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June 1, 1978

Mr. Don E. Crabtree
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Kimberly, Idaho 83341

Dear Don:

I just had a very exciting week: the "grand" opening of the Ice Age Art exhibit and 3 days of discussions with a professional expert from Sydney, Australia!

Thanks to you, I was invited to the opening of the Ice Age Art exhibit at the Museum of Natural History (pamphlet enclosed). The exhibit was, of course, fascinating. Because of crowding, however, I left most of the viewing until another visit. It was exciting nevertheless. (also ran into Lucy with her husband there.)

Thank you for mentioning my name to Mrs. Stone of the Museum regarding possible flintworking demonstrations (hence also the invitation to the above opening). They are expanding their Upper Paleolithic exhibit around October, and they may be contacting me for possible demonstrations then.

Last weekend, Brian Cotterell of the University of Sydney, Australia, visited me for three days. He is presently on a sabbatical at Brown University (at Providence, Rhode Island). Brian gave a paper at the Vancouver use-wear conference last year. I think his paper is probably the best effort ever by an engineer (he's a mechanical engineer) or a physicist on the mechanics of flaking related to archeology. I still don't understand all of it. Even if it were not 100 % correct, it is still a very significant contribution. He has been working (off and on, of course) on crack paths for some 13 years or more! His professional specialization is fracture mechanics.

Would you believe it, Don, that Jeff's flintknapping demonstration at Vancouver was the first one Brian ever saw! Well, he has had a few hours of personal practice now. We had many discussions, but I made a point to see that he does some flaking. I told him that his contributions to archeology on the mechanics of flaking would probably increase ten-fold if he did some flaking.

I tried to expedite his learning process (and stimulation of interest) in flintworking. I guided him flake by flake, interrupting him at first to do each "platform" preparation and to remove hinges/steps - in just striking off flakes from a core, pressure flaking a preform I had prepared, and doing some thinning on a thick "blank" I had prepared. I could not believe how well this seemed to be working. I gave him two more preforms and an antler tine pressure flaker as he left. I hope that did the trick, and that he starts on window glass, etc., etc.

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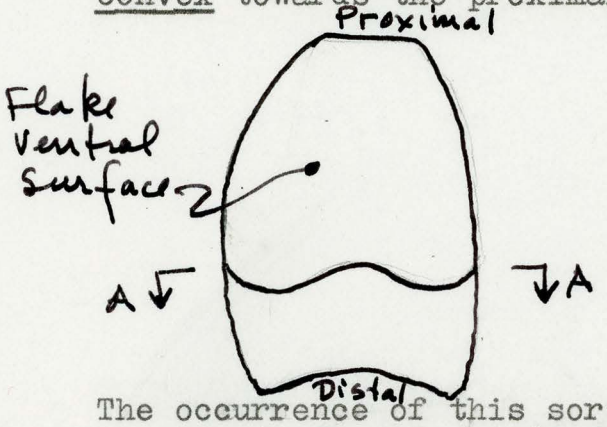
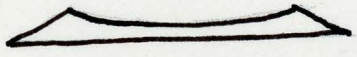
We had interesting discussions on fractures. He was very much interested in a number of unusual fractures on flakes that I showed him. He seemed to be particularly interested in the samples related to the attached sheet. (It was a "hand-out" at a recent flintworking demonstration and talk to a small, informal group in New York.) I am just starting to work on the problems referred to on the sheet. By the way, I gave him also an unusual flake showing ripples (undulations) partly convex towards the proximal flake region: Something like this



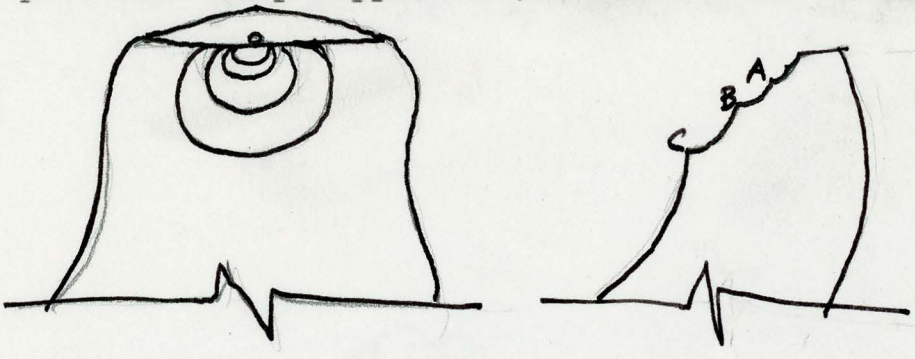
Very Approximate Sketches.



Sect. AA (Approx.)

The occurrence of this sort of ripple configuration, which appears to occur most frequently near flake terminations, is related to the phenomenon that I refer to on the attached sheet.... By the way, the unsymmetrical ,"one-sided" fissure pattern in the case of unsymmetrical geometry is, I believe, related to the nice analogy with glacial flow in a valley that I seem to recall you referred to in your polyhedral core paper. (The fissure pattern that I am referring to is indicated approximately on the attached sheet.)

We also discussed what I have been referring to as proximal "step-ripples". (Is there a better term?)



Terrible Sketches! (But you have seen what I mean.)

I have seen these or similar ones only on flakes produced by very hard hammer (hard quartzite or steel, for example). I suggested to Brian that these may be related to vibrations of the partly removed flake due to the blow. As the crack progresses, say from A to B to C, the "periods of vibration" increase. (This is analogous to the "period of vibration" of a tuning fork increasing when the length of its arms is increased.) At the discontinuities in slope, such as location B at the step, the crack stops, and then starts again. The increases in the "periods of vibration" contribute to increasing spacing between the step-ripples. (Rate of the applied force increase, as well

as some other factors, may also be relevant here.)

We had a number of other interesting discussions... By the way, the attached sheet on ripple and striation configurations suggests that such configurations may give some glues on the flake shape (dorsal and cross-sectional geometry) from looking at the flake scars on the core alone.

During my weekend with Brian, it became even more evident to me that "personal experience on knapping" is crucial to understanding the mechanical processes of flaking of interest to archeology. I think it is not necessary, nor desirable, for every flintworker to make "replicative" studies of classes of particular artifact "types" in order to contribute to archeology. Yet even in such "non-replicative" studies, I believe, it certainly helps if one knows how, for example, to thin bifaces, to do parallel flaking, to produce blades from polyhedral cores, etc., in as many ways as possible. So these "non-replicative" studies are another reason for flintworking.

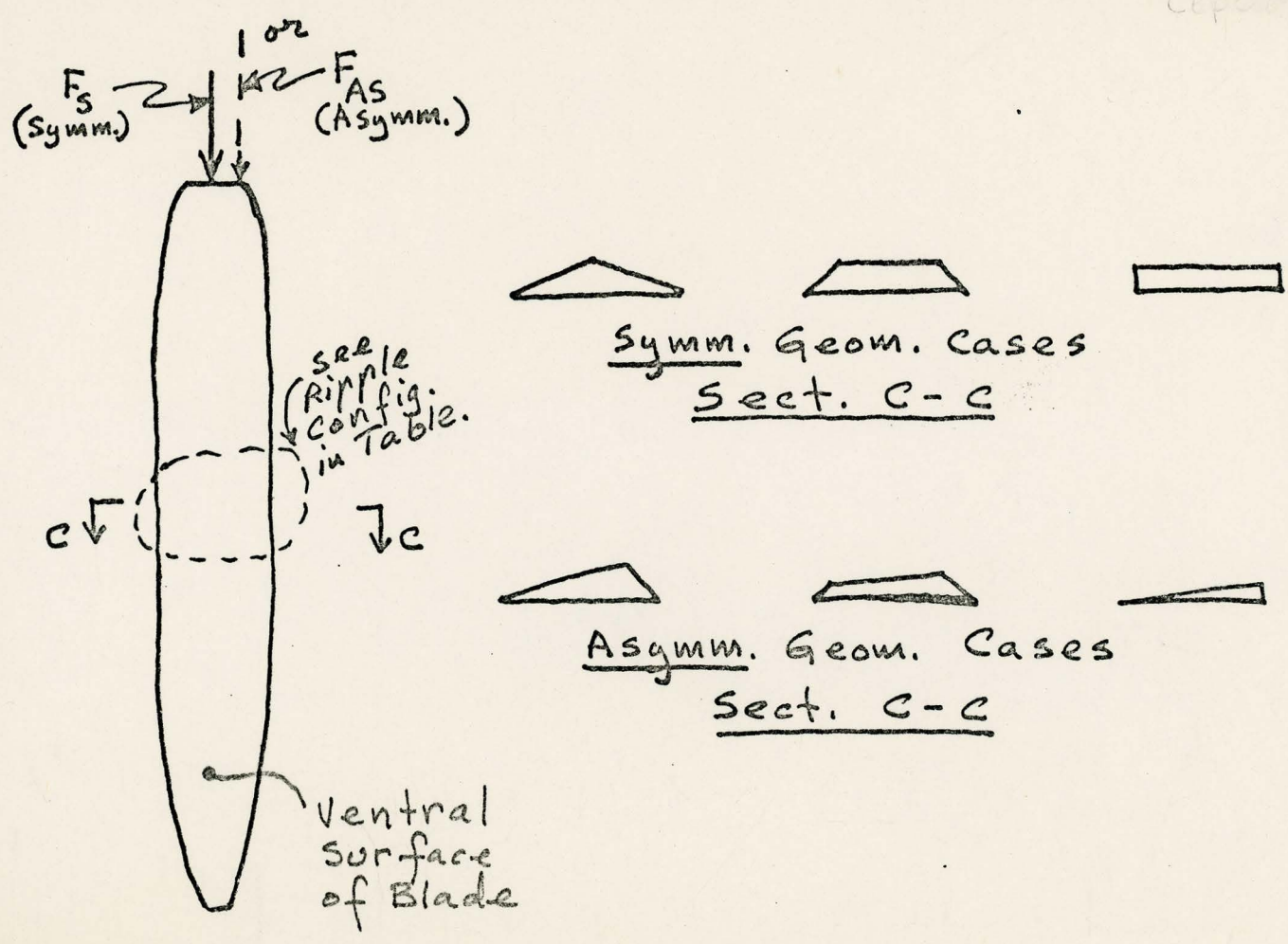
By the way, in his Vancouver paper, Brian Cotterell notes that understanding of archeologists' flaking problems can contribute to fracture mechanics in general (no matter where it is applied). Unintentionally, flintworkers will no doubt contribute in this respect.

Best of luck to you and Jeff for the flintworking school!

With best wishes,

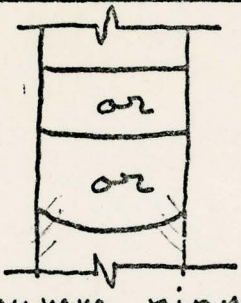
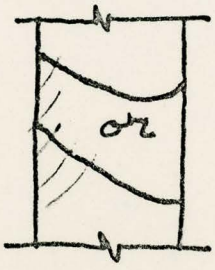
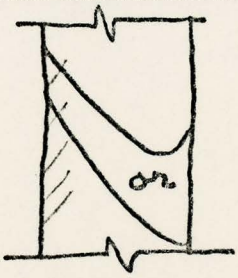
Are Tsirk

P.S. Remember I mentioned to you about the ultrasonic modulation technique for measuring crack velocities? Well, I inquired about the availability of the equipment needed. It seems that the only places in the world that have the required equipment are Freiburg and Cambridge (England).



Approx. RIPPLE CONFIGURATIONS

(Observed or Expected Tendencies)

	Symm. Force F_S	Asymm. Force F_{AS}
Symm. Geom. (Sect. c-c)	 Symm. ripples	Similar Trend Asymm. ripples
Asymm. Geom. (Sect. c-c)	 Asymm. ripples	 More Asymm. ripples

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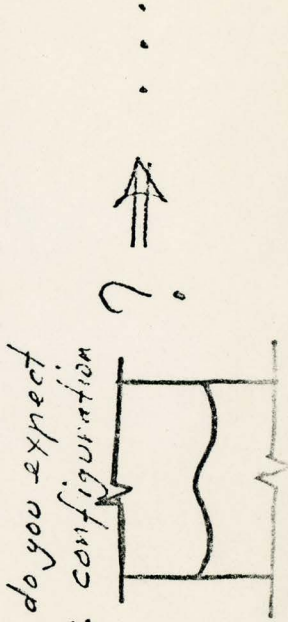

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