September 4, 1991

Interim Report No.2 For: Pat Delgado and Michael Chorost
From: W.C. Levengood
Subject: Continued Examination of Crop Circle Formations.

Gentlemen:

Please keep in mind as you examine this material that many of the comments refer back to my previous report of Aug.2, 1991. If you use the code numbering system this should not be a problem. Most of the photos and photomicrographs, as you will note are based on work with earlier samples. Much of the work discussed here provides more information regarding the earlier, partially studied sample groups. I will continue to refer back to these samples since I have not completely examined any group to my satisfaction.

EXAMINATION OF SUBMITTED SAMPLES

I.) Code: G16-126 (Lockeridge) Sample groups A,B and C.

In the Aug.2, 1991 report I presented data showing significant stem node size increases in the "Circle-A" and Ring-B" samples when compared with "Control-C". In the enclosed photo of excised nodes from the 2 and 3 positions on the plant these differences can be readily seen. Note the more protruding nodes in the A and B samples. Although the node-4 samples did not show a significant increase in the size ratio the sample-A nodes were observed to have (see photo) various degrees of bending. This could have been caused by the manner in which they were packaged, however, no severely bent node regions were found in the controls.

Microscopic Examination-- detailed comparisons of the node tissue in samples A,B and C disclosed some very interesting differences in cell structure and opened up another exciting perspective in these studies. In both the A and B node tissues the accentuated cell wall pit formations were again seen. I say "again" because as you will recall this effect first appeared in the G16-116 sample (Aug.2 report). If you compare photo marked "Node-3 Control" with photo marked "Node-3 Circle" you will note many small, well outlined cell wall pits in the Circle tissue (arrow shows an example). Also compare node-4 control and sample where the differences are again seen; however, in this case the cell wall pits in the circle sample are slightly elongated.

Although these pits are not seen in the controls this does not mean that they are absent in the control tissue. They are normally very difficult to observe and photograph in fresh tissue. The question is-- why are they so apparent in the circle samples? It appears that some mechanism has expanded and increased the diameter of these pits. An indication of this cell wall stretching is shown in the photo marked "node-2 Circle" where faint streaks or lines are extending out from the pits. The pattern of these lines indicate that they are stretch marks in the cellulosic microfibril networks composing the cell wall matrix. What appears to have

occurred is a rapid expansion of the cell walls which resulted in an expansion of the pit structures (like a spot on the surface of a balloon as it is being blown up). The mechanisms relating to this wall pit effect are discussed in detail in a later section.

In both the A and B samples the input of energy producing the node expansion appears to be concentrated in the Node-3 region. This is illustrated in Fig.1 where the data previously discussed in the Aug.2 report are plotted as a function of node position on the plant. The difference is quite striking. In all of the samples I have examined the maximum expansion occurs in the Node-2 and/or the Node-3 regions. If I may again evoke the idea of an ion plasma interaction the observed concentration of node expansion at the 2-3 positions (which are about half way up the stem of the plant) can be explained by simple physical principals. At the base of the plant ions would leak directly into the soil base and produce a reduced effect. At the upper apex leakage would occur into the air from the apical leaves (approximately a point discharge).

There is some indication from the accumulating data that the greater the node size ratio the more expanded the cell wall pits. For example, comparing Node-3 circle pits with Node-3 ring, one can observe slightly smaller pits in the ring sample and as shown in Fig.1 the pit enhancement is not as pronounced in the ring sample nodes.

Visual Seed Examination-- throught this and the following reports the seed examinations are based on the number of malformed or abnormal seeds. To understand what is judged as abnormal refer to the enclosed photo showing seeds from the G16-116 analyses (circle - 40% abnormal, control - 6% abn.).-this sample group was also the first to exhibit the pit enhancement - also the first opportunity to examine fresh tissue.

Sample	Abnormal Seeds
A-Circle	32.3%
B-Ring	10.0%
C-control	1.2%

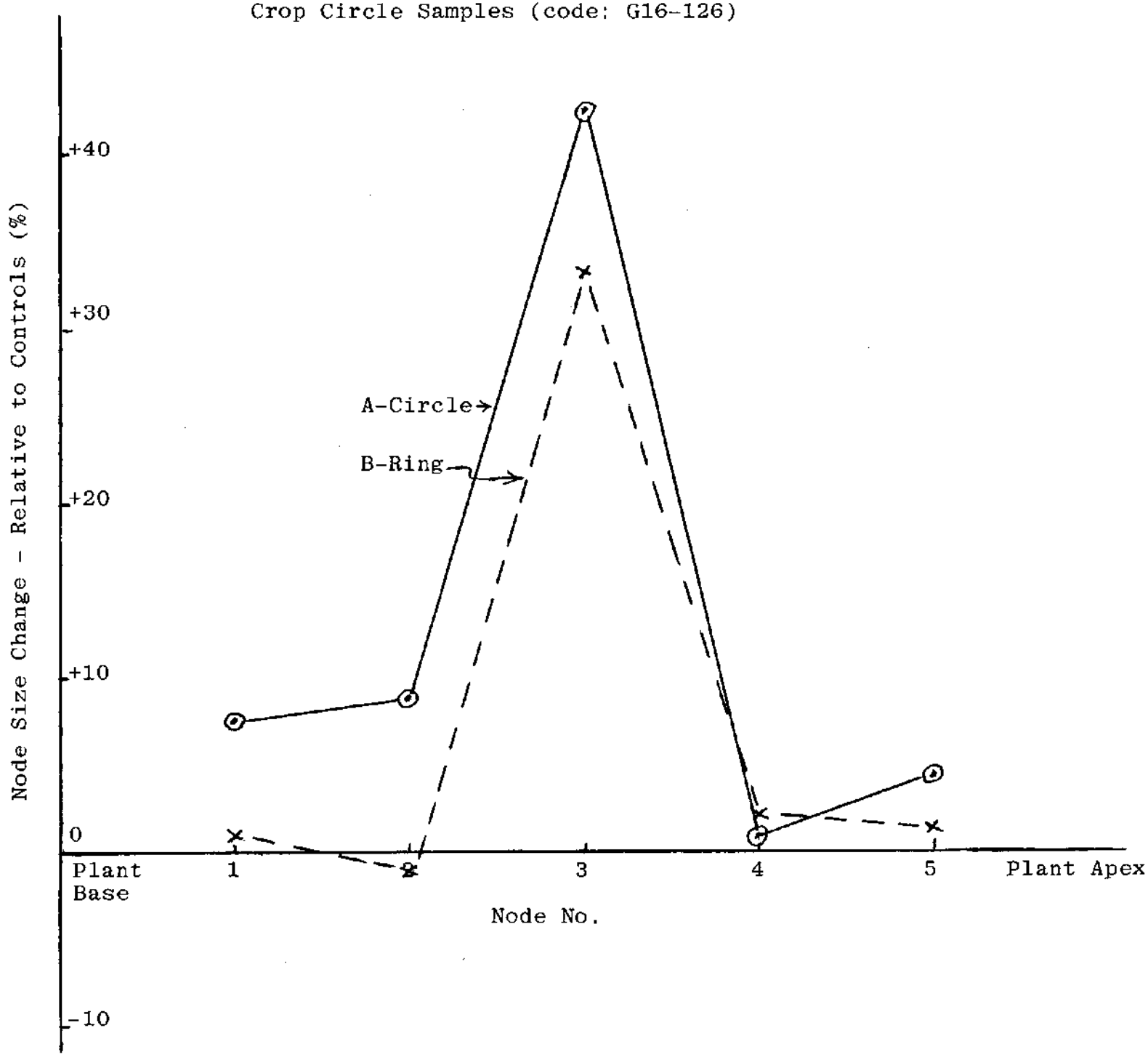
II.) Code: G16-126 Sample groups D and E. (wheat) Alton Barnes

In the D-sample from a small,approx. 110 in. dia. circle the nodes were significantly expaned but to a much less degree than in the A and B samples (node-3 max. at +9%). The node tissue disclosed the pit enhancement with some elongation of the pits noted.

Visual Seed Exam.--

Sample	Abnormal Seeds
D-Circle	20.0%
E-Control	1.5%

Fig.1 Relative Node Size Change. .s Related to Position on Plant
Crop Circle Samples (code: G16-126)



III.) Code: G16-126 Wheat - Samples H and I (Maisey Farm)
The nodes in the "Ring" sample-H were not significantly altered in size when compared with the control-I sample. A degree of pit enlargement was observed, however their size and frequency were much less pronounced than in samples A,B and D.
Visual Seed Exam.--

Sample	Abnormal Seeds
H - Ring	6.3%
I- Control	2.0%

The overall effects seemed to be considerably less apparent in this sample - perhaps less energy input in the outer ring formations.

IV.) Code: G16-135 Wheat samples from: Pat Delgado
Received - 7-29-91, Samples taken: 7-20-91
Formation at:Alton Priors, Wiltshire
Comments from Delgado: "jet black substance smeared on the upper surfaces only of the seed heads and leaves"

Microscopic Examination-- the intact wheat heads were observed to have patches of this black material over what is presumed to be the upper surface (see comment by P.D.) and located in most cases at the upper or bearded end of the seed glume. It was quite apparent that the black regions were where the plant tissue had been severely "charred", in fact fragments of this charred tissue still retained the cell structure on a macro-scale (40X mag.). Many loose charred fibers had broken away and were scattered over the surface of the seed heads. In several regions fibers were located which were still attached to the seed beard and occasionally only the tip of a fiber had been charred. There are no indications of any external "substance" having been applied to the plants.
This charred tissue is however a very interesting effect and for it to have occurred in the form seen here the following conditions were necessary.

1)-the plant tissue must have been on the dry side. This was confirmed by the fact that the control seeds were very close to harvest maturity, therefore the plant stalks and outer tissue of the seed heads would not be green and hydrated.

2)-for carbonization (charring) of this nature the heating must have occurred in a reducing (non-oxidizing) atmosphere.

3)-the heating must have been intense and for a very brief period of time. Otherwise underlying tissues would have been charred.

Visual Seed Examination--

Sample	Abnormal Seeds
Circle Floor	11.8%
Control	1.0%

At this juncture I again examined the grass samples previously discussed in the Aug.2 report (see Code; G16-120). In this tissue the black layer appeared to have been applied to the leaves in a very uniform layer. On re-examination it became evident that the black layer was really composed of the charred suberized layer on the leaf surface. This is a waxy film which would under reducing conditions become amorphous carbon. I would say that both of these samples were produced under very similar conditions as outlined above. In fact, the energies may be quite similar in all of these formations - they only appear different because as the crop matures changes take place in the plants response and sensitivity to the imparted energy.

V.) Code:G16-137 Barley from Pat Delgado
Received: 7-23-91 Taken: 7-14-91
Formations at: Stonehenge (two pictograms)

Although the nodes on the plants from both the formations had higher node ratios the data were not significant due to the fact that only one plant was available from each location.

An excellent seed supply was available and after taking out of dormancy are now being examined in the redox system. Preliminary data strongly suggest a physiological difference between the control and formation samples. The results of this and other redox experiments will be summarized in a later report.

VI.) Code: G16-139 Wheat from: Pat Delgado
Received: 7-26-91 Taken: 7-17-91
Formations at: Dundry-near Bath (Hill Farm)

Node expansion significantly increased in the circle floor sample (node-2 max. at +16.8%).
Visual Seed Exam.--

Sample	Abnormal Seeds
Circle Floor	6.7%
Control	1.3%

VII.) Code: G16-141 Wheat from: Michael Chorost
Received: 8-12-91 Taken: 7-30-91
Formation at: Lockeridge, West Woods, U.K.
Comments: Formation made 12-16 hrs .prior to collection.

Node expansion significantly increased in the "Oval-sample" with node-2 maximum at +10.4%
Visual Seed Examination--

Sample	Abnormal Seeds
Oval-sample	0%
Control	0.6%

These plants were very close to maturity when the formation appeared and this may account for the lack of abnormal seeds.

SIMULATION OF CELL WALL PIT EFFECT

When the very unusual cell wall pit expansion is examined in relation to the other observed abnormalities such as deformed seeds, node expansion and carbonized tissue it becomes apparent that an external, rapidly occurring and pervasive energy input is involved in the crop formations. One property of this energy is to produce localized heating on the plant surface. If this energy also produces internal heating in the plant tissue this could account for the rapid cell wall expansion and the resultant cell wall pit enlargement.

To examine this possibility sections containing nodes from still fresh control plants were placed in a microwave oven for a 30 sec. exposure. A re-examination of this tissue revealed a precise duplication of the cell wall pit enlargement. A photographic record was made (film still in camera). The microscopic "stretch marks" were also seen on these rapidly heated cell walls. At least one phenomenon associated with these crop plant formations has been duplicated in the laboratory, albeit on a microscopic scale.

COMMENTS:

Several aspects of the crop circle formation problem were very tentatively discussed in the Aug. 2 report. Now,I feel that we have a much more solid data base and statistical analyses to lend support to these earlier comments. To summarize my current thinking:

1)-cell wall pit enlargement in crop circle samples appears to be a manifestation of a very rapid internal heating.

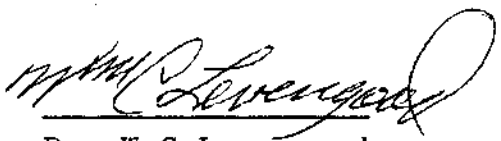
2)-the wall pit enhancement can be precisely simulated with microwave energy input into fresh tissue.

3)-a stem node expansion effect in crop circle samples has been observed in the majority of the samples examined. These node changes are assumed to be related to the internal heating effects.

4)-damage to the developing embryo or seed is quite evident if the crop formation occurs in the early development stages of the plant.

5)-if the crop is approaching harvest maturity when the formation occurs the seeds show little external damage; however, physiological changes are observed when examined with the redox test method.

6)-the superficial charring or carbonization of the outer tissue in two submitted samples indicates two aspects of the energy input; first the rate of heating was rapid and second the presence of a reducing atmosphere.



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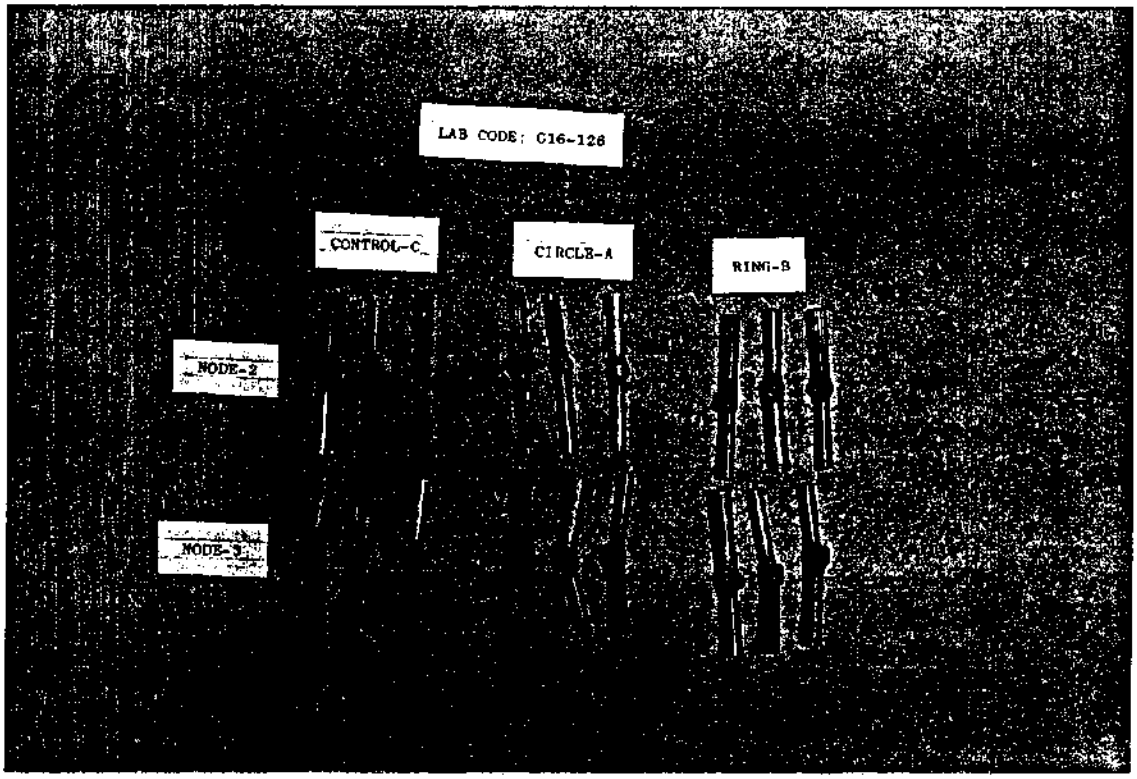
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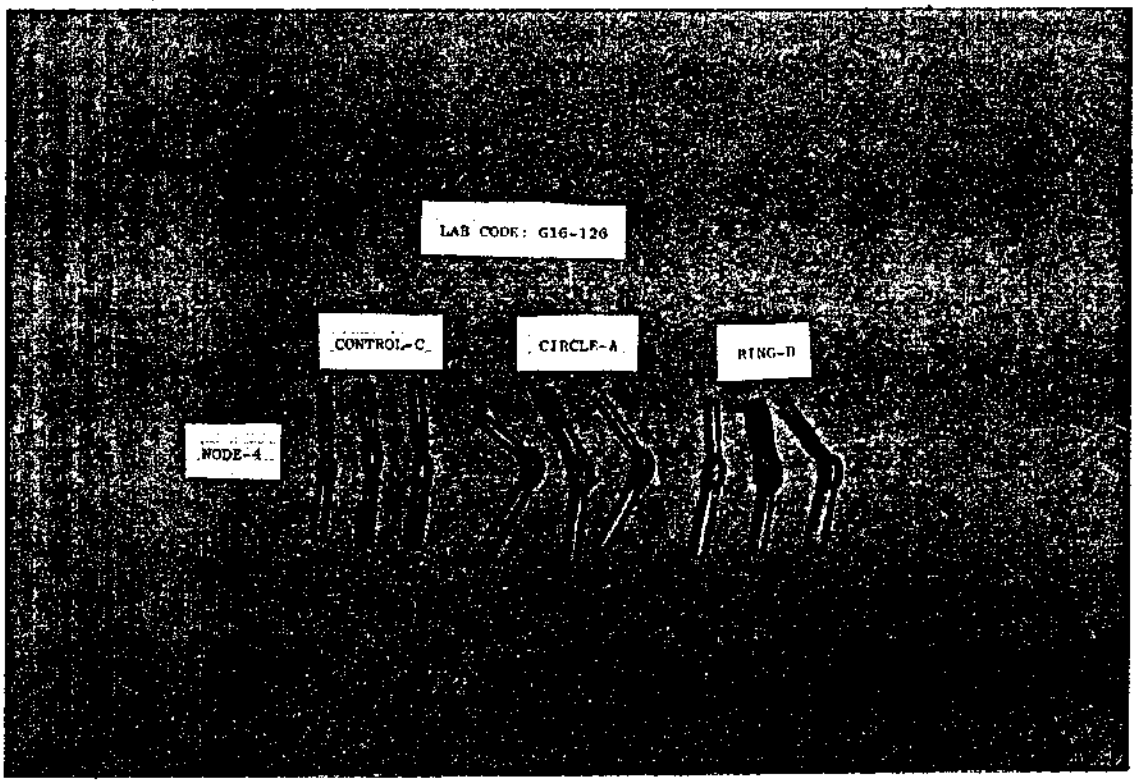
CONTROL-C
CIRCLE-A
RING-B
NODE-2
NODE-3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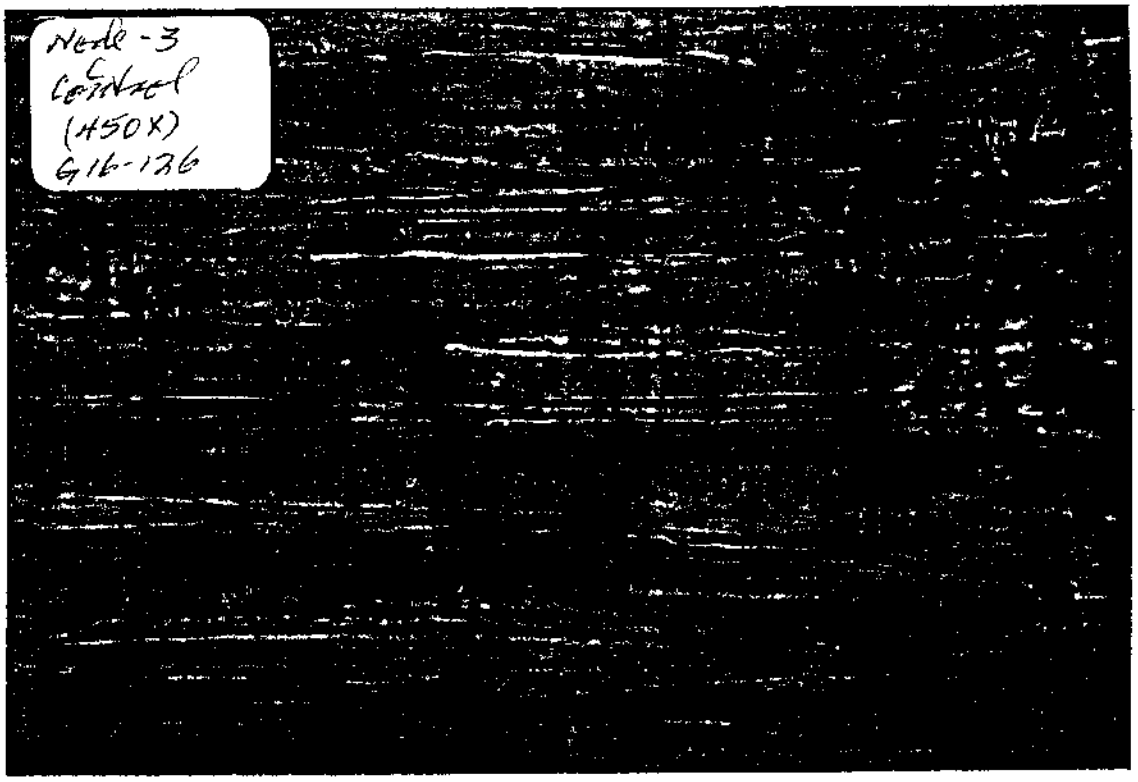
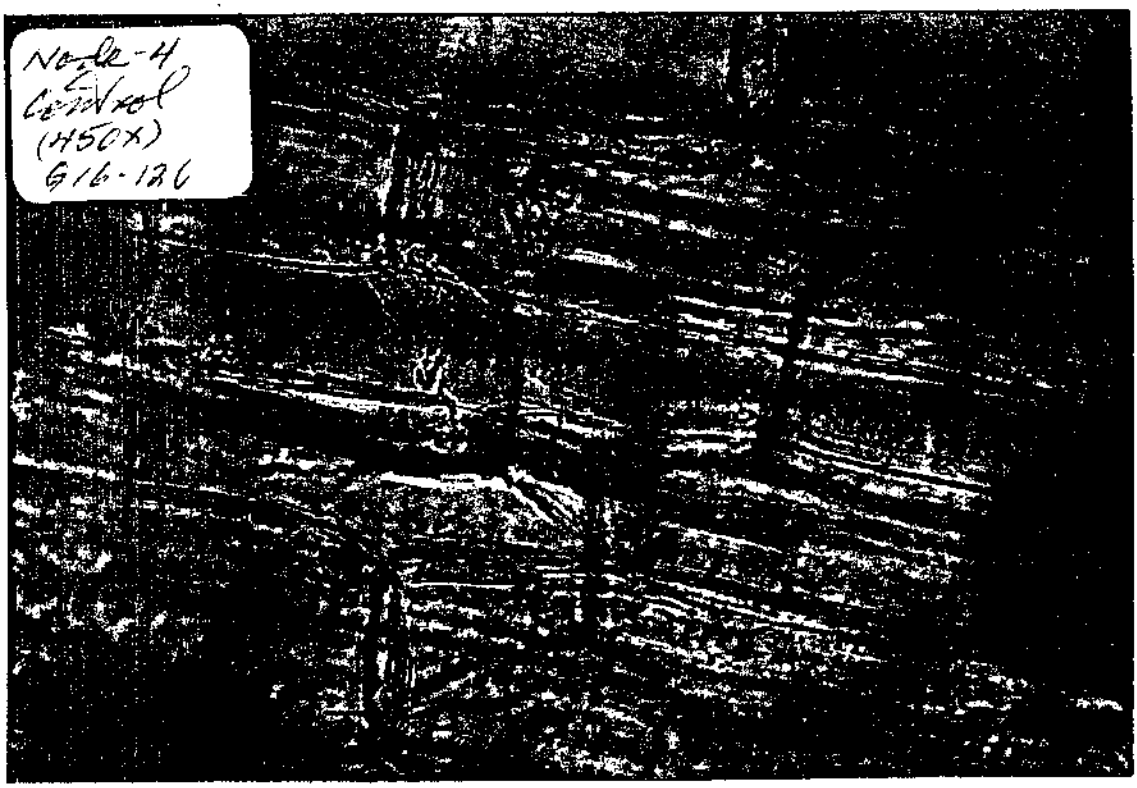
CONTROL-C
CIRCLE-A
RING-D
NODE-4


Node-3
Central
(450X)
G16-136

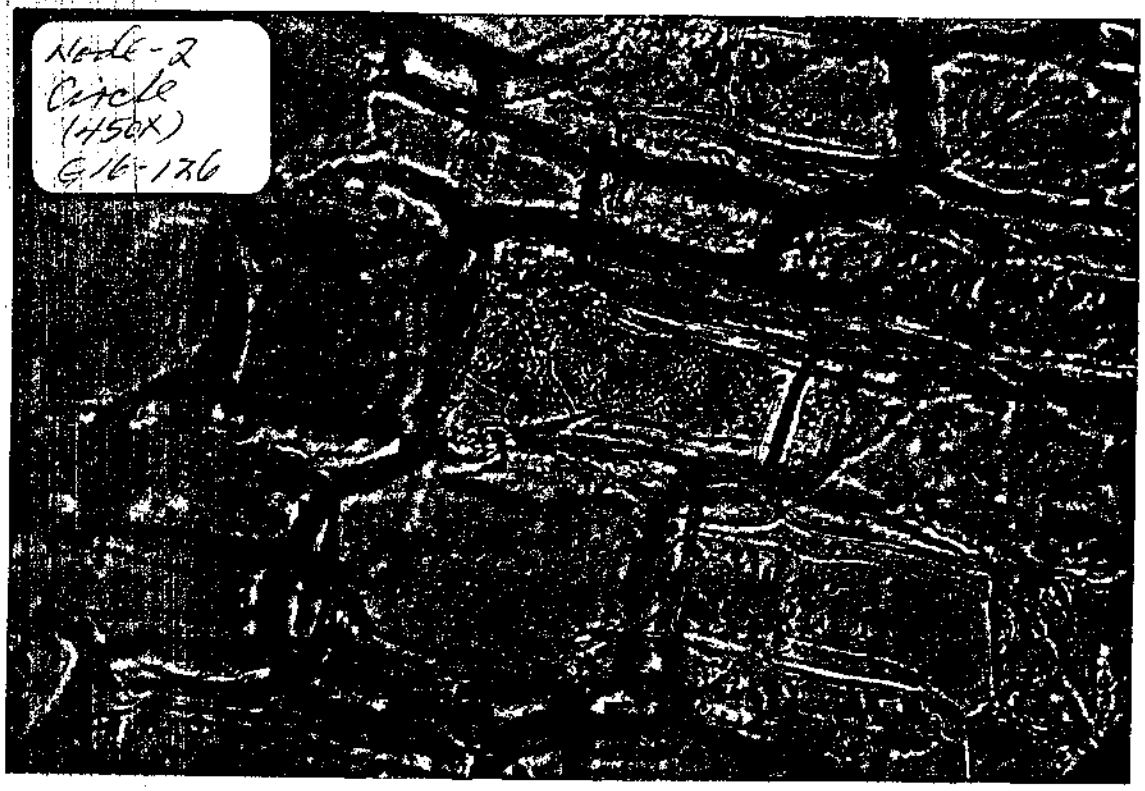

Node-3
Circle
(450X)
G16-136


Needle-4
Control
(450X)
G16-126


Needle-4
Citrate
(450X)
G16-126


Node-4
Control
(450X)
G16-126


Node-4
Circle
(450X)
G16-126


Node-2
Circle
(450X)
G16-136


Node-3
Wing
(450X)
G16-136