not even sure of that. In this material, I wonder what pressure would give. Not much.

Byers:

Not much.

Bordes:

This is different ~~xxxx~~ material. This fine - what is it, quartzite?

Byers:

Quartzite.

Bordes:

Quartzite. It's good one, and there I think I can see some pressure work. What do you think, Mr. Crabtree?

Crabtree:

I think this is a typical step-fracturing of pressure flaking on a coarse-grained material. And with material from a site of this antiquity it is possible that some of these could have popped off from the frost. It's quite indicative of coarse material, untreated agates and jaspers. They apparently did not use the heat treatment yet and did not need it because this is a superb piece of chalcedony. And the character of the work on the two ~~xxxxxxx~~ is just about equal. Almost a duplication. It is suprising the skill with which they handle this quartzite. However, it is a very fine-grained quartzite and allowed them to carry a good flake over the surface. But they didn't do much better with this good agate because here are these little tiny micro-flakes hanging on the surface. The work is comparable on both pieces yet they are very ~~ix~~ different materials. The chalcedony is quite adaptable to heat treatment and the quartzite will change and work a little better but there is no evidence of thermal change on either of them. It looks

like it could be probably more of a pressure retouch on the stem than on the base. These flakes are just random with no regularity at all. And they have ground stems. There is a slight curve left on the artifact and also some of the original blade surface which indicates the blade rather than the core technique.

- Byers: Don, not to argue with you, but the mineralogists say that they are both quartzite from the Canadian shale. shield?
- Bordes: This one too?
- Crabtree: Both of them are quartzite.
- Bordes: Oh, well.
- Crabtree: The texture of this one appears to be typical of untreated agate to me. I would have to look with a glass to see whether they are composed of sand grains but this is quite definitely a quartzite. But I thought that this other one was chalcedony.
- Bordes: If it is a quartzite, it is a very, very fine-grained quartzite. Finer than I have ever seen.
- Tixier: There is quartzite like this in Belgium.
- Bordes: I have seen it. Oh, it is not as fine as that.
- Tixier: It is finer.
- Bordes: No, no.
- Tixier: Oh yes, I saw.
- Bordes: No, No. After a point. I will tell you something, Tixier, and you will agree with me. Classification by mineralogists and classification by prehistoric people were not the same.
- Tixier: Quite different, yes.
- Bordes: It doesn't matter the nature of the rock, it doesn't matter so much as the texture of the rock. And I am very sure that as soon as it was as fine as that - Paleolithic people did call it flint and to Hell with the differences. And they were right. Because you know, I have seen a lot of things that I call flint and I'm sure Paleolithic people did call flint and which have fancy names in mineralogical classification but they work like flints so they are flints. At least as far as we are interested, you know. And these quartz points are rather funny, you know. Those poor people must have been quite desperate to use that you know. Ya, they did a beautiful job in this terrible material. It's not bad - it's terrible.
- Crabtree: It is like tombstones to work with.
- Bordes: Ya, ya. Oh, ya, it's terrible stuff. And they did quite well with it. Of course, they could not make anything flat.
- Byers: There is the raw material.

- Bordes: Oh ya, I know it. We have the same in France.
- Byers: Pebble quartz - off the beach.
- Bordes: We have the same in France and it's very simple to do something with it. From time to time in this material you'll find a pebble of good quality and then you can get almost as good as in flint. But that's not very often, and it did not happen often to these poor people. If I can see from what is there. And that is something else. What kind of material is it?
- Byers: That's felspar.
- Bordes: Felsite. Well, that's not very good. Ah, that is better. Ah, this one. Ah, there is perhaps some pressure flaking on this one. And that's something in this material, also.
- Tixier: This one is a finished tool or unfinished?
- Crabtree: This one appears to be done by percussion and, I think Dr. Bordes will agree,
- Bordes: Yes, it seems to be percussion.
- Crabtree: It's very poor material and it crushed. No edge strength apparently and the work is very poor. Now with this material better work could have been done but look at these little step-fractures and it's just as poorly done as the poor material but it may be because they used a hammerstone on the edges and did not have the control that Dr. Bordes has. If they had used an antler billet and not the hammerstone and had changed the angle of force they could have perhaps detached the flake without the crushing. But in this case, it looks like they used a hard hammerstone and that they miscalculated.
- Bordes: But this is rather good in another way. For the material, it is a rather good work - flat retouch, long enough for the material. It's not bad. Perhaps I wonder if there is not some type of pressure. Look at that.
- Crabtree: May be.
- Bordes: Here, see these flakes.
- Crabtree: The material is so coarse that it is hard to determine the flaking pattern. The regularity of the edge would indicate that they had excellent control.
- Bordes: You have to see. Look at this retouch. This tool here.
- Tixier: Is this type of an arrowhead frequent or rare?
- Byers: That's very common in later times.
- Tixier: Concave ~~by this.~~ *base.*
- Byers: Concave base, yes.
- Tixier: Straight edges and pointed.
- Byers: Straight, yes.

Tixier: And triangular in form.

Bordes: Well, something more to say about that? Nothing?

Alan Smith: Well, shall we move to the next collection then?

Bordes: Ya, I think we move.

Coe: Because of the location of the collection on the table, I'll have to take it up a little bit at a time. It goes from Virginia to Florida and Ohio to Alabama. The closest material to the Bullbrook is this lot right in here from the Williamson Site in Virginia. I don't know whether you want to move this out now or what. This is a site in the tidewater section of Virginia close to the Atlantic coast quite a few miles from Massachusetts but not too unlike the Bullbrook material and if you place of this site, such as the Shoop site in Pennsylvania in between you have a certain relationship. You'll notice that there is one point that is fairly well fluted but the others tend to have very little fluting. A couple of blanks, unfinished points, flakes, end scrapers, and these little short stubby things. Whatever you want to call them. I suggest that we take up one lot at a time that way perhaps it would be less confusing.

Bordes: All of that. All ~~the~~ from the same site?

Coe: This is all from the same site.

Bordes: Ya. This also?

Coe: Yes.

Bordes: Oh, ya. Well what did you think of ^{it} ~~that~~?

Crabtree: There is a great deal of resemblance between this technique and the Bullbrook material. They are very comparable. An interesting thing with this one is that it shows it was broken in fluting on the first try for the flake curls over ~~a~~ the end and broke the point. The first initial flute shows that there was no raised platform preparation This would indicate why they went down so deep in order to accomplish fluting. This one here was successful. It's broken from shock and from flexing. These three proximal ends indicate almost the same technique as the Bullbrook material. There is no indication in any of these of any thermal treatment. These are very heavy points, of course, and the shapes are almost reminiscent of the Folsom material. But no indication of Folsom technique. That's about all I can say on this. There was one single flake that has the same end characteristic of the Bullbrook ends.

Bordes: Yeah.

Should
tidewater
section
be capitalized?

Laugherty Don, is that a blade fragment?

Bordes: Oh, well it's a blade of course. Well, but something which is curious is this tool. ~~But it's not a burin, I don't know what it is.~~

Tipier: *This borer*
Bordes: *Oh, it's not a borer - I don't know what it is.*
Tipier: *Perhaps it had been ~~piex~~ escalier a Piece Esquille and then a borer or drill.*

Bordes: ~~Could~~ be. I don't know.
Could

Cerattue It's hard to say.

Bordes: It's ~~some kind of..~~ *the same kind also.*

Cerattue: This is a portion of $\frac{1}{2}$ a blade and there is a slight amount of what looks like pressure *retouch.* The retouch is fairly well spaced on the edges. ~~of the retouching on that blade.~~

Bordes: *Ya it could be.*
It could be percussion too you know.

Byers That's a characteristic of all these sites, there are a lot of these in Bulbrook and there are a lot of those in ~~De Bert, Schupe Sites~~ *the Debert and the Shoop* too.

Bordes: Well.

Coe: Move to the next.

Tipier: There was *one level* only. ?

Coe: This was only surface material. Only surface material.

Tipier: *ah, only surface material,*

Coe: If we move on to the next lot we have this representative from the Carolina

Should this be capitalized?
Piedmont area. This goes into part of ^{Virginia} Va. and South Carolina but still is along the Atlantic Coast but it is a upland area not too unlike this area of France, in thru

this region. What I have is from one site which is called ~~a Hartaway Site~~ *the Wardaway* Site. It contains

a very good representation, ^{of} quite a long period of time. The earliest material must be equal to the Clovis material and then subsequent occupations ^{come} coming on down to ^{historic} ~~historic~~ times actually. The first items here are the oldest. Actually this ~~is~~ is a Clovis point that's been reworked, ~~with~~ corner notch ^{ed} coming in at this later time. The scraping tools that we found with the earlier complex of this sort and with these later points you get these little end scrapers, ^{that} seem to be characteristic of the Williamson Site. Following this in time we come up to material of this sort which is dateable in a number of places ^{at} around 9000 years ago, 7000 B. C. So all this is earlier and certainly this goes back to at least 10,000 B. C. without any difficulty. Following this, you get quite a change in style and finally at around 4000 B. C. points very similar to the ones ~~that~~ that were discussed this ^{morning.} ~~morning.~~ This is one of the points from Canada. I just laid over here for comparison. Many of these are made from quartzite too. This is a section of a unfinished point. Finally the latest material is about 2000 B. C. similar to the Northeastern big blades such as you have this point. While I am ^{talking} ~~talking~~ about this I would like to mention a second site which is Russel Cave, ^A actually ~~it's~~ it's in Alabama but very close to the Georgia line and the lowest level in Russel Cave, which is dated at 7000 B. C., is almost ^{identical} ~~identical~~ in type to this period on the ^{Hartaway} ~~Hartaway~~ Site.

Bordes: Well, Bordes speaking. I won't get very much into the points which are too special which is a ^{business} ~~business~~ for American ^{typologists} ~~anthropologist~~. But here, ^{for instance} I see a nice scraper ^{on} ~~and~~ what is a typical ^{Levallois} ~~Levallois~~ flake and I wonder if you have really ^{the} ~~the~~ ^{Levallois} ~~the~~ cores.

Because you can get ^{one Levallois} ~~some~~ flake or even two ^{Levallois} flakes from cores which are not very typical but this one is really ~~is~~ first rate, you know. ^{And then you have} Then there are

a lot of side scrapers too, end scraper ^{on} ~~with~~ a retouch ^{ed} blade, and a beautiful, it could be Aurignacian... This is rather strange.

Have you many like that?

Coe A number.

Bordes Yea. That's a kind of.

Coe ^{The} Side scrapers are more common but this type occurs frequently.

Bordes: That is not an Aurignacian ^{blade} ~~is~~ ^{it is} Something special.

Henry
Irwin: Yea, those things ^{are} common... ^{in the} Paleo-Indian You find ~~it at Lindenmeier~~ Lindenmeier.

Bordes This one?

Henry
Irwin: ~~Take that other blade from the other assemblage~~

Yes, I expect that ^{broken} ~~other~~ blade from the other assemblage comes from one of these things that ^{has been} ~~been~~ cracked ^{in the middle}.

Bordes: Yea, yea ^{probably} and then these end scrapers with a lot of retouch like in the Solutrean.

^{They did partake of this mania of the Solutreans} ~~This takes~~ to make ^{much more} a retouch than was necessary. They ^{just} are

^{loved it.} ~~just~~ lovely, Ya. ya, and this one too. Completely, ^{unifacially} ~~completely~~ retouch ^{ed}. Beautiful

side scraper. Could be Solutrean.

Irwin ^{Yes} And Spanish.

Bordes. Ah yea. Very small platform very oblique. Could be wood struck or

something like that.

- Bordes: Well.
- Crabtree: It's surprising the refinement and the thinning control of this age material. Good retouching of this particular style and good thinning technique. Very fine denticulation on the edges. I don't know whether it is distinctive or not, but this point is a larger form of the same denticulation. Deep bulbs of pressure. This edging is a little like some of the very refined work of the Lindenmeier site, only a different technique of fluting. But I am particularly interested in this very unique type of serration. It appears the point was serrated and flaked at the same time. They balanced the flakes one opposite the other on this side and took this one off, then this one, and used this for shaping the artifact, which is quite unique. If you'll notice here on this artifact the same technique is not present and the serrations are only done from one side.
- Tixier: It is common in South Sahara and in French Guiana.
- Crabtree: It is not particularly common in the States.
- Tixier: That serration. One retouch on each side in the notch. See.
- Crabtree: In the notch $\frac{1}{2}$ right.
- Tixier: In the notch.
- Crabtree: It leaves a distinctive sort of character here with the ridge down the center, actually a diamond-shaped cross section.
- Tixier: I think it needs a very thin compressor#, you see. Very narrow tool.
- Crabtree: Very narrow tool in order to do this. On this one, the retouching is very good.
- Tixier: Is it a pressure one?
- Crabtree: Yes, on both sides and has basal thinning. There does appear to be a difference in age between the time the pressure flaking was done and the notching was done. However, the original work was very excellent and there is just a slight retouch here showing not nearly the control of the first work on the artifact.
- Tixier: Did they try to flute it.
- Crabtree: Yes, on both sides. These heavy massive objects appear to be done all by percussion. No pressure retouching on any of these. This appears to be all the percussion method. We might check these out to see if this technique of all from one side carries on thru and it apparently does. However, here it shows up again of using the two sides, but not quite the refinement of this one. But the same feathering out at the center. Indications on this side of the stone lead me to believe that this material was heat-treated. However, not having any of the flakes, or the cores, one can't make that a final decision. I am looking for one facet of the original surface left on this to be sure. But these

three or four pieces appear to have been altered. I think that is all I have to offer for this group. This shows quite a distinctive basal thinning, it almost appears to be fluting using a flake technique or a blade technique.

Bordes: Oh, yeah. It may be made by percussion yet.

Crabtree: I am about through with this one. Maybe some of the edges might have had slight retouching but they appear to be almost entirely by percussion. This is a portion of a blade. In order to get the diamond shape, he was working on this ~~ridge~~ ^{ridge} to bring the flakes over from both sides to get the contours to form a roughed-out preform, and by using this blade instead of the core. Did you get to examine these, Dr. Bordes? These feel slick but I can't see any basal grinding on them.

Bordes: No. They have certainly been made by percussion, most of them.

Crabtree: I don't see any sign of pressure retouch on any of them.

Bordes: No. No. That's percussion.

Irwin-Williams: I wonder if you could comment on the possible methods of production of that Levallois-like flake. What kind of method could have been used. Also on the blade. The gray blade over there near the scraper.

Bordes: It is quite defined.

Irwin-Williams: Yes. Well, I wondered if you could comment on them.

Bordes: Well, there is not much more to say about the Levallois flake. When you say it is Levallois flake it carries its own definition in itself. That means a flake that has been made on a prepared core to have the shape of the flake predetermined before you struck it off. And that means that somewhere you have prepared cores. No question. This one, I am positive it cannot be even a chance of Levallois. It's too much typical.

Irwin-Williams: Well, that's very interesting. I wondered if there was any possible method of telling whether a flake of this kind would have been struck off with an anvil as you demonstrated, or with a percussion instrument.

Bordes: Oh, that's another question. But I would say from the way it has been struck that it has been struck with a stone, not an anvil. This size of a Levallois flake is very easy to get off with a stone hammer. It's when they are bigger that you are obliged to use an anvil technique.

Crabtree: Dr. ~~what~~ ^{wheat} might like to say something about this. Is this from an ancient man site? They seem to be all ~~flaked~~ ^{flaked} from one edge on this graver.

Bordes: That's a borer all right.

- Wheat: This is a fairly typical thing in the recent Folsom horizon. We got a variety of these. Some of them, incidentally, are flat pointed on the end, a little chisel point rather than this. And this, along with the very tiny, what we used to call gravers, nobody really knows much about them or the use for it - some suggest they were used for tattooing.
- Bordes: This, well, is it not in the Folsom that you have needles with eyes?
- Wheat: Yes.
- Bordes: With that you can make a hole in the needle. Oh, ya, I did it. With this one, it would be quite all right. You have to sharpen it a tiny little bit and then it works. After that, it becomes blunt and you sharpen it again, and you can make a hole in a needle very easily with that. I would not be surprised if it were something like that. Or like the borers of the Upper Paleolithic. You can ruin your ~~good~~ needles. It is better to make a hole in the skin before you bore with the needle. It goes much better. With that you can make also the first hole and then you go with your needle and thread ~~thru~~ ^{through} it. No question.
- Wormington: Are there any that big with Folsom, Joe?
- Wheat: Yes, with the ^{Van Horn} ~~Van Horn~~ Folsom material I can show you several of them.
- Epstein: Mr. Crabtree, you mentioned looking at that material and also the material we saw this morning. You distinguished between thinning and fluting and I was just wondering if you could explain that just a little bit better. As to how you can determine which is ~~ix~~ which.
- Crabtree: Well, with the fluting, Gerry, there is a platform preparation. For instance, this one here indicates fluting and that the flake was probably removed from a platform projecting high above the base. The channel flake has been shortened on the base of this particular artifact. The normal thing is to prepare a hump or projection here to serve as a platform. Then when the flake is flexing and bending, it is a single controlled operation. Fluting requires a refinement technique of placing and preparing the platform properly in the center and at the proper angle. Also, the prepared artifact, before fluting, must be of the proper shape. Must have the proper surface retouch and must have a ridge - or a greater mass - in the center, or the median line. Basal thinning does not require all this preparation for it is merely to take off surplus material from a thick, weighty piece when the artifact is not suitable for hafting. It does require a striking projection at the base, but not a prepared platform and the thinning is done by simple percussion blows which need not be as calculated as the fluting technique.
- What they were striving for on this point is a basal thinning for specialized hafting. Such as this. See here, when the artifact is not suitable for hafting, it is thinned down by simple percussion blows that do not require

the accuracy of fluting. There is quite a difference between basal thinning and a regular fluting technique. And I imagine two different techniques were used on these two artifacts. On this one, they have started far back here with a fairly heavy mass to guide the flake. And this must have been a fairly high ridge to have held that narrowness the full length of the artifact. Here we have basal thinning which might be mistaken for fluting, but it has been thinned by simple percussion while these are single flakes and are actually fluting flakes. Some of these may be an attempt to produce fluting but they miscalculated and ended up with indiscriminate blows. It is hard to describe the difference between the two techniques. It may be that basal thinning is sometimes called fluting, but close examination of the artifact scars will reveal that it was not initially designed for fluting. Just the reverse analysis will reveal when the worker miscalculated on his fluting blow and ended up with basal thinning.

Bordes:= Oh ya, ya.

Epstein: Are these from the same site, Dr. Coe, or not?

Coe: No. One of these is from Alabama and this is from Kentucky.

Crabtree: This one would demonstrate a very definite technique here of a fluting process. A shearing off of the tips with both first and second flakes and this is a very definite and diagnostic technique. Quite different from basal thinning. Fluting is much more of a refinement and actually a specialized technique while basal thinning is generally just to lessen or thin the base of the artifact to facilitate the hafting.

Tixier: What about -

Bordes: That is something else - just speak about the other.

Coe: Maybe it would be better to take them in the order that they are on the table. You may have more room. Before we go to the Kentucky sample, I would like to say that it is a direct connection between France and this site in addition to the Levallois flakes. In 1914, the French company started to develop a hydroelectric plant on this very piece of property.

Bordes: Oh ya, that's French Colonies.

Coe: In developing the backward area of the Piedmont. But in 1916, other events transpired and work was continued by the Hardaway Company, hence the name Hardaway Site. So the Kentucky sample includes a few point types, at random, again all from the surface. One type is called Cumberland. That is the long usually fluted type. Clovis. Then a Quad point which is unfluted and one they call Meserve. Then a few flakes and end scrapers. This lot right here.

Bordes: You call this type Cumberland?

Coe: That is called the Cumberland type.

- Bordes: Yes, because it so happens that I have one in my Lab from Tennessee which is exactly a little longer. You have seen it. What? A little longer. It was a beautiful thinning. Ah, this one, well, I think this one fell on a rock or something like that. I don't think it is a graver or a burin. I think it just fell hard on some stone. It happens also in the Solutrean and it did happen to me when I shot arrows with flint head and I got a beautiful set of burins like that.
- Coe: It never was fluted either to any extent.
- Bordes: Yes, that is an amusing thing. And all that comes from around the same part?
- Coe: Now, the next lot comes from Alabama.
- Bordes: Ah, yes, this level.
- Coe: From one site.
- Bordes: Ah, ya, this. O.K.
- Coe: This lot is all from Alabama. One site. This is all surface, from anywhere in Kentucky. This is one site in Alabama.
- Bordes: Always the same way to cover the scrapers with retouch like in the Solutrean. But where is Mr. Solutrean? Ah, here he is - dreaming. Same thing. And always the side scrapers that could well be Mousterian or Solutrean also. And this, oh well, Pleasant culture. This kind of small bifacial borer or something like that. And also beautiful retouched blades. Look. It is almost a Willow Leaf. And lots of retouched blades and scrapers, concave and convex on blades and small blades with fine retouch. And those, that's a kind of scraper you could find that in Mousterian too. Retouched blades, ~~then~~ reused. A flake with some retouch - utilization. Typical Levallois. Yea, yea. Again this kind of Magdalenian I borer. Big borer. These fluted points with channel flake.
- Tixier: But what a beautiful Levallois technique?
- Bordes: Ya, ya. That's the same thing. This is another Solutrean-like scraper. Well. But perhaps Mr. Crabtree has something to say on some of this.
- Crabtree: Not a great deal. I did notice the refinement of spacing of the platforms of force on this artifact, but on this one it is not as well defined. This one shows nothing other than we have an occurrence of these at a site in Idaho. They have a "parrot beak" sort of thing, carefully chipped back and as many as five beaks on the same tool. Probably quite a definite use for these - for grooving bone, etc. They are always made of jasper, never of obsidian. The end of this flake appears to be almost a square end without too much preparation, but certainly well-controlled and unifacially flaked.
- Bordes: About that, I would not say it is the kind of thing we call ^{lower case} Parrot-Beak. I will show you in the Museum that that is something quite different. I can make one and show you

exactly what it is. That's a kind of backed-beak but nothing to do with the Parrot Beak. lower case

- Crabtree: These, don't you think have quite a change or difference between this and the regular Cumberland style?
- Bordes: Oh, this one, ya. It is flatter. It is more thinning than fluting.
- Crabtree: It seems like almost a whole different method or style between these two.
- Bordes: The technique of flaking is not the same either. That is something different, Ya, of course.
- Wheat: I have a question here, Dr. Bordes. You called this a Levallois technique.
- Bordes: Oh, no. That's a kind of joke.
- Wheat: I know it is a kind of joke. I follow your reasoning here. But my question actually concerns whether the flute is before the side chipping or, in other words, which came first - the side chipping or the fluting.
- Bordes: Ah, well. That's something not easy to tell. Here I think with this one, I wonder if the flute was not before the flake. Look at it.
- Wheat: That goes in there you see. That's what I was getting at. Because several places the side chipping actually truncates the flute.
- ~~Bordes:~~
Bordes: But in other places - there were on other types. You know that tool here. No question here. Yes, there is no question. On this one it could be, but it is difficult to tell, you know. If it was really the end of the flake or if it is a section of this flake by the fluting. It is not very easy to tell.
- Crabtree: With the glass you can see the compression and rings. When you look at these scars, if the rings have been sheared at the ends, they will have been intersected by the channel flake. These channel flakes will be intersected by the retouch if it is done after fluting.
- Bordes: Yes, but you can see most of them, but not always.
- Crabtree: But at the ~~point~~ tip it is quite obvious there.
- Bordes: Yea, it seems there is rather two of them.
- Coe: The next lot is -
- Irwin-Williams: Could I interrupt for a second? I wonder if you could comment, Dr. Bordes, on possible methods of producing these blades here that you mentioned.
- Bordes: Oh, well - this one is difficult to tell. It could well be wood struck. It could also be with a punch. You know,

sometimes the difference is so little between that it is almost impossible to tell and I am very sorry that I can't say more. You have seen yourself on blades I have made, some difference of striking platform when the punch is nearer or further from the edge and we are to strike more or less strongly.

Irwin-
Williams

So a wide variety of techniques could produce these kinds of blades.

Bordes:

Oh yes, certainly. If we had one or more of the blades from this site, we could tell statistically that they used more of this or this technique. But on five or six - no soap.

Tixier:

We need the raw material.

Bordes:

Ya, ya.

Coe:

The next lot is also from Alabama but a little to the West. The six at the top are similar to what you have seen but the other two are more triangular in form and somewhat different. The latter group is called Redstone by the people of Alabama.

Tixier:

The concave bladelet is always ground.

Bordes:

Yes, yes, yes.

Tixier:

And after fluting.

Crabtree:

This one was broken in manufacture. This is a well-defined well spaced blade. We'll go back a little bit to the difference between basal thinning and the spacing of this one here. This type of a pressure point is very characteristic of the fluting type flake with the distal end of the channel step-fracturing. However, when they finished the blade, they could take these little diagonal flakes off on each side of the bulbar scar. This is the reason, with the Folsom, we always have these side flakes on the basal end. It removed the heavy bulb and gave a straight line on through. This is a very interesting example of fluting flaking technique.

Byers:

This is very interesting, indeed, because in the Bullbrook site this flake is taken out first and then this is taken out later. We have points, some blanks, that show the two side flakes taken out first and this piece isolated, prepared to take out this flake. And then it was turned over and the platform beveled on the other side and a piece isolated in the same way but taking out this fluting flake. It is interesting to see the difference of order in detachment of the flakes.

Crabtree:

Yes, that's a real interesting observation of clearing the channel flakes so that it is released more easily by parting with the artifact.

Tixier:

Is there a special name for these flakes coming from fluting.

Bordes:

Channel flakes. Don.

Crabtree:

This is interesting. If they had gone another quarter of an inch, it would have broken the artifact. ^{Just they} A step fracture is an interesting thing to observe. ^{What applies} Direct downward pressure and ^{make} making a hinge ^{and} and the flake still adhering to the artifact. ^{See there, the} And they were able to follow directly on through and stop ^{where they wanted them to terminate} right next to the tip. This type of ~~a~~ step fracture is a common occurrence and is not a hinge fracture, and the flake is still actually adhering. This one has, of course, a little different form and it does not seem to be characteristic to the normal wide ends necessary to keep the flake from spreading. ^{Ordinarily} You would make this wider and a little heavier here at the tip in order to carry the flake on through. ^{In this case} Here they were using a narrow thinning technique which increased the chance of losing the distal end of the point. It is interesting that this technique developed with this particular shaped point.

it before this happened

Coe:

This is a Redstone type.

Tixier:

Don Crabtree, are points which are fluted shaped like this to determine the intention of fluting?

Crabtree:

Somewhat. Because you are going to feather out the channel ^{flake} at the distal end and you need this shape for strength and also for supporting the tip. ~~I mean~~ to carry the flake entirely through to the tip you must have a fairly solid, rugged preform. I have found now that I must have a little additional material at the tip for support to prevent the channel flake from hinging. Otherwise, the tip will be removed. Actually, you are splitting the point in three pieces. If the midsection of the artifact is not thick enough and does not have a ridge, or a double convexity, the flake will spread and break the artifact. So, the force must be directed at the proper angle from the base to the tip in order to get a perfect termination of the channel flake. So, to answer your question, you do need this specially designed preform. The channel flake is part of a ~~cone~~ cone and, therefore, tends to spread, and to prevent this spreading, the shape of the preform must have mass to contain the force.

Henry Irwin:

~~Was this flaking done before or after the fluting? This is rather much lighter in addition to having it heavier. This is a Folsom style.~~

Coe:

~~The next lot of material is from two hundred miles North in Tennessee. There are three points. Two are the Cumberland type and one is called Clovis type. Then the other items are from the Nuckolls Site in Northern Central Tennessee. Fairly large blades to start with.~~

see attached correct sheet

Dougherty:

Could I ask a question? What do you find in the way of debitage, cores and things along with this? I am curious as to how big a flake or blade you have to make one of these points like this one - the thick one. It doesn't show much curve. Is that a substantially larger blade to start with or flake which has been whittled down to the smaller shape, or do you have cores to go with these?

Coe:

As far as the Nuckolls Site goes, this is all collected by

amateur individuals and the total inventory I don't know. There are cores of one kind or another, some very crude ones. None as finely prepared as the ones we have been talking about. Apparently they must have used a fairly large blade to start with.

Daugherty: Don, could I ask you what kind of a flake do you think that would look like when you started out. The thickness of that suggests that it could have been some substantial size or is that necessarily true?

Crabtree: It would have been considerably larger. In doing this type of work, I prefer to start with a very thick blade. Shocks and strains are present in a fairly thin blade whereas a larger mass will have greater strength. I use, you might say a miniature core technique. Because, if you use a blade that is fairly close to the thickness of the artifact, its inherent strains will not absorb the shock. On this particular point there is almost a bipolar technique indicating that a support was used. But, you'll notice he still saved the point. I prefer to use a shearing between the base and the tip so the forces do not oppose one another. This eliminates a bipolar break where the forces would oppose each other. The point I am trying to bring out is that shearing eliminates this opposition of forces.

~~Daugherty: Another question. Does this material, and this material over here, and those scrapers and point similarities - is this about the same material from different sites?~~

Daugherty: What happened? Did he pick this up.

Crabtree: Probably he repositioned the artifact on the support and then he retouched the tip for you can see these flakes are over-lapping the previous scars. I mean, if he was going to take this flute off, he would isolate the platform. His angle of force may have changed or the artifact may have broken at the distal end. So instead of a shearing between the tip and the base, he got opposing forces from the tip to the base and they met in the middle. It is a wonder it didn't collapse, but it didn't. This has heavy undulations on this side from the shock. Apparently this was a miscalculation. But it does show the merits of shearing. This may not be the proper term, but I can't think of another word for it.

Daugherty: Another question. Is this material, and this material over here - I notice those scrapers and point similarities. Is this about the same material from different sites?

Coe: You mean the points or the stone?

Daugherty: Yes. I mean culturally is it very similar.

Coe: Yes:

Daugherty: I mean is it classified the same broad grouping. ✓

Bordes: Well, I have something to say about this last group. Here is a double end scraper. And if I remember right, that is the first we have seen. Are there other of those - these double

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Irwin: change to as follows:

part of 2v.1.1

I suggest you look at that like Don suggested to see whether the secondary retouch was put on before or after the fluting. The fluting could have been done when it was rather much wider also in addition to having a heavier point. This is a Folsom style.

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Coe speaking: The next lot of material is about two hundred miles North in Tennessee. There are three points. Two from the Cumberland type and one of the so-called Clovis types. Then the other items are from the Nuckolls Site in Northern Central Tennessee. Fairly large blades to start with.

end scrapers?

Coe: Occasionally.

Bordes: Occasionally. Here also is a composite tool again. A scraper with a borer at the other end. But that I have already seen in this collection but not this double scraper.

Coe: On the broader flakes frequently they utilize the whole circumference.

Bordes: Yea, but it is not a matter of that. Here it is retouched, you know. It is a double scraper on retouched blade, but the important thing for me there is a scraper at both ends and I have not seen that until now.

Coe: The next lot of material is again from Northern Alabama. It shows a number of early types. Some we haven't seen before and in the lower corner is a small lot of material from the Stanfield-Worley Rock Shelter lower level. I think some might be interested in the so-called Quad points. And in what they are calling Dalton in Alabama. These are the Quads - these are the Daltons. This is a Dalton from the lower level of the rock shelter.

Crabtree: There is an amazing amount of refinement in this retouch. This one here has been abraded on the edge. Notice these two with the very fine, extremely fine work on the edges. Almost a sinuous edge. They are very finely worked. That one is - and this one too. They have a little different order of flaking on this side. This one is edge ground. This is apparently the last flake here. Then they didn't bother to take these off, the little diagonal flakes like on the Folsom. Folsom took off these two laterals to clear what bulb was left, but they did clear the platform prior to fluting. These Cumberlands are considerably finer and much better retouched than the others that we have seen so far. This is some very unusual material - hardly identifiable. I haven't seen any like this before. The flaking of the edge character is very similar to the fluting style.

Is one of these sections repeated
Practically word for word
which is right?

Itwin Williams Does that have preparatory side flakes before it had preparation of the main flake on one side?

Crabtree: This one appears to have been freed before this one. This is apparently the last flake and then they didn't bother afterwards to take off the two laterals like they did in the Folsom to clear what bulb was left. But they did isolate the platform before taking off the flake, Cynthia. But these are considerably finer and much better retouch than the others we have seen so far.

Coe: These are the Cumberland type.

Crabtree: See here, Dr. Wheat, how characteristic they are of almost your Southwest material. Very fine dentate sort of thing. Very unusual material. It is hardly identifiable. I've never seen anything like that before. Very unusual, ~~this is not it~~ It is unfluted but the edge character is very similar to the fluted style. Apparently it just wasn't needed.

- Bordes: Oh yeah, yeah. Look at this one with the tentative fluting on one end and a kind of thinning on the other. It is something in between.
- Crabtree: It looks like a very coarse material, but awfully lustrous. Here, oh, I thought we had another one of the burins, but he just missed and that was a flat. It might give some indication of the method of manufacture. The question came up by Dr. Daugherty whether this was done from a core or a blade. But this indicates that it is almost a part of a core.
- Bordes: Could be. It could also be a point that was longer at first, then broken and then done again. Something like that which was done again. Could be. I don't know.
- Crabtree: Another retouch.
- Daugherty: What would cause that flaking, that rippling down there?
- Crabtree: It was flexing just as it was coming off. It was chattering slightly. Considerable compression right at the far end.
- Daugherty: Would that indicate a certain type of blow?
- Crabtree: Well, with percussion this is a little more pronounced. But sometimes this can be caused if the surface is a little irregular. However, this was caused by compression as the flake was parting from the back portion and before this happened, it undulated just before it tore loose and was detached. It was slightly flexing from this point. Say if it moved two millionths of an inch, and your angle started to change, you get this chattering here at the end. I mean it's actually flexing as it comes off the end. While here, it tears in a pattern till it hits the weak point and as the flake is leaving it goes over the irregularity and up and down and still hangs on as it hinges. I didn't explain that very well.
- Coe: This point is from Florida, ^{the peninsula.} It's not a very good example of a Clovis type. They call it Swanee type, Dalton type. You see there is very little resemblance between what they call a Dalton in Florida and a Dalton in Alabama. Then a notched variety. Of some interest to some of you is this specimen which is called a gouge.
- Tixier: An adz. That is an adz.
- Bordes: I don't know. I don't know what it is.
- ~~Bordes:~~
Tixier: Such kind of tool exists in the Neolithic from Thiute in Egypt. It was studied by - -
- Phil
Smith: Thompson?
- Tixier: No, it's not Thompson - it's Arkin.
- Coe: This specimen is not an accident. Quite a few of them have been excavated from a particular level.
- Tixier: These are also in the Sahara and the Neolithic. But there is a little polishing here and those I know. And it seems

to be working wood you see. Making bowls. And the removing is there is a little polishing and then percussion and then polishing, percussion, polishing, percussion. This is the same tool. It 's very familiar to me.

- Bordes: And in this corner, what is this?
- Coe: In that corner we have O'Howell material. We go back North now just a little bit. Three old specimens and I have some more in a box I'll bring over before we get to the Hopewell.
- Crabtree: It's surprising the variety of fluting techniques that is shown here. This appears to be Flintridge, Ohio material. These are, no doubt, heat-treated. This tabular piece is of siliceous clay and is fairly granular but after they have been treated they work very well. These have wide, collateral flakes and basal polishing which is quite a classic stye. Notice that nearly all of them have step fractures rather than hinge fractures. They were able to stop the flake here rather than hinging off. But they were able to stop at the right time. These are basally ground. Collateral thinning and very nicely done. The detaching of these flakes is part of the blade technique. the flakes on both sides show evidence of this.
- Coe: Those are Adena type. Ground blades.
- Crabtree: Adena type. Apparently made from beautifully detached flakes.
- Bordes: What material is this?
- Crabtree: They call this Flintridge, Ohio flint near the Buckeye Lake out of Columbus, Ohio. They say this clear material comes from across the Ohio River in Southern Ohio. Whether it does or not, I don't know. I mean this is their contention.
- ?Bordes: What do you think of the technique? It looks percussion.
- Crabtree: Percussion, yes it is. And well done. Extremely well done.
- Bordes: Is there not a little pressure here perhaps?
- Crabtree: I think so on that part, but the flatness of these collateral flakes is amazing.
- Bordes: Oh, ya, ya, ya. Oh, that's beautiful! You see this one, they did not dare make it fluting on the two sides I think.
- Crabtree: There just wasn't sufficient curve in order to flute on this side. It was too flat to contain the forces for removing a flute and they knew that before they did it. *Cynthia* ~~Cynthia~~, if this spacing were better, it would resemble Hell Gap. Well, it's not like the alternate, opposite Hell Gap technique. But they are wide collateral terminating flakes. There is a slight similarity to Hell Gap but a different technique was used. Not nearly the refinement of the Hell Gap point.

- Bordes: That looks partly percussion too. The other side, I am not so sure. But it could be percussion and pressure but then, if it is pressure, it is rather wide flakes.
- Crabtree: They are almost too wide for pressure flakes. I mean, your limitation with this type of material is too great to remove that width of flake by pressure and how they avoided getting the deep bulbs, I don't know. It is a very interesting technique that I don't fully understand. The bulbar scars are diffused. No pressure.
- Bordes: Yes. But perhaps it has been slightly cut - this flake. Here you have secondary flakes which destroy a possible negative bulb.
- Crabtree: Very nicely done.
- Coe: That one that you are identifying is Plano in Ohio.
- Tixier: This is Plano point?
- Bordes: Ya.
- Crabtree: This is a jewel of percussion work. Very fine.
- Bordes: And here.
- Crabtree: Was it found in a cremation. There are a few fire checks showing here and it appears to have been in a fire. Oh, it was cracked and repaired. It's a good job of repairing. These ~~just appear like~~ on this side appear to be pressure, but they are very broad. But of course they could be big thinning collateral flakes. This one was all from one side, curved to this point. From here clear ~~them~~ almost to the opposite edge and well over an inch wide. Same thing here.
- Bordes: And there are small cores here with the same technique that we have seen this morning.
- Tixier: And heat treating, yes?
- Crabtree: You can see the heat treatment. Very evident.
- Tixier: Very easy. See it is very easy.
- Bordes: *This is a little different perhaps.*
That's a core, of course. attached correction
- Tixier: But it looks like a burin.
- Bordes: But it looks like a - like it has been done on a burin after.
- Crabtree: Dr. Coe, is this a common type of their cores to make a polyhedral with flats. It's the first one that I have seen from that area. Nearly all of them are rectangular.
- Coe: I don't know what the percentage might be but these are not uncommon. Both in Ohio and Illinois.
- Crabtree: It's interesting. Each time they prepared a new platform for this particular type of flake. Here is, apparently, a bi-directional core. It's almost like one of the burin type of things.

- Bordes: Ya, ya. We have same thing in the Upper Paleolithic. But there are three little blades which are interesting. This one has an abrupt retouch on a part on the one edge. If it had been on all of the edges, it could have been called Lallame La Dou. It's the only thing that I have seen that looks a little bit like that. This one is a nice denticulate with not too much retouch. That's a strange interesting one also and this one shows some inverse retouch overlaid by utilization rather than that. But poorly treated, don't you think so.?
- Crabtree: Notice the points.
- Bordes: Ya, it's very small. And here you have a double bulb.
- Irving: May I ask a question about these cores and blades? Cores or micro-blades, whatever they may be. The Arctic specimens that you looked at this morning probably date from just a little earlier than these. It might be interesting to compare the techniques on the Arctic specimens and these. Can you, off-hand, make such a comparison?
- Bordes: Well, you know, about this comparison of techniques there is one thing. We are getting too much food at the same time and no time to digest it. So I don't remember quite well exactly where are your blades. This one I hold is a truncation ~~small~~ truncation of this micro blade.
- Crabtree: The blades that you have ^{from the Arctic have} had a little greater curve than these. However, the core demonstrated that they were able to take off very straight flakes and they were a little more minute. They seem to hold a better ^{from} and they had better control. But the basal technique of preparing ^{a platform} each time appears to be almost the same ^{also the} in placement of the tool and of clearing and freeing the flake at the basal end before it was detached. That technique appears to be almost identical with this. But some of these have a slant while yours ~~were~~ ^{had} ~~flat~~ almost a perfectly flat surface. However, this is the first one that I have seen. And to make a comparison, you would almost have to lay them out side by side and take them one at a time in order to determine the similarity or difference.
- Irving: One rather distinctive feature common to both of them is that on some of these cores, the angle between the striking platform and the fluted surface from which the micro blade was struck was thirty to forty-five degrees. And some of these, and also on some of the Arctic ones. And this is a rare feature in North America. Of course in both cases there are cores with right angles. Ninety degrees between the striking platform and the fluted surface. These are a little more irregular than most of the Arctic cores. There is a lot of variation in those when you get over into the Central Arctic.
- Crabtree: ^{of the core} There are two ^{one is} examples here. This one is a type of rectangular core and this one was from a polyhedral core. If you'll look at the basal portions of those. ^{has} ~~One is a rectangular core~~ with a slant to provide a platform for removal of blades.
- Irving: Flat fluted surface.

Crabtree: And the other one has the flat surface which indicates the polyhedral core type. This one has an angle too on the edge, while this is perfectly flat. Well, this is a beautiful collection from the Eastern United States. Along with the Bullbrook and other assemblages, we have covered a lot of ground today.

Tixier: May I show you some Piece Esquillee from North Africa?

Alan Smith: While Mr. Tixier is moving his specimens, I wonder whether it would be a good idea before we break up tonight if we could take five or ten minutes for Dr. Bordes and Don Crabtree to give us a brief summary perhaps using the blackboard of how you tell percussion from pressure.

Crabtree: We have.

Alan Smith: But all the time you say I think this is pressure and I think this is percussion. The question is what are you looking for or what seems to be the points that are diagnostic.

Bordes: Now that can be done up to a point. I shall try to do it with the help of Crabtree. Well, it is just the kind of thing you see and you are very much embarrassed to explain. But I shall try anyway. That is one of the reasons why it would be good for typeologists and archaeologists to work flint by himself even if he does not come up to the efficiency of Crabtree.

(Lapse in recording time)

Jelinek collection

Jelinek:

I brought in several different kinds of batches of material. You'll see as I go along that I don't have as many points as other people because I thought that we would probably be interested in debitage as well. The earliest group of material here would include the three bifaces at the far corner of the table. These all belong to, in general, the same stone flaking tradition which built up in the late Archaic in the Midwestern area and is the same sort of tradition that includes the biface from the Adena culture that Dr. Coe had yesterday. Now, my impression of each of these points, at least the two biggest ones, is that the primary technique of manufacture is percussion - well controlled percussion - with perhaps pressure used in finishing the edge. The next group includes these brown micro-blades and cores from Poverty Point in Louisiana and these are generally also assigned to a late Archaic context. This would place them perhaps around 900 B.C. or so. However, more recent studies of the

distribution of these sites in relation to other material in the vicinity of New Orleans indicates that they may be somewhat later than this. The Poverty Point stone industry is characterized by small cores, small blades, and frequently pointed small blades which are currently interpreted as being point^{ed} thru heavy wear and ^{heavy} retouch caused by use. The retouch on these blades is generally unifacial and generally on both edges of the blade. It seems to ^{me} be that it is extremely infrequent to encounter one of these blades ^{which} that has been retouched on the bulbar ~~side~~ surface. The group below ~~the~~ ^{Poverty} Poverty Point material and including the three corner-notched projectile points off ^{to} the left, is Illinois Hopewell. ^{And}, in this group, I would say again that the projectile points are ^{probably} out of the same tradition that produced the red ochre Archaic points just above, and the points are probably made largely by controlled soft hammer percussion, with perhaps finishing by pressure. Again this would be merely my interpretation. Under these points are three flakes of light ^{chert} ~~chert~~ which are ~~but~~ biface ~~debitage,~~ ^{debitage,} probably coming from the manufacture of points and one larger flake of dark gray material which is probably derived from what is called a cache blade, in regard to the Hopewell culture. ~~At A~~ ^A large ovate ~~debitage~~ biface generally found in concentrations of up to a dozen or more and representing apparently concentrated wealth in the form of stone material which could be worked into large implements at a later date. The manufacture of these ovate bifaces again would probably currently be interpreted as percussion. Then there is the ^{smaller} ~~smaller~~ blade industry which may or may not relate to the Poverty Point micro blades. If the current interpretations of distributions of

Poverty Point ^{around} ~~from~~ New Orleans ^{are} ~~is~~ correct, the time horizons of these two blade techniques would be quite close otherwise they would be separated by several hundred years. The ^{perimetrical} ~~peraminal~~ cores here are fairly characteristic of Illinois Hopewell micro blades. You get some idea of the size range ^{of} ~~in~~ blades and cores from the sample here, ^A and again the technique, I would interpret from what we have seen here, would be one of, I ^{would} ~~would~~ suspect, indirect percussion with a punch because of the small striking platforms on the blades and the amount of rippling which seems to appear frequently on the cores. However, there are a few specimens there which show very little rippling on the bulbar surface of the blades ^A and it would be interesting to hear comments on whether these might be formed by pressure techniques similar to those which were used the other day to manufacture obsidian blades. The final group of material from the Midwest is the group of rather irregular cores out of white chert and the spalls below the cores from Cahokia, ^A and these materials come from a time horizon, oh, perhaps 500 or more years later than the Hopewell blade material from the ~~the~~ same area, but they seem to represent a distinct ^{traditions} ~~tradition~~. There does not, in intervening cultures, appear to be a carry over in manufacture of similar flakes. At the same time these are quite distinctive in their thickness and their similarity to burin ^{spalls} ~~spalls~~ as opposed to the more ^{lamellar} ~~lam~~ material from the Hopewell industries. It would appear that the product sought in this ^{flaking} ~~flaking~~ was the spall ^{itself} ~~itself~~ from the usage marks on the spalls and the lack of usage marks on the cores. Again usage here appears somewhat similar to the usage on the Poverty Point implements indicating,

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eventually

perhaps, some kind of lateral pressure, taking off short stubby flakes and naturally grinding the edge to a certain degree. I think ^{maybe} we might have some comments on this Midwestern material first and then go on to the High Plains material. ^{Caps.?}

Bordes

Well, I will begin. ~~Bordes, speaking.~~ First the red ocher, ~~there is a~~ very beautiful. There ^{is} a very beautiful ^{half of a} off white point, ^{which} looks like a very, very good percussion work with perhaps, I don't know, some either pressure or ^{indirect} percussion, because here it is really, there are some flakes which are really very, very well controlled. ~~controlled.~~ Not beyond the possibility of somebody who would be working with flint everyday & however. The other, ^{about} the same comment. That's a nice ^{piece} piece of work, anyway. The smaller one could be ^{perhaps} ~~perhaps~~ some pressure. What do you think of it, Crabtree?

Crabtree

It appears to be pressure, ^{Solutrean} very similar to some of your Silurian material, with ~~this~~ ^{the} almost, ^{flaking} same type of flaking technique used here, ^{like} as used in much of the material we saw in the museum yesterday.

Bordes

Looks ^{if these} as though there people like the ^{Solutrean} Silurian in France used percussion for big points and when they got smaller went to pressure. I think so. Well, then the

Poverty Point, ^{Louisiana} ~~was~~. Well, it's a small blades but there are a lot of ^{barers} ~~bores~~ I think. I think there are a lot of ^{barers here} ~~bores~~ there. Well, ^{anyway} in a way what we call ^{barers} ~~bores~~ in France, ^{Sahara} no question, ^{and} some are bigger and remind me of some ^{Sahara} ~~Salin~~ stuff ^{were} ~~were~~ are used to ^{drill thru some hard stone.}

Tipier

And perhaps some ostrich eggs. ^{think these pieces are} ~~But perhaps these pieces,~~ ~~Tixier speaking,~~ like

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French
~~French pie~~

They are very, very nice and little ones and I think

we can see here a sort of grinding that ~~was~~ ^{it is} used. Just ~~in~~ ^{on} the ~~front~~ ^{point}.

Bordes

Ah, ya. Yes, it has been used to drill some ~~other stuff~~ ^{rather tough} material. That is

~~something else~~ something else. That's a notch, a notch is a notch, is a notch. And ~~it for~~

~~those are~~ ^{the} cores, ~~with~~ small cores with ~~something else coming off~~ ^{lamelles taken}. Well, I don't think

it is impossible to make them by ~~the act of~~ ^{direct} percussion. I did things like that very

easily. It's ~~more~~ ^{no} difficult to make that by direct percussion than to make a

carinate

cabinet scraper. Could be, however, it seems to be a ~~special~~ ^{special} preparation ^{of the} striking

platform that would call for punch work, ~~Because~~ ^{with} this preparation or perhaps

only with a wooden stick or ~~.....~~ ^{the antler it could be also.} But certainly not what I call direct

percussion. About now.

Jelenik

Just a minute. ^{Irving} ~~Irving~~, did you have some ~~comment~~ ^{comment} on those cores?

Bordes:

This one is ~~different~~ ^{different.}

Irving:

Nothing very enlightening. The usual absence of the faceted platform distinguishes

it from most of the Hopewell cores I ~~think~~ ^{most} and also from ~~those~~ ^{Arctic} of the ~~Arctic~~ cores.

The cores ~~of~~ ^{this} sort which are pretty simple also occur elsewhere in the Missouri

Valley in Arkansas and South Dakota but not much is ~~known~~ ^{known} about their chronology and

probably much older than the Poverty Point ^{and Missouri Valley} but this is just a possibility as of yet.

Jelenik

Geoffrey, did you want to say something about these? ~~About this..... size.~~ ^{About the stone size.}

Coe:

My only comment was related ~~to~~ ^{to} the quantity of these small ~~cores~~ ^{borers}. If they were

used for boring than they must have ~~used~~ ^{produced a} fantastic ~~quantities~~ ^{quantity} of drilled objects.

which are ^{not} in evidence. The Poverty Point type sites uses these little ^{borers} ~~bores~~ or gravers in the term ^{rather than} of thousands, dozen ^{or} and hundred. Also the materials ^{all} available are ^{small}

^{boulders, two or three} ~~bores 2, to 3~~ inches in diameter other than the larger..... material..

Bordes; Well, ^{about} I got this Poverty Point material again. Here is a core which is at first

look different, but which has been used as a kind of hammer and this looks to ^{me} ~~be~~ as

if was used as a hammer and it is not a ^{preparation} ~~percussion~~, I think, ^{of the} a platform for a punch.

Well, ^{the quantity of borers} ~~well~~ for ^{borers} you know, flint tools are very easy to make and are very quickly

* worn out. And I don't know if ~~there~~ ^{there is} ~~there are~~ any ~~beds~~ or things like that in

this ^{culture} material, but if I rember well, in the Southern ^{culture} where they made

these ^{beds} ~~best~~, there is also thousands and thousand of these blades. Well let's go to

Illinois Hopewell. That's middle Woodland?

Jelinek That's right.

Bordes { Well, just one minute. It ^{doesn't} ~~doesn't~~ matter ^(sneezes) ~~it gives~~ life to the recording.

Well ^{for the} ~~there is~~ a point, I think ^{that} ~~what~~ what Jelinek says ^{is} ~~if~~ quite all right. It

looks like ~~apercuss~~ percussion work., competent, nothing exceptional and perhaps a

little pressure to finish ^{it something} ~~it~~. ^{it something} Here perhaps a little more pressure. These blades

you say were made by punch technique. I ~~will~~ ^{wonder} ^{for} many of them. It could

be, ^{but I wonder} It could well be. I wonder if it was not by oblique striking with. This

could be punch but ^{there is} ~~unless~~ you know ~~this~~ really not much of a striking platform. Of

course, I can use ^{another} a blade as a punch but that ~~won't~~ ^{is about what would} be necessary. This one could be.

Jelinek; ^{platform} The ~~platform~~ is too small but.

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Bordes;

No, I don't think it's too small because we don't know enough still about

punch technique, ^{But I would} ~~can~~ say ^{then it is working} ~~small~~ small punch and really good

people working it. That's quite possible. And these flakes are certainly the flakes

at the beginning of the making of these points. There is no question about it. They

are absolutely identical to the ^{Solutrean} ~~Solutrean~~ flakes or the flakes you find in the

^{Mousterian} ~~Mousterian~~ tradition where they ^{have very thin hard axes also.} ~~are very fine and thin~~ also. That's no question. This

one is another thing. Was struck hard. The platform is gone more or less now. ^{not is} ~~this~~

a small platform, that could be punch but then, and this that leaves the cores, which

of course, looks a little like it was made with a punch. ^{not all of them} This one, perhaps but no

special preparation. And these ^{discoïdal} ~~other~~ things which are interesting. I don't think

they are cores, you know. They are tools. ^{kind of discoïdal} ~~This is~~ end scrapers, more or less

bifacial. ^{is} ~~and~~ here that finishing ^{if} ~~of~~ this man ^{had struck} ~~a~~ strike a little low, he would have

taken out ~~1~~ of it a beautiful ^{Levallois} ~~Levallois~~ flake. Now there is ... Cahokia. Cahokia is

another thing. There is a lot of small tools ^{on lamellae} ~~made of lamelle~~ or burin spalls with

very ^{abrupt} ~~good~~ retouch. On two or three sides, which remind me very much of ^{Saharian} ~~.....~~

Here also they were certainly ~~t~~ doing something. What I don't know. And ^{these} ~~this~~

very ^{elongated cores look like burin form but} ~~cores like burin~~
^{perhaps they are just cores}

It's very difficult to tell..

2

Crabtree: Look at this thin biface. Removing a flake of this size requires special platform preparation. This one indicates the same sort of platform preparation, however, the pressure appears to all be done unifacially. There is a slight amount of pressure retouching here on this edge, but this particular point shows ~~only~~ percussion on this side. It shows edge sharpening by pressure retouch on one side only and the platform was removed along with the flakes leaving a very sharp edge. The others appear to have been sharpened from both sides using a special bifacial retouch to straighten the edge. Most of these indicate special core preparation particularly in orienting the platform to increase the accuracy and leave no overhang. This one shows a better utilization of the core. Heat treatment is also indicated here. Look at this scar which is the point of force. Notice there is a direct line between the top and the base which indicates the use of a support or anvil. A few of the flakes may have been removed by pressure on this one. It seems that the treated material was pressure worked while the untreated material shows wider flakes indicating percussion. This is obviously the side of a heat-treated core. This one shows a flat platform so it, no doubt, came from a cylindrical core rather than a conical type. These cores ~~may~~ have been used as tools, but primarily they were made for cores. These cores show step fractures which prevented the worker from going further and they appear to have been discarded ~~before~~ before they were exhausted.

All of these have been treated. The original untreated surface is on the dorsal side while it shows luster on the ventral surface from the change. This one also is altered and shows some platform preparation, but the core is nearly exhausted. Now, this one does not show the refinement of core preparation and you can see that the worker was losing the shape of his core and could not keep it cylindrical in form.

This blade also shows a change in texture. These also show abrasion on the ends indicating a support method. This is an untreated core very likely done by direct percussion. This one is flattened slightly at the bottom. This core shows that the blades were removed from both ends in a bipolar manner and it also shows a grinding of the platform. The ends of these flakes look like the worker held the core in his hand and then, with a punch, removed these small flakes. A single ridge was followed to get this type of triangular flake. We have two \times styles of micro-blades here. Some are triangular and others trapezoidal in shape. Here are a couple of the triangular blades, unretouched, and show no use pattern.

Jelinek:
Jelánek:

Do you see any evidence of heat treating on this last group which is the Cahokia material?

Crabtree:

Not a great deal. This is slightly obvious on this particular one. The others don't show any change of texture at all. When the worker was removing this flake he also severed the end of his core, and there he was all thru with working on this one. But it looks to me like they invariably altered their material when they were doing this small blade technique. This material is quite lusterous but they utilized all of the surface and I can't find any of the original surface and, therefore, can not be sure of the altering on this one. This one is definitely untreated and notice that it is very granular compared to the others. This definitely shows the change of texture between the altered and untreated materials. I think that is about all I can say on this batch. Dr. Bordes do you want to comment?

Bordes:

Not very much except that I am not quite sure that this is a core. It's a piece of thing but I see here some trace of work to transform into some kind of tool - denticulate or hollow scraper. I don't think there would be any core preparation as neat as that.

Tixier: Don Crabtree says here we have a beautiful and well retouched cutting edge from projectile point of Hopewell. If this is a cutting edge, can we speak about this and tell these pieces projecting. Here is a problem. Is this a projectile or is this a double scraper or knife.

Jelinek. Well, this is an interesting problem but one which I had already noted because these normally just from the form in the silhouette are classified as projectiles. But they are obviously quite large to be used as projectiles. Although they would be used with a spear thrower or dart shaft. But this problem of use is an interesting one, and one which I don't recall seeing mentioned. Perhaps some of the other people here are familiar with Woodland material.

Crabtree: Well, I do think that this point is just a little unique. It has all been done by percussion on the one side. Normally you have a right and left-handed usage for a knife. However, this was sharpened on both sides by pressure retouching. This, of course, has been used, but it leaves a straight very sharp edge for a hafted knife. I really don't know much about function, but if you were going to use this as a projectile point you would balance it out and make it doubly convex rather than having almost a uniface for this would give it additional strength. In the technique of shaping, it would have been more perfectly balanced for a projectile point. A point that is doubly convex rather than flat on one side will be much stronger.

(There is no page 84)

Jelinek: Can you recall anything about function on these Middle Woodland points, Geoffrey? Or will anyone postulate the use of this knife.

Coe: We might add that most of your Middle Woodland points that are true projectiles are much smaller than this. That these seem to be the exception in size.

Bordes: Well, over there - there is something on this point that I have not seen. That is kind of Solutrean blow that could well come from a projectile point falling on something hard rather than the knife work. But after that, after this burin blow, the point has been pounded in a scraper-like way and it could well be that these people liked standardized tools and used the same thing sometimes as projectile point and other times as knives. Because, you know, to make this burin blow by using it as a knife you would really have to try to cut hard and be really strong yourself.

Alan Smith: I suggest that perhaps Madame ~~Goucheard~~ ^{Guichard} would like to look at the Mousterian.

Madam ~~Goucheard~~ ^{Guichard}: No. No, no.

Jelinek: Well, we will go on to this last batch of material. This is virtually all debitage material. There are no deliberately manufactured implements that I am aware of in this set. The four small boxes here contain debris in the first three

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from manufacture or retouch of end scrapers, apparently. These all come from the

Blackwater ^{Draw} ~~area~~ area of the ^{Llano Estacado} ~~Omoistacano~~, where stone is extremely ^{scarce} ~~scarce~~ in the

natural occurrence. The flakes all show a very characteristic battering ^{at} ~~and~~ the bulbar

end which is presumably the old worn edge of the scraper as I would ~~not~~ interpret it.

and at the striking ^{platform} ~~platform~~ itself, there is almost ^{inevitably} ~~inevitably~~ a small polished

facet, but very small. Frequently these flakes after having been struck off, have

been retouched and reused ~~again~~ indicating possibly again the scarcity of stone in this

area. The fourth box is composed mostly of small flakes of bifacial ^{debitage} ~~debitage~~ which

superficially might be confused with the end scraper retouch type of flake. I think

that perhaps through balancing of analysis in this manner in a ^{debitage} ~~debitage~~, one can come

up with more in the way of function or, at any rate, traditional difference within

^{flaking} ~~flaking~~

industries and we have seen now, and this is the sort of thing I have been

trying to start. The ~~other~~ other two batches of material are all from a single late

Archaic site adjacent to the Pecos River on the high plains and demonstrate the

differences in ^{debitage} ~~debitage~~ when different types of material are available. The

multicolored material is from typical river gravels along the Pecos but in this

~~particular~~ particular area, there was a banded chert also available and the banded

chert ^{debitage} ~~debitage~~ on this site, ^{presumably flaked} ~~presumably flaked~~ by the same people using possibly the

same techniques as the gravel material, is quite distinctive. There is ^a much higher

percentage of flakes of bifacial retouch in the banded chert ^{debitage} ~~debitage~~ and much in

~~general~~ of coars

general of coarser, cruder flaking exhibited in the other material with the exception of the small pebbles of chalcedony which in these industries, again, are used ^{largely} ~~likely~~ for bifacial retouch, I think. Any comments or shall I start.

Bordes!

Well, I have comments to do. First about the ~~end scraper retouch~~ ^{end scraper retouch}, well you ~~some of them~~ ^{well you some of them} I have the causes. No, ~~end scraper retouch~~ ^{end scraper retouch}.

~~No!~~

And among these small flakes it seems to me that ~~one~~ ^{on} them they ^{have} made some kind of very small ~~tools~~ ^{tools} which are not very easy to ~~p~~ see and it will be necessary to have time to go ~~through~~ ^{through} all of them, one by one, to see what they are. But I can see a lot of small ~~percussions~~ ^{truncations}.

Yes, there are.

Jelinek

Bordes! Good or bad, or just some of ^{use} retouch, or perhaps crushing, but here for instance is one ^{which} ~~that~~ is certainly very good.

Jelinek: Yes, yes.

Bordes: No question. And that, to me, ^{is} ~~in more to me than the flakes~~ ^{than the best} ~~on a tool~~ ^{these}.

Jelinek: Yes, a ~~very~~ ^{very} high ~~percentage~~ ^{percentage} of these points show retouch.

Bordes: This, you know, for instance this one, can be a kind of butt scraper ~~it~~ made ~~it~~ on a flake, a short flake. But this one could be ^{also} just like ^{that} on the ground and ~~somebody~~ ^{somebody} stepped on it. This is not very characteristic, but the ~~ones~~ ^{ones} we are holding, this one there is definitely a tool. That is made ^{on purpose} ~~no question~~, no question. It's a small

~~truncated~~ ^{truncated} flake and perhaps ~~it will be interesting to look at these little~~ ^{it will be interesting to look at these little}

things ~~is~~ *in your culture* because most of the time except for small blades, I have not seen very much small things in this ~~A.~~ ^{American} stuff. No, that's just... *nothing*.

Jelinek There is a very fine retouch.

Bordes Ya, it happens .

Jelinek I looked at most of these under a binocular microscope and, yes.

Bordes Well, it would be interesting I think ~~to~~ ^{to go} *closely* into this matter. Most of these are just small flakes with ~~so~~ ^{so} small a retouch that it could be anything but things like that ~~though~~ are just definitely tools.

Jelinek: What do you think ~~is~~ ^{of} the origin of these flakes on end scraper retouch.

Bordes: Some, yes. Some ~~are beautiful~~ ^{I agree, others no.} , good ~~is~~ ^{is} the best thing I can do ~~is~~ ^{is} *make you* a batch of end scraper ~~flakes~~ and then ~~you will~~ ~~I will~~.... ~~and~~ you put them in a box and after that you can look and compare.

Jelinek I've tried this.

Bordes Ya, you have tried it. Well, then perhaps you have a heavy hand with all your

end scrapers because this ~~to an extent~~ ^{for instance} I don't think this ever ~~was~~ the end of a scraper.

It's a little ~~perfect~~ ^{too thick too} .. But ~~perhaps~~ ^{perhaps} ~~it's a bottom scraper~~ ^{it is a bad end} on the other ~~end.~~ ^{hand.}

But this one you know, have you found those like that.

Jelinek Oh, yes there are others.

Bordes *There are others.* Well, to me that is as much ~~as~~ ^a tool as a ~~beautiful point.~~ ^{beautiful point} And ~~that~~ ^{that} you say is from flaking of ~~it~~ ^{bifacial things?} or something.

Jelinek I think so.

Bordes: Ya, I think so. ^{Too} Most of them, of course I have not time to look ^{through} ~~thru~~ all of them

but for instance this one is perhaps from a ^{bifacial tool} ~~percussion tool~~, it could also be from an

end scraper. It's very difficult to ^{tell} ~~beat~~ one thing from the other.

Jelinek: Yes, well, this was why I put them in.

Bordes: Yea. What are these little bits?

Those are
[Handwritten scribbles]
..... I like.

Jelinek: But most of these are interesting in ^{showing} ~~showing~~ this crescent shape.

Bordes: Oh, yes, yes, yes.

Jelinek: Striking ^{platform} ~~platform~~

Bordes: Oh, yes, most of them are made from is there more talk here?

Jelinek: With abrasion adjacent to this and all the features ^{that we} ~~have~~ been brought out

Bordes: And now for this bigger batch which come from the Pecos.

Jelinek: These are the Archaic materials . There probably isn't much to say about them.

I just brought them in to show the contrast.

Bordes: Ya, ya, ya, ~~this/it/~~ there is, there ~~x~~ is, there is, that could be also a thing of ^{bifacial work} ~~percussion~~ but, here, for instance, I see ^{for me it} ~~there~~ is a very nice and ^{denticulate} tool.

No. question.

Jelinek: Yes, Oh, ~~they are~~ there are tools in there all right.

Bordes: ^{OK} They are all right. Nice side scraper, no question. Godd, good. Not very

good material. I think it can be worked. *d*

- Jelinek: These were just random selections out of bags of unanalyzed material.
- Bordes: It could be cores, it could be much. Ya. And this is from the same origin but different material?
- Jelinek: That's right. This is altered and unaltered chert which occurs locally.
- Bordes: A lot of small flakes which could be of bifacial tools. Here they took off the platform. You know, that is something very strange. It happens also in the older culture. Quite ordinary flakes without any retouch but they took off the burin. As if this could be a tool by itself for the taking off of the burin. And flakes, no retouch on the flakes. Here it is broken and you can't tell. I knew perfectly big flakes like that with not one retouch except that they took off the burin. Ah, that's nice! What? There is nothing else to say except they certainly used a soft hammer technique to remove the blade. Mr. Crabtree.
- Crabtree: I think that the function has been well explained. There is one quite obvious thing in this collection. On certain finer-grained material they haven't used the ~~xxx~~ thermal treatment. But when they did ^{do} the fine pressure retouch, the material appears to be altered. There is only two positive indications here of the treatment. Here is the

natural facet and this is the treated side, demonstrating the changes of texture. These are ~~practically~~ the same materials and they show the change very well. When they did alter their material, they apparently ^{treated} used various small flakes which gave them better control of the thermal temperatures than they would have had if they had altered large blocks of this material. This debitage of small flakes ~~it~~ shows quite a uniformity of flaking. This is evident by the types of bulbs of force left on the flakes and also on the ^{distal} ends when ^{they are intact and} the flakes were not used for some ^{functional} purpose and ~~we have the distal end intact.~~ These outside thinning flakes ^{indicate the} show that apparently they ^{production of} did produce some quite large tools in relation to these knives over here. Of course, there is no comparison between the two tools other than demonstrating the difference in technology. ^{There is a} ~~I mean the~~ similarity in technology between ~~using~~ ^{the} well-controlled thinning flakes showing very small platforms. ^{and the technique used on the knives.} ~~it~~ This overhang indicates the use of a billet as the tool. This would relieve the shock as the flakes terminated at the ends. This material here resembles ^{ignimbrite} ~~ignimbrite~~. I think that is about all I have to say about this material.

Bordes: Well, I have ^{one} ~~the~~ last thing to say about this collection. And that is that I have been very much interested to see a little of American debitage. Not only the beautiful, wonderful tools. And I congratulate Art Jelinek for bringing it. Because it is less glamorous than the beautiful tools but in its way it is interesting. I am sure that all of these people that are here are aware of the necessity to pick up not only nice points, but also the flakes. These dumb flakes will take so much space and are so heavy but can give a lot of information.

Irwin-Williams Collection (Blackwater Draw)

Wormington These Blackwater Draw blades might be good to discuss in discussing blades.

Bordes: Yes, we will have to have some more space for them.

Jelinek We'll have to move the table.

Bordes: Start again, Cynthia.

Irwin
Williams We have a collection here of blades and blade-like objects from the Clovis type site at Blackwater Draw in New Mexico. This is a collection of George Agogino and I might add that these are not the best blades that are usually found with that Clovis. Most of these specimens were either in the hands of reluctant amateurs or were out for illustration, which is usually the case.

~~the same~~. In any case, there is a pretty wide ^{selection} ~~selection~~ of ~~this~~ this kind of material here, including some tools made on blades and, ^{addition,} ~~in addition,~~ a few things which should be of interest, a few little β flakes which are found in these boil springs, as they are called locally and which show a very high degree of polish and luster which ^{perhaps} ~~perhaps~~ we can ~~compare~~ ^{contrast} compare and ~~contrast~~ to the greasy luster which you find on heat treated ^{ed} material. Well, those are all the preliminary comments on the ^{material} ~~material~~. Do you want comment on it now?

Bordes Well, ~~this is Bordes speaking.~~ Seems to ^{me} be that there β is a nice lot of blades here, with some retouch and very good scrapers ^{which} looks ~~like~~ ^{like} the very much like the ^{Upper} ~~Paleo.~~ ^{Lithic} in the open ^{sites} ~~sense~~. This one, ^{for instances} point has a good retouch on the two sides and it, ^{could well} will be ^{Aurignacian} ~~Magdalenian~~ or something like that. This blade that I hold now ~~and~~ has a very ^{narrow} ~~large~~ striking platform, good bulb, and it looks very much like, ^{either} a punch technique or pressure technique. But pressure, my ^g guess is that it is a little too big, so it must be punch technique. This one has ^{the} striking platform ^{removed.} Looks like punch technique too. ^{it seems as if they used} And the same idea, perhaps not this one. This one could be struck with a wooden hammer, billet or something like that. The smaller ones, this could be struck also by wooden billet, but it's ^{very} ~~very~~ difficult to tell. This one could be also struck with a wooden billet, but it could, ^{also} be punch technique. Sometimes it is ^{almost impossible} difficult to ^{make?} ~~make~~ the difference. There is here one tool that could pass one ^{in France for a point a face plane of the lower Solutrean.} ~~of lower Silurian.~~ And it is even better than the one I found yesterday @.....

Well, after all perhaps ^{they} it did swim ^{through} the Atlantic. ^{Something} ~~which~~ ^{Some things} looks like a punch

technique for most of the blades from what I can see, ^B but really there are not enough

blades to be ^{quite} ~~quite~~ sure. Some are certainly made by punch but ^{whether} ~~whether~~ they were all

made by punch technique or was it several different techniques? I think that always

^{there} ~~there~~ are several techniques used. Following the shape of the core, the type of the

blade, and sometimes you begin something with punch ^{technique} ~~technique~~ and then you miss one

blade and you , you keep again your core by using direct percussion, or indirect

percussion and even stone percussion and then you go on again with punch and so forth.

I don't think there has been any ^{curvature} ~~curvature~~ in the ^{work} ~~work~~ using only wooden ^{technique} ~~technique~~

for making blades. That would have been crazy and they were not crazy. Now what do

you ~~think~~ think, Don?

^{And} ~~that are~~ as you say, ^{Creative} Dr. Bordes, there are two distinctive types of flakes here,

there are several techniques used in ~~this~~ this particular case, ^{and} and with the Folsom

complex, this was seemingly a common thing to abrade and polish the ^{tips of force} ~~points~~ or cores

~~on here~~, There are two ^{specimens here} ~~of these~~ that have demonstrated that but, as you say with this

array of flakes it is difficult to say, ~~with the~~ others on here, you can see that the

~~square ends~~ is on here, but most of them have been ^{used and deformed, modified} ~~utilized into form~~ or crushed in

~~their~~ manufacture where ^{and then} ~~they have been~~ ^{reshaped into} ~~reshaped as~~ this scraper style, here, on this.

^{These flakes show a similar technique like} ~~But the one is~~ a distinctive behavior pattern apparently of this Folsom technique is

^{of} ~~this~~ ^{polishing platforms} ~~polishing of this~~ to ~~withstand~~ enough force ^{to detach the flake} ~~to drive it straight thru~~ and

^{from this very small} ~~have a straight flake~~ carrying clear ^{through} ~~thru~~ to the end with a very small ~~tip~~

impact point. ~~There is one other flake here that you'll ...~~

Bordes *ya, ya* That would certainly ~~make~~ ^{make} a punch technique. And this polishing, evidence of

this polishing, is less slippery than the normal pressure flakes. /

Croftree! It gives a greater ~~strength~~ ^{strength}, much ~~great strength~~ ^{greater strength} to distribute the force all the way ~~thru~~ ^{through}. There is another one here of the ~~same~~ same style that showed this, /

~~and it~~ ~~don't~~, this one is abraded as well.

Bordes: Not much is left of it.

Croftree Some will keep ~~little~~ dragging their tools to give a little additional strength.

There?

This seems to be a very, very ~~diff~~ definite procedure ~~on here~~ of abrading these,

slightly in order to get this long ^{narrow} ~~of a~~ flake.

Bordes This small faceting on this one probably some ^{rubbing} ~~hitting~~ on some stone, or something.

Croftree May have been, ~~some of those in here~~. Some show untreated material, and some

show that they did use ^{the alteration,} this one material here is ~~a~~ very unique, ~~sort of thing~~. It almost

borders on the opal. No indications of heat treatment, but ^{an} ~~the~~ extremely fine

grain ^{of} material and exquisite work could be done with / that sort of material.

Bordes: Oh, yea,

Jelinek. Part of that is that boil spring polishing on there.

Bordes: Yea. That is not a polishing.

Jelinek I think it's the same material as *this*.

Bordes As this. *all right*,

Croftree With a little different ~~refinement~~ ^{refinement}.

Bordes: Yea, but that's a very good material . I would love to have some, a big block of this material.

Crabtree Oh, yes, this is beautiful material. Some of the finest in this ^{type} ~~source~~ of quartz, ^{family} ~~minerals~~.

Bordes: We have things like that in flint but its... ^{not as} ~~big a block~~ ^{black} but ~~its~~... ^{if you are lucky}
~~and in~~ you'll find one nodule in two or three thousand, which are like that.

Tixier ~~Tixier speaking~~. This bright polished by some boil spring material is very common in North Africa . Lots, and lot, lot, of flint tools from Lower Paleo. ^{and to} Neolithic which are mixed and boiled and rolled in the ^{sand at the} springs, ^{and} sometimes there is bifaced handaxes from Lower Paleo. ^{lithic} which are used more than one centimeter by some ^{boiling} ~~boiling~~ springs .

Crabtree: ^{is that so.}

Bordes: Well, look, Crabtree, was this is ^{it} ~~this~~ not a change of aspect between this small flake and this.

Crabtree Yes, this could be.....

Bordes: It could be. ^{treated}

Crabtree Very clearly so, You see, Cynthia, on this side.

Dr. W. H. Williams Oh, yes, indeed. By gosh.

~~That very good on here~~

Bordes: This is heat treated this one.

Crabtree There is a change of texture. It's quite obvious in that particular piece ~~rough~~

^{Here is another piece}
~~here is another piece here.~~ I ~~didn't~~ didn't look at the edge but this appears to be

untreated natural material, ~~here with this.~~

*O'Brien
Williams*

By the look of this, this would have been in , stop me if I am wrong, this would have been treated. We can say that, after it was made into a blade. ^{because} The relatively coarse outer surface is all over the blade but not in the small fracture off the side.

Leather

One other thing that I would like to bring out is the wide range of material with the small collection ^{showing how they favored good material,} ~~that we have is the so many have favored materials.~~ They stayed with a certain consistency, a certain type of material, ~~utilized~~ but here we range all the way ^{through} ~~thru~~ from quartzite to one of the finest grained most beautiful materials

and apparently they had utilized all ~~utilized~~ of these things. Whether there was some particular ^{special material} ~~special~~ things that they ^{liked for} ~~used~~ these uniface tools ^{maybe for its} ~~here for a~~ toughness or something like that . Notice the similarity in ^{the character of the} ~~character~~ flakes. ~~of the quartzite~~

~~Which~~ ^{is} interesting the range of texture of material, heat treated, untreated quartzite to ^{almost} ~~all most~~ the opalescent ⁺ ~~character,~~ probably two different techniques or three here of ^{from the} ~~your first~~ roughing out ^{to} ~~and~~ the final very special preparation, ^{of} ~~the~~ point of ^{force;} ~~force~~ percussion, pressure or a combination of the two ~~on here,~~ or the punch technique.

Bordes:

That is something amusing on this beautiful material . A man tried to pressure retouch and then probably, he got disgusted with this ridge and did not bother to go on so he threw it away. ^{See one, two beautiful flakes then} ~~It wasn't too beautiful, then...~~ ^{to heck with it.}

That means ^S that probably he found that this flake was not big enough or that he had

a lot of material. ^{and did not} You don't care very much about ^{it.} ~~this?~~ That is a flat, it's a flake which has been taken out of something ~~it~~ which has been retouched. Ya, it could be also a side scraper. Could have been something like that .

Erving: Are there very many other artifacts made ^{of} from quartzite from this locality?

Erwin Williams: There are a number but certainly the ~~favorite~~ favorite material is this finer grained chert and chalcedony.

Erving: ^{Could} And these two things ^{that} which look like points of ^{face plane} are both made of quartzite, but nothing else is , I wonder if that is of any significance or is that just ...

Bardas: Well, this could have been of this kind ^{point of face plane, of flint figure} or of chert, I don't know you call it. We could never ~~find~~ find the difference between flint ~~the~~ and chert.

Erwin Williams: I think this apparent ~~the~~ selection of quartzite for making these ^{point of face plane} things is ^{purely} really artificial due to the fact that ^{some of the} some chert makes much better ones ^{they are} and much easier to take photographs of and illustrate ^{is all} so it ~~calls~~ for illustration.

Henry Irwin: ~~Irwin speaking.~~ One of the problems of the whole Blackwater area is, ^{th/} as I think Art ^{is} pointed out earlier, ~~is~~ that there just isn't much flint locally and they ~~went~~ went a great distance. They went over to the Albates quarry in, you don't have any Albates ^{Albates?} ^{Albates?}

material, But there ^{quarry} . Here is albatas in the tool assemblage. Most of this chert comes from the ^{Albates?}

Edwards Plateau. I don't know about quartzite.

Irwin
Williams:

There is certainly none available locally and there is a tendency, as Art pointed out earlier, to use everything and to resharpen all the tools down to the point of uselessness. Perhaps this accounts in some part for the use of some of the tiny resharpening flakes as tools after they have been struck off.

Jelinek:

I have the impression that this is more characteristic of the later industries of the Blackwater Draw and a little less characteristic of the Paleo-Indian material. The topography may have been somewhat different during the time the Paleo-Indians were present and then there may have been accessible exposures of the material closer. In some degree, anyway. At least in terms of the quartzite which occurs in large pebbles in the gravels of this area. And it is exposed in tremendous quantities along the edge of the Llano Estacado up to the ^{north}~~North~~ of the Blackwater Draw. I think the quartzite would probably have been the most accessible material, being maybe twenty-five miles away. Whereas, the other finer materials would have had to have been brought a greater distance.

Crabtree:

No preparation on that one.

Irwin
Williams:

What of this one?

Crabtree:

It has been shaped to clear and free the flake and increase the degree of accuracy. Notice the very flat flake with almost no overhang and no bulb of percussion.

Bordes:

For that I must tell something. Every time you use cortex as the striking platform, you have a much more diffused and smaller bulb.

Wormington: We have quite a mixed bag here. I think we'll start perhaps with the Folsom material because I believe we have some pieces here broken in the process of manufacture which may be of some interest. This is Folsom material from Lindenmeier. This is perhaps, I suspect, a preform. These I would suspect were broken in manufacture. These are some of the channel flakes that were removed in the course of fluting. This is a very characteristic type of scraper with this little projection on one side. Perhaps you would like to comment on this before we go on to other material.

Bordes: That's something else?

Wormington: That's something else. This is just the Folsom material, right here.

Crabtree: This one here is remarkably thin. The flute has been detached with a step fracture at the end showing a great deal of control. Their ability to stop the flake by a step fracture rather than a hinge. I would like to define a little of the difference between a step and a hinge fracture. A step fracture terminates in a right angle truncation and a hinge fracture terminates in a curved break. This step fracture takes a ^{direct} ~~direct~~ downward pressure with just enough outward pressure to detach the flake. I am speaking of pressure and I should, perhaps, refer to it as force until the technique of fluting a Folsom is more sharply defined. On this Folsom, they were able to control the blow, or the force, sufficiently to stop the flake at the distal end without letting the flake come forward to end in a hinge fracture. And some of these have been carried entirely ^{through} ~~thru~~ to the distal end. The distal end of this artifact

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is abraded apparently indicating support to withstand the force used to detach the channel flake. When applying force at the base, the angle between the base and the tip cannot vary more than one or two degrees in order to terminate the channel flake properly. Because of the preform being designed too flat, the channel flake spread on this one. It's unfortunate. Oh, here is one that shows no polished platform or none of the preparation that is usually associated with the Folsom technique. This is the distal end of the channel flake for you can study the force lines and they indicate where the force was applied. This is also the distal end of the channel flake which, unfortunately, is not nearly as diagnostic as the proximal end. This shows a feathering out of the flake at the distal end to transmit the pressure from one end to the other. Marie is quite right in saying that these pieces here are preforms. They certainly are. I can see no evidence of the thermal change on any of the artifacts, but the smaller flakes do indicate heat treatment. This one is quite lustrous but not knowing the source of the raw material, it is difficult to determine whether it was altered. This one demonstrates the normal preparation of the Folsom showing the preparation and the grinding of this edge and the control the worker had in forcing the flake the length of the artifact. I'll turn it back to Dr. Bordes and Marie.

Bordes: Well, I have not much to say after what Don Crabtree said. He is the expert in making the Folsom, I am not. But, however, I agree with him that this is certainly a preform for some point. Here it is very interesting this piece because it shows that they were reposing on something when they were working. They made a special preparation and very probably there has been two flutings, you know. One on the other and none of them was too good.

Crabtree: You can determine how it was broken on the end there, Dr. Bordes, by studying the break there on that side. In the second fluting, I would say.

Bordes: I will say that there was a flaw in the flint and it gave a kind of , what is the word, rebound of the short wave and it went South.

Crabtree: This might account for the excess material on the tip. No doubt this was the tip and they left this thickness here for support which would help in the fluting. Notice even in the preform that they have left the tip thicker.

Bordes: ^{Yag Yag} One of these channel flakes has been after worked into a tool. They made the small platform on this side and then very ^{probably} ~~poorly~~, by pressure, they made it a sharper edge.

Wormington: Here is one that has the little graver tip too where it has been pointed.

Bordes: That I don't know. I would like to have a big glass to look at it. It could be.

- Wormington: This may not be a good example, but we have dozens of ~~them~~ ¹⁰³ ~~them~~ ^{them.}
- Bordes: But this could well be an accident. As for this kind of special scrapers with this point which here is almost a borer, I wonder if it is not something akin to the old joke about the curved gun to shoot around the corner. You scrape your skin like that, but sometime I tried the scrapers on fresh skin and sometimes there are little bits of flesh that you cannot get with this edge and then with that you can get it much better. And it's a kind of composite tool I think, rather than a special tool. Instead of being a scraper it is scraper plus another tool all the same. Like there are burin scrapers, burins or scraper, borers. This is a scraper - well, I don't know how to call it - beak or something like that. And that is really very interesting. But that is about all I have to say on this bit of material.
- Wormington: Before we leave Folsom altogether, may we just have a look at these. I brought this simply because it is probably the most extraordinary example of fine flaking on a Folsom that I have seen. You might like to examine this. This is of some interest, I think, because something very characteristic of the Folsom is the removal of flakes on either side of the channel. I would be curious as to whether this was done after the fluting. I suspect that it was. And this is quite characteristic of the classic Folsom and among the knappers who were producing forgeries many of them are not on to this yet, and this is a great help.
- Crabtree: This is a good observation. The Folsom is quite different than Dr. Byer's collection. *the fluted points in* *When these little diagonal flakes* ~~are removed prior to fluting they will be intersected~~ *by the channel flake scars.* of the channel flake is done prior to fluting one can easily see the intersecting flake scars. These diagonal scars at the base ~~is~~ ^{are} the big difference between some of the Eastern

fluting techniques and the Western fluting techniques. These two little flakes are removed to leave a smoother surface to provide the flatness for hafting and they are generally removed after the fluting. This one is awfully flat. Because of the thinness and the flatness of ~~the~~ *this* preform, it would have been disastrous to have tried to flute this for it needs a ridge to guide the flute.

~~For~~ *on the mass in the middle* It is the ridges₁ that guides the flute and this ~~one~~ *preform* was left too flat. So he salvaged the point by ~~not fluting~~ the opposite side and removed ~~just~~ *big* just a single flute on the one side. *not fluting on the opposite* The Lindenmeier site produces one of our finest examples of edge retouching and as far as I know it

has not been exceeded at any other site. These retouch flakes are so ^{new} tiny - Just mentally calculate what type of tool was needed to remove these tiny flakes without leaving a crushed edge and each one required individual flake preparation. *a flake on one side - then* The worker ~~removed~~ *turned the point & removed a flake on the other* from one side to the other on both sides. This is a fine example of lateral edge retouch showing great control. It is almost unbelievable. The spacing per inch and the amount of flakes removed in order to sharpen the edge of the tool is extraordinary. It seems like almost art for art's sake. A very refined technique.

Bordes: Well, I have some words to say about that. About this specially beautiful bit of work. It seems to me that this

point was broken not in the making but by utilization.

It seems there would have been no point in making this fine retouch on a piece which is broken and so I think they did make it complete and you can see the first preparation here. There are flakes like that and the others are a little more ~~outward~~^{abrupt}. I think that this point was used and broken in utilization, not in preparation. What do you think of it, Don?[?] Look you can see the two different sets of retouch.

Crabtree:

Yes, the two different sets of retouch are very obvious on this side. This flake didn't go over as far ^{as} ~~the~~ the retouch and you can see the shearing of the ends - such as this example. It is not as obvious in this particular piece here but, usually, you can see slight compression rings starting at the point of force. These compression lines are not present when the flake is feathered out and these have been feathered out very regularly on that side. By inspection of these rings with a glass, it can be determined if the retouch was before or after the fluting.

Bordes:

But I don't see the point of making such a fine retouch on something broken.

Wormington

These next four examples are also from the Blackwater Draw locality near Clovis, New Mexico but the upper horizon. This is more recent than Folsom. This is one of the Meserve, Dalton perhaps, and these are in the ^{Scottsbluff} ~~Scotts Bluff~~ tradition though lacking the stemming. But it does seem a somewhat different type of flaking and I thought it might be interesting to compare this with the Folsom.

Crabtree:

To compare them, we must start with the unfluted side.

Two different techniques are demonstrated between the ~~Scotts Bluff~~ ^{Point} and the Folsom. The ~~Scotts Bluff~~ ^{Scotts bluff} has very deep, very sharp, well-defined retouch flakes. The flakes are not parallel sided because the worker did not take advantage of the ridges to guide the flake and there is an overlapping of flakes and no regularity as there is on the Folsom. The techniques are entirely different. It is difficult to determine the exact point of force when there is a folding over of the flakes like this. These have been feathered out and terminated at the end with a great deal of ~~compression~~ ^{compression.} These flakes ~~show~~ ^{show} that the worker took a much heavier bite into the side to remove the flakes so that the edges would have enough strength to withstand the pressure and the flake would pop out right to the end. If they were pushing slowly, you would not have the well defined ridge in the center like we see here. As a thinning technique, they met the flakes in the middle. If this particular shaped point was fluted, it would produce a narrow channel and it would hold the narrowness to the tip - similar to the Clovis technique. The Folsom preforming preparation produces a much broader type of fluting flake because the worker leaves excess material down the median line to guide and broaden the flute.

Bordes:

Yes, yes.

Byers: May I say something before you move on. This first point that you picked up broken in the manufacture - excuse me, I can't see through the microphone - shows very clearly that this flake here is a lateral flake that ran and not a centrally placed flute flake. It shows the same preparation at the base that you find in some of the Eastern points and these - ^{atypical} ~~a typical~~ if you want to call them Folsom - are the things that are typical of the Eastern ^{Fluted Complex.} ~~fluted complex~~. And according to my observation, the discards from the fine stuff on the Plains is the equivalent of the fine stuff in the East.

Bordes: Well, to come back to this point. It seems that it was broken after the first fluting was done since the platform was reversed already. But you know, as it is, it is not in the middle, it is a lateral flake. I wonder if this is punch or pressure technique. It seems difficult for me to miss it so much. And I wonder if it could not be tried just by percussion.

Crabtree: It could be. This shows compression here that you wouldn't get with the pressure.

Bordes: And I did some experiments with fluting and I got some very often, you know, the fluting not ~~from~~ ⁱⁿ the middle but just on one side because you can not be accurate enough with percussion as you are not as accurate as you are with pressure or punch technique. And so it could well be that this is an example of fluting by percussion.

Wormington: Shall we go on now? This mass of material is part of the Black Spout material from Wyoming where there has been

much controversy concerning it. It is all surface material. Some people just on the basis of ^{typology?} typology attribute great antiquity to it. Kreiger regards it as Pre-projectile Point, but we have absolutely no way of dating it. My feeling is that it could be of almost any age, perhaps relatively recent. These were some of the techniques that were used in this.

Bordes: This? That's a Levallois core, but not exactly.

Crabtree: The first one I picked up here is a peculiar type of flaking, but it seems to be distinctive among a certain group of people. These are thick, tabular flakes and this is because the worker did not follow the ridge but, instead, positioned his blows ^{one} ~~one~~ behind the other. This is something slightly on the order of a side struck flake. The blow is struck well inside, or similar to the Levallois technique of moving inward to remove a heavy tabular piece. From the patination, the little projection here appears to have been reworked after this flake was removed. On this side scraper, the flakes were removed this way and then it was turned around and flakes removed from the opposite side. This is very characteristic of this flake technique - both from this side utilizing the ridge first, then moving back inside again without following this single ridge in order to give the beveled edges on both sides of that particular flake. The others are really in Dr. Bordes' category. Here is another representative

style of this type. Another similar type of flaking technique. But quite a different technique was used on this one. This is moving back inside, something like a Levallois flake. It seems characteristic of this technique to move one blow in back of the next one. The material is extremely fine-grained; one of the finest quartzites that I have seen. Here is another fine example of beautiful quartzites. Notice, again, that we have the same technique to provide these very thick heavy flakes for some purpose. For what, I don't know.

Bordes:

There is here a lot of flakes which looks to have been made by the Mousterian or some kind of Levallois technique. I agree with what Don Crabtree says and this core is amusing because it looks at first like a good Levallois core, but it is something which is slightly different. It is the same idea but there has been, it seems, that either the flakes did hinge fracture or, ^{in France, we say} ~~it went~~ it went on the other side and that could be a Levallois core. Well, from here and in Africa, no question, it would be called a Levallois core. So the Levallois technique, after all, is known in the States. And this I wonder. This is made on a flake. And a kind of bifacial tool.

I don't think that it is a core. I don't see any special preparation of any striking platform. It could be a first preparation of a Levallois core but I will rather call it a kind of denticulate with a thin back. That happens very often in Mousterian culture in France. Nice side scrapers. And, well, what is this tool? The one with the little borer. Ah, here, certainly there has been two different times of working. First a flake of this type and then somebody picked it up and made a small alternated borer with alternate retouch. Perhaps a thousand of years later, perhaps only ten years later. Sometimes the patination is very quick. But, anyway, it can be anything. Big blade, yea, in this quality. This shows a blade technique, one blade taken off. It looks quite different from the rest of it. Well, you can find this in flake culture you know. From time to time they made blades. In some Mousterians there is up to forty percent blades, you know. But, anyway, this is certainly not Mousterian this bifacial tool. Made by percussion I think - no question. There is another one I think. That is another thing. Also this is a kind of denticulation with a backed technique. That's ~~##~~ very common in some Mousterian. Perhaps for hafting, perhaps for just holding in the hand. Better, but that is quite common in some Mousterian. You know most of these tools you could lose in a Mousterian assemblage. I don't say, or mean, that it is Mousterian or it is very old. It can

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be sometime in France some Neolithic looks very much when you take off the ~~typical~~ ^{typical} tools looks very much like Mousterian. So it can be any age. It can be very old; it can be young.

Bonneville
Bordes What is the age?

Wormington We don't know. This is ~~work~~ a very controversial ^{subject}.

Henry
Irwin: It's a quarry site, so I suspect there are quite a number of ages.

Wormington Probable.

Henry
Irwin; It is a big quarry. ^{That} It ~~has~~ very fine grained cherts that ~~out crops~~ ^{outcrops} in the ^{Black Hills} area.

Wormington This is the sort of thing that ^{is} often perhaps erroneously classified as a burin. I would like to hear your comments on this.

Bordes No. That is just an ^{octagon} ~~article~~ of fracture, I think. It was a thick flakes that ^{took} ~~came~~ ^{a part} off of the side ^{off}, well let's ^{see if it was} ~~say~~ of taking it out, and it broke.

Wormington That was my impression.

Bordes, But that can have been ~~used~~ afterwards as a burin or something else, you know.

It can very well have been used after as a tool but technically it is not a burin.

Tihier A broken scraper.

Bordes; Oh, it's a ^{broken} ~~broken~~ anything. Yes.

Tihier Scraper.

Bordes; Yes, yes, But no I think the flake broke when they took it off and then they made a kind of retouch on one side and maybe a small ^{bore} ~~burin~~ on one side and on the other

it was pointed. Perhaps ^{they used} using it as a burin but it is not technically a burin.

No it ^{is} right there, the yellow one.

This is something different, I think.

Yea, this is something else. I brought this. This is unfortunately only a

cast, but it does show the very fine oblique flakes ^{ing} that can be done on this quartzite.

This is the same basic material from the same site. This is not as good an example

of ~~flaking~~ ^{flaking} but this ~~show~~ ^{shows} what can be done with this particular material..

That's a very nice cast anyway. Beautiful transverse, oblique pressure.

This is essentially the material from which it is made.

Ya. That is not so good. Is that the same thing?

No.

That's something else? All right.

That was of no importance. And these I brought just to show the sort of change

of material ~~thru~~ ^{through} time. The earlier people really made a great ~~effort~~ ^{effort} to ~~get~~ get fine

grained material. The later period people utilized just whatever was ~~available~~ ^{available}. And

this was just to ~~show~~ ^{show} material change. If we go still later, however, into ^{the} sort of the

~~whole~~ protohistoric period, often we get a return to the fine grained materials. And

there is a ~~whole~~ ^{whole} series of these very small end scrapers which are characteristic

of a late period. I thought perhaps you might comment on these very small scrapers.

Some of the late protohistoric sites that ~~Weamer~~ ^{Letmer} has been digging...

is this statement
interrupted?

Yes, they are very nice small end scrapers. They look a little like some ~~Mesolithic~~ ^{Azilian}

scrapers in France, but, however, on this one, you have this little point like in the Folsom type which seems to have gone a long, long way. And with a fine retouch.

Wormington: Yes.

Bordes: This also is retouch up on here. Spanish Solutrean-like they are. Some are ~~Azalian~~ ^{Azilian} like. How do you call it - covering this retouch which covers all the face is more Solutrean-like or Folsom-like than the upper ~~Magdalenian~~ ^{Magdalenian} or ~~Azalian~~ ^{Azilian}. Never that in Magdalenian or ~~Azalian~~ ^{Azilian}. The outline yes. Mainly this one or this one. They are very small but we have as small as that in the Early ~~Mezolithic~~ ^{Mesolithic} or the ~~Mezolithic~~ ^{Mesolithic}.

Daugherty: Marie, may I ask a question? Do you find those hafted in the sites?

Wormington: No, there are no perishables available or no bone.

Daugherty: We find identical scrapers to these up in the ~~plateau~~ ^{Plateau} and we have found them hafted. And the method of hafting is to put them in a deer bone about this long that it isn't tapered in any way toward the scraper point. The things are set way in so that just a little rounded curve projects. I would guess that in some of those where it begins to flatten off either ~~thru~~ ^{through} use or ~~thru~~ ^{through} retouching in sharpening, because only the curve projects that it would get flatter and flatter as they sharpened it until ~~it~~ ^{there} wasn't anything left. And you would get a change from a rounded to a fairly straight across type of scraper end.

Bordes: It could be. But are your scrapers which are hafted retouched on the dorsal face ~~also~~ ^{also}?

Daugherty: All around.

Bordes: All around, yes, but ~~on~~ the dorsal face here is completely retouched on some of them, you see. ~~they~~ Have you this kind of retouch?

~~on some of them, you see. Have you this kind of retouch.~~

Daugherty All the way around ~~to~~ the

Bordes Around yes, like this one, but what I mean is it retouched covering all the dorsal face?

Daugherty: It varies. Some ~~it goes~~ clear up to the top and some are like that last one you had there with the ~~flatter~~ ^{flatter} flake.

Bordes: ~~Another~~ Another question. Is there ~~any~~ any trace of utilization on the flat side in your scrapers?

Daugherty Not much.

Bordes: Not much, no. No I wonder if ~~this is~~ ^{this} thing being hafted as you say, were used like that or ~~like~~ like that, *pushing*

Daugherty These would almost have to be coming back toward you because they would have to be held direct.

Bordes: Like that you mean, working like ~~that~~ ^{that?}

Daugherty They are set in such a round end with only this little bit sticking out you couldn't *get any scraping action.*

Bordes All right.

~~You couldn't get any scraping action.~~

Tixier ~~Tixier speaking.~~ I think so, because in North Africa when end scrapers are burnished, you see, the burnishing begins here and often is covering on the upper ~~face~~ ^{back face} face but never on the ~~biface~~ ^{biface}. And I think that there are some scrapers, some hafted scrapers, in the *Wiltonian* of South Africa. *Phumbnail* ~~Some rare~~ ones, I think.