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PHOENIX COPPER, B. C.

GEOLOGY NOTES

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INDEX

PHOENIX MINE

STRATIGRAPHY

AGE	FORMATION	LEGEND		ROCK TYPE
TERTIARY	MIDWAY	Pf, Pa	737	SYENITE, FELDSPAR (PULASKITE) & AUGITE PORPHYRY DYKES & SILLS
		Db	736½	INTERMEDIATE TO BASIC FLOWS
	KETTLE RIVER	Ar	736	ARKOSE, SHALES, CONGLOMERATES & COAL SEAMS
JUR. - CRET.	LARAMIDE	Gd	734½	QUARTZ DIORITE & DIORITE
TRIASSIC	BROOKLYN	Ba	736½	BASALT
		SC	738½	SHARPSTONE CONGLOMERATE
		Ar	739	ARGILLITE WITH PEBBLES
		Sk	746	SKARNS: LIMESTONES, Skl; ARGILLITES, Ska; SHARPSTONES, Skc; CHERTS, Sks
		Ma	740	MARBLE
		As	740½	AEOLIAN SANDSTONE
		Ar	745	ARGILLITE WITH PEBBLES
		SC	738½	SHARPSTONE CONGLOMERATE
	RAWHIDE	Sh	743	SHALES
PALAEOZOIC	KNOBHILL	Ms	739½	MUDSTONE & SHALE
		Ch	742	CHERT
		Ls	740	LIMESTONE (PODS & LENSES)
		An	746½	ANDESITE

G.F. AUGUST, 1964

KNOB HILL FORMATION

Very little work has been done on this formation. The sequence proposed of Andesite, Limestone pods, chert and Mudstone is that found on the railway grade West of the Brooklyn Mine.

The Andesites vary in composition and texture and a great amount of petrographic work is needed to sort this out. One such Andesite area on the Ehelt side of the Marshall Lake ridge has a Rhyolite texture with Malachite coated shears which assay 0.60% Cu. It is possible then that some of these "Andesites" contain copper.

The sequence is not the same everywhere. The Brooklyn contact to the South of the mine area is with a coarse grained Andesite and Seraphim points out that it is a "clean, fresh-looking hornblend diorite, most likely a flow or hypabyssal intrusion."

The Limestone pods are rather strange, isolated pieces of marbleized Limestone. Abont half-way between the mine office and the Snowshoe pit on the road there is a lens of white marble, maybe 10' long and 2' wide. (A-62-63)

The Cherts are generally massive and gray to black. It is possible that some tuffe are mixed in with it. As yet no thin section study has been made.

Perhaps the best structural evidence of the top of the Knob Hill formation will come from the Argillites and Mudstones in contact with the Sharpstone Conglomerate to the West of Marshall Lake. Some of these Argillites look similar to the Rawhide formation. A-63-86 (N76°E-56°N) and A-63-254 (Anticline from limbs N30°W and E-W-29°N) indicate that the contact with the Brooklyn Sharpstone Conglomerate must be an angular unconfarmity. However, the contact at A-63-254 is broken but not highly sheared as one might expect with a décollement.

KNOB HILL FORMATION cont'd

CONCLUSION:

The differentiation of the Andesites has not been worked out. Probably the Mudstones are the only structural features readily available for structural studies. These suggest that the Knob Hill formation is highly contorted and forms an angular unconformity with the Sharpstone Conglomerate. LeRoy proposes (p 30) "The rocks of the Knob Hill group form a broadly elliptical trough-like fold, the center portion of which is buried beneath younger strata...." This fold may be a portion of a syncline with an approximate North and South trend."
If this trough exists it may have some ore control and therefore should be studied carefully.

Since the Brooklyn formation is now considered to be Mid-Triassic in age and the Knob Hill as Palaeozoic, then an unconformity must exist between these two formations.

RAWHIDE SHALES

ABSTRACT:

There is some difference of opinion among the authors who have described this rock type. This is understandable considering that none of them took into account any folding. Upon mapping, it is found that there are anticlines and synclines and these are most likely cross folded to a certain degree.

AUTHORS: LeRoy (1908) This author calls this rock an Argillite and places it in the late Brooklyn formation.

p 40....."The Rawhide formation....overlies conformably the Brooklyn formation. The exposure is an erosion remnant of a formerly more extensive development and has a maximum thickness of rather less than 100 feet... The beds are either almost horizontal or dip at low angles to the Northeast...... The two principal sets of joint planes are almost vertical and strike N60°E and N15°W, respectively. These combined with minor planes cause the Argillite to break into rhomboidal blocks."

McNaughton (1936)

He also uses the name Argillite and, like LeRoy, considers it to be above the Jasperoid.

....."The Argillite Southeast of Phoenix are flat lying at the Argillite-Jasperoid contact 500' East of the Rawhide Mine, but elsewhere they strike N40°E and N50°W and dip Westerly 21 to 42 degrees. The estimated thickness of the band of Argillite 600' South of the Rawhide Mine is 300 feet. What may be a poorly preserved fossil plant was found in the Argillite 800 feet Southeast of the mine."

Seraphim (1953) This author calls the rock a shale, and considers it to be in the early Brooklyn formation.

......"The Shale has well marked bedding, showing light and grey laminations and intercolated lenses of sandstone and conglomerate with smokey-grey chert and sparse jasper pebbles. The beds in some places are flat and in other places dip as much as 15 or 20 degrees West and Northwest. ......The Rawhide formation, then, is a lens of shale lying below and transitional to the Brooklyn Formation.

RAWHIDE SHALES cont'd

FIELD OBSERVATIONS:

The rock is more correctly a shale, although in some outcrops slatey cleavage is found. Bedding is one to four inches, often with cleavage on the bedding plane and at two other directions intersecting at a sharp angle. A little pyrite is sometimes on these planes. Some of the Shales are carbonated. The texture is normally very fine grained and grading cannot be seen. However, Dr. Little has found such an area about 200' West of the showing on the upper railway grade near the Snowshoc Mine. Here the beds pointed out are graded and overturned. However, this is an exceptionally contorted area and I feel other locations would have to be found to prove that this whole outcrop is overturned.

STRATIGRAPHY:

Its place in the stratigraphic column is not clear, as evidenced from the authors mentioned, and their maps. This is understandable when one realizes that the Shale is not only at the base of the Sharpstone, but also in it. As mentioned, Dr. Little has been able to prove that some of the beds are overturned. This may explain the structure. Also, he has found some fossils in the upper Snowshoe railway grade outcrop. These too will help, especially if the lower railway grade outcrop has the same fossils.

The possibility that these may be two different horizons is suggested from a structural analysis using 48 points. Here the lower railway grade has beds bearing N12^{o}E-50W (Fig. 1) which have cylindrical cross folding with a calculated axis N79^{o}W plunging 50^{o}W. Good drag folds are available and one was found with an axis N 77^{o}W and plunging 37^{o}W.

RAWHIDE SHALES cont'd

STRATIGRAPHY cont'd:

The upper railway grade outcrop however is N14°W at -30°(Fig. 2) and has a cylindrical cross fold of N12°E plunging 12°N. Thus if we are dealing with same beds the cylindrical fold must in turn be rotated almost 90°! (Fig. 3)

One other outcrop of Rawhide Shale has been seen 3000' West of Knob Hill Repeater Station on the power line. This was a very small outcrop (A-62-71) which may have had a bearing of N20°E-37°W.

McNaughton also considers the shales at the Skylark to be Rawhide but unless Dr. Little has found fossils here for correlation I would suspect that these are Knob Hill Shales.

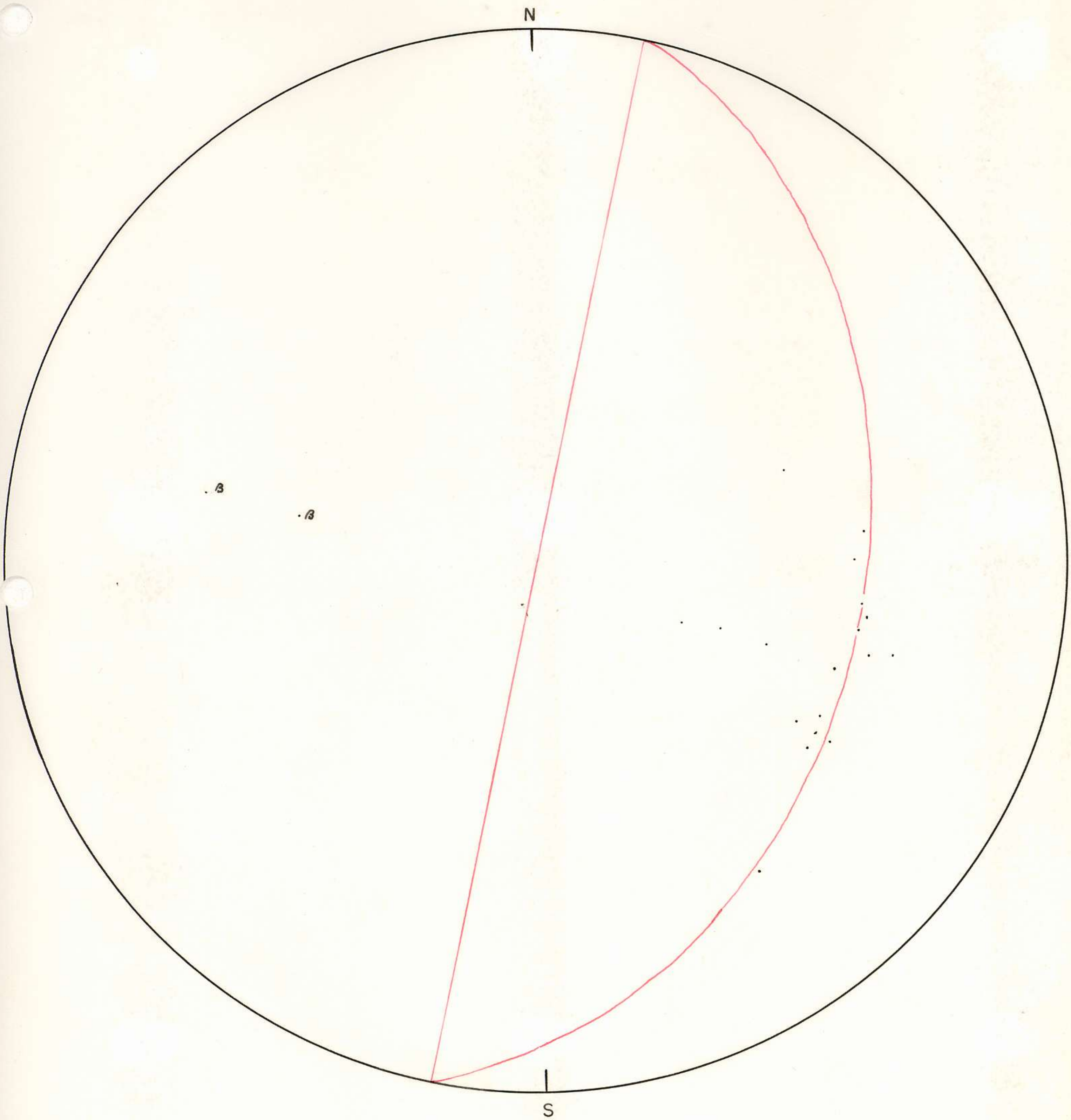


Fig I Rawhide Shales Lower R R Grade

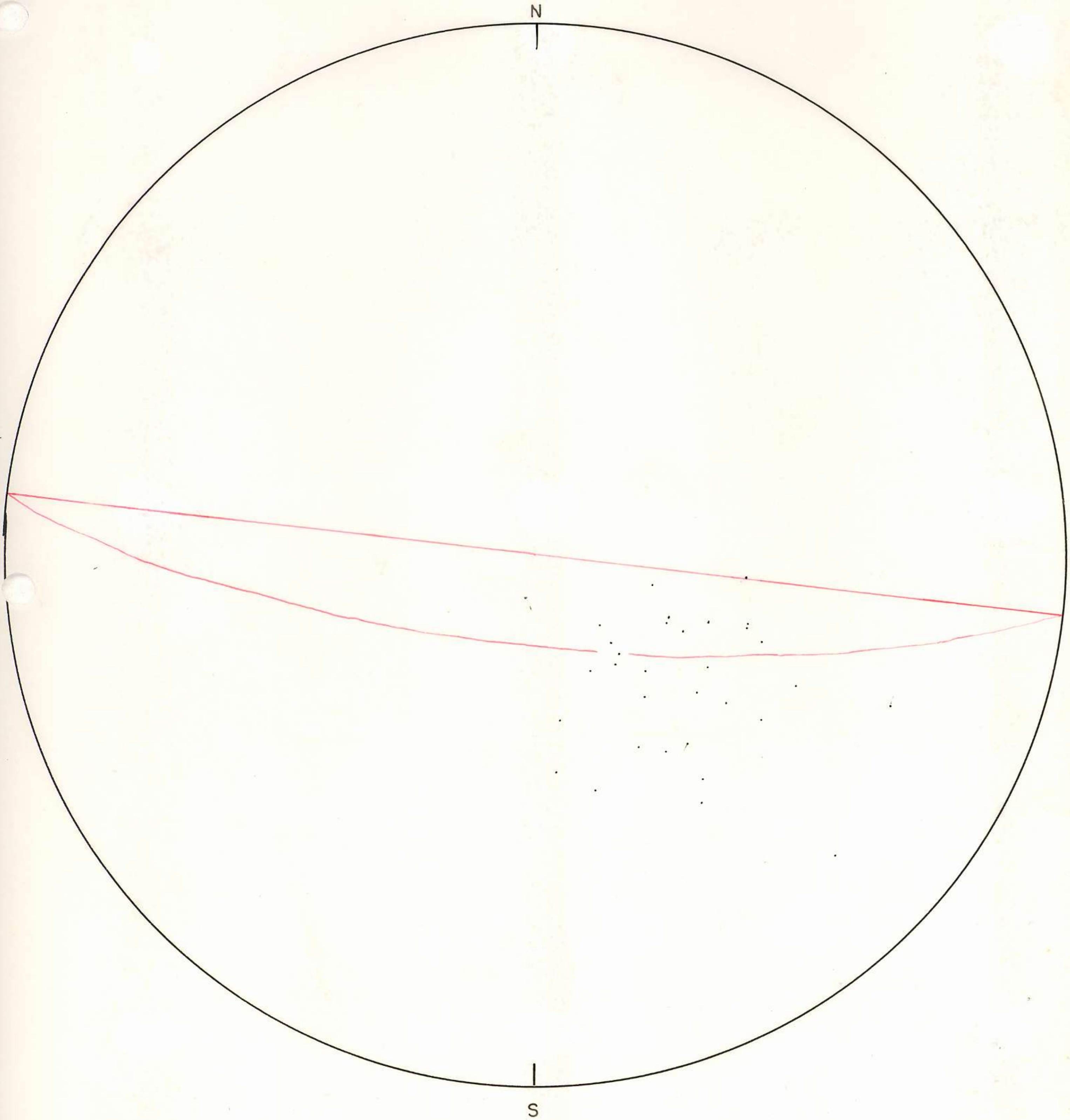


Fig 2 Rawhide Shales Upper R R Grade

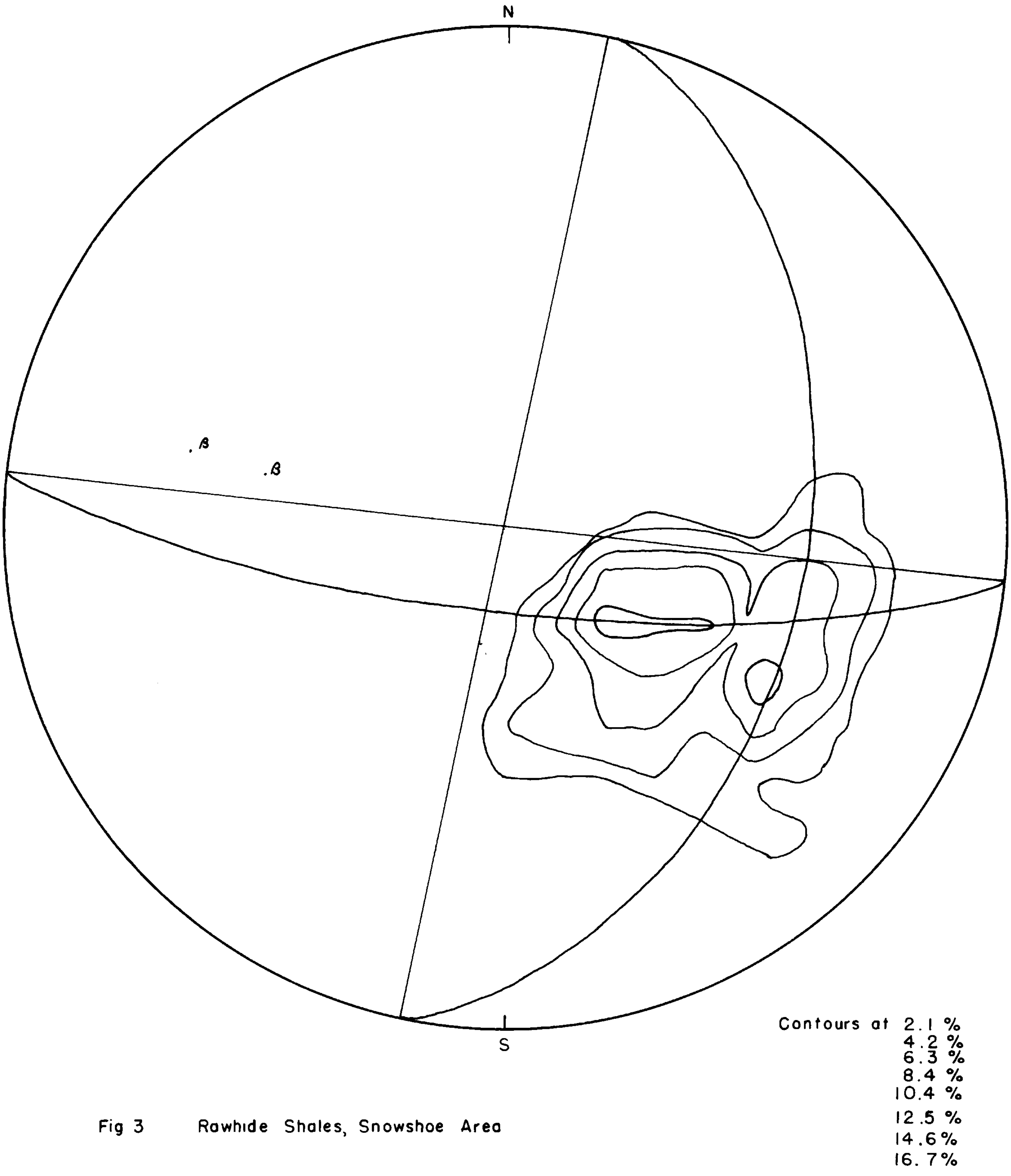


Fig 3 Rawhide Shales, Snowshoe Area

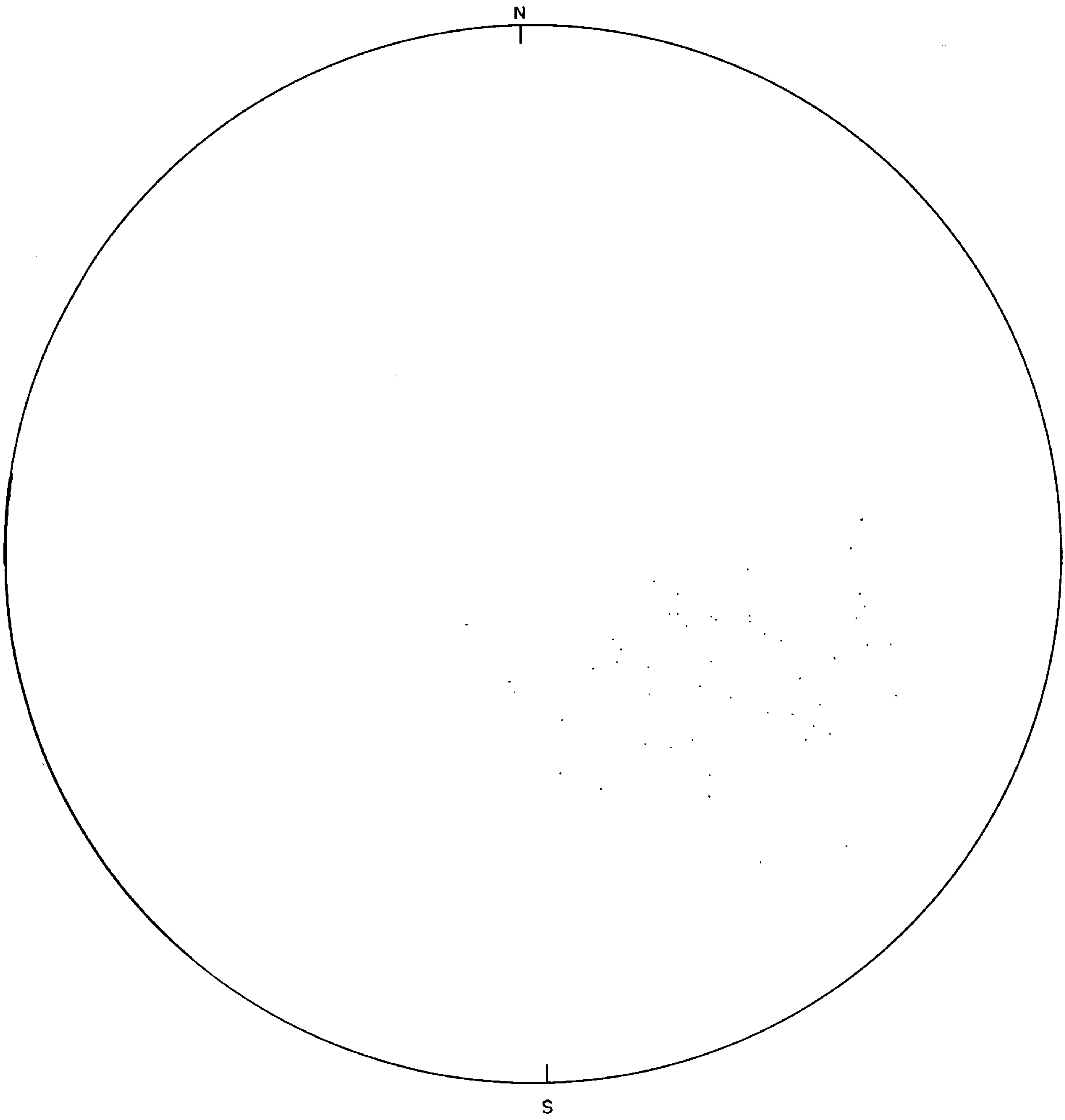


Fig 3b   48 poles from Rawhide Shales

BROOKLYN SHARPSTONE CONGLOMERATE

JASPEROID:

LeRoy has been completely influenced by J. E. Spurr's definition of Jasperoid. (See Memoir 21, p 35)..... "A rock consisting essentially of cryptocrystalline, chalcedonic or phenocrystalline silicia which has formed by the replacement of some other material, ordinarily calcite or dolomite. The Jasperoids may be white or various shades of red, grey, brown or black, the colours resulting from different forms of iron in varying proportions."

So influenced has LeRoy been with the above definition that when he sees "Aeolian Sandstone" in limestone he calls it "limestone replaced in part by silicia." (See plate 111, Memoir 21)

R. H. Seraphim uses the term "Peanut-Brittle Limestone" for the same illustration and suggests that the chert ovoids are windblown pebbles. I believe he is completely right. (See A-62-90)

Seraphim came to the conclusion that the Jasperoids are sharpstone conglomerates. No doubt, for the most part, he is correct. The road to the West of the Ironsides Pit has a cut which shows graded bedding and that the tops are right side up. (Sample of clear sharpstone (A-62-5).

On the other hand, some Sharpstone should be called Sharpstone Agglomerate. Samples A-62-145 (of which a thin section has been made but not yet examined) and A-62-149 near the junction of the Phoenix #3 highway towards Grand Forks, show this rock type. The matrix is red or green and filled with small fragments, some of which are feldspars. The large fragments are rounded and have reaction rims although some limestone fragments as a whole are unaltered.

Brooklyn Sharpstone Conglomerate cont'd.

That faulting does produce a sharpstone breccia can be seen at the end of the Fisherman's Creek road at the junction with the railway grade, (A-62-232) and at the R. Bell Mine, (A-62-219). Both have breccia textures very similar to the Stem-winder Limestone breccia.

SOME COMPOSITIONS OF THE FRAGMENTS IN THE SHARPSTONE

Sample A-62-4 has a fine grain Trachyte, as does the core at 28.5' from GS 58. This is rather amazing as the Trachytes are considered to be rather recent. The only Trachyte seen that is close in appearance is A-63-54 which H. T. Carswell considers to be the neck of a volcano.

Also in GS 58 at 76.5' there is a fragment of ore. This would be on the hanging wall side of the Ironsides ore body.

GS 50 has a fragment of what looks like Pulaskite. This dyke material is supposed to be the last intrusive! Certainly a thin section is needed.

A-63-341 may be in a fault zone proposed by Dr. H. W. Little. The matrix seems to be red argillite and the fragments are unaltered fossiliferous limestone.

A-62-19 on the FW side of the Ironsides pit has a fragment of Aeolian Sandstone.

CONCLUSIONS:

It is seen that the Sharpstone are time transgressive. They seem to start before the Brooklyn Limestone deposition and continue to after the last igneous phase when the Pulaskite was intruded. (Although no Kettle River Arcose fragments have been found).

CONCLUSIONS:

There seems to be at least three sources of Sharpstone. At present it seems likely that most of it is sedimentary. However, there is no doubt that some is Agglomerate and if further study of the matrix and particle fragments is made, likely a large percent will be found to be due to volcanism. Finally, some are breccias such as at Stemwinder Mine due to faulting.

It is possible that some of the skarn of the Brooklyn formation is replaced Sharpstone.

The significance of time transgressive formations is quite important as it means that limestone areas, (potential ore zones) could easily be covered.

As an example, the ore in the Gold Drop area is covered by Sharpstone, as is the ore in the Stemwinder Mine.

The structure of the Sharpstone Conglomerate has not been worked out. Dr. Seraphim gives an imaginative explanation but 300' West of the Idaho dump one can see that the Sharpstone is almost vertical, as it is at the Stemwinder. I have seen isoclinical folding in the Limestones but the Sharpstone has not been mapped on large enough scale to see if these are doing the same thing. I doubt it. Seraphim seems to have started separating out the Limestone as he mentions "coarse" Sharpstone and has tried to indicate this on his map. However, the Sharpstones need to be mapped in detail with emphasis on particle size and composition. Top determinations need to be made in all formations.

IRONSIDES ARGILLITE

Probably the most important horizon marker as far as ore is concerned is that of the Ironsides Argillite.

Generally, it is a green colour but also includes some red Argillite. Probably the most distinctive feature is the small pebbles and concretions. These serve to identify the "FW Argillite". Recently, these pebbles have been found in the Hanging Wall Argillite so we are either dealing with a repetition of the sedimentary sequence or an overturned syncline. (Overturned to the West)

The same green looking Argillite with pebbles has been located on the HW side of the Idaho and Brooklyn Mines. It is possible that these were once located on the HW side of the Ironsides. Again, to the West of Marshall Lake, an Argillite bed can be traced for about 1200'. A few pits at the South end have skarn but to date no new ore has been found along the contaot. It is possible that the Argillite contact had been faulted before mineralization took place. Thus the Idaho-Brooklyn zone could have been opposite the main Ironsides zone when mineralization took place. In that case the Stemwinder would have been opposite the HW zone. Further faulting then placed the Stemwinder opposite the FW.

It is possible too that these smaller ore bodies represent separate periods of mineralization. Certainly they all have Limestones which are relatively unaltered. The mineral relationships also suggest that mineralization was different from that of the Ironsides.

On the other hand, if mineralization took place before faulting, then one could expect ore still to be found to the West of the Brooklyn and Idaho.

IRONSIDES ARGILLITE cont'd

A percussion hole West of the Idaho at GR 50675N and 47311E has Argillite in the logs. This is under Pulaskite, and one wonders if it has been drilled to the North if ore would have been found under the Pulaskite before intersecting the Argillite.

The main Argillites discussed are as follows:

Bench 14	- Ironsides	BG N 10°E -22°E	GR48780N 48900E
Bench 6	- Idaho	BG N5°W -72°E	GR 50470N 47810E
	- Brooklyn	BG N10°E -80°E	GR 51340N 47810E

The same Argillite has been found in the Rawhide Mine and Snowshoe Mine. It is believed that the locations are not only due to gravity faulting which has the effect of lifting blocks of ore to the East but also due to gentle anticlines and synclines.

BROOKLYN AEOLIAN SANDSTONE

The first mention of Aeolian Sandstone is Seraphim's on "Peanut Brittle Limestone." Since then a very definite bed of Aeolian Sandstone has been identified on the Footwall side of Argillite in the Ironsides. In the hope that it may serve as a marker horizon the Aeolian Sandstone was carefully noted in Limestone occurences. It was found that almost everywhere Limestone could be found, that some Aeolian Sandstone beds would be present. The sequence of Argillite-Aeolian-Sandstone and Limestone remains quite consistent and the three together have been taken as a marker unit.

A-62-92	Peanut Brittle LS, North of Marshall Lake, not associated with Argillite
A-62-214	Aeolian Sandstone near B.C. Mine - not known if Argillite is present
A-62-218	Same
A-62-125b	Aeolian Sandstone near LS with skarn - Polished section made. J.P.
a-62-119	Aeolian Sandstone (Near Little's proposed fault and my "Agglomerate"
A-62-155	Aeolian Sandstone on #3 Highway, some cubes of pyrite are present
A-62-169	Aeolian Sandstone frosted pebbles, ~~matrix~~cement is lime
A-62-184	Aeolian Sandstone on RR grade to Ora Denora, LS matrix
A-63-10	Aeolian Sandstone on Mt. Attwood, clear limey Sandstone
A-63-131	Aeolian Sandstone, nearest Sandstone to Brooklyn, lime matrix
A-63-142	Aeolian Sandstone, Limey matrix, silicified, slightly hematized
A-63-155	Aeolian Sandstone, Limey, slightly chloritized
A-63-170	Aeolian Sandstone, Limey
A-63-171	Aeolian Sandstone, Limey
A-63-225	Aeolian Sandstone, Deadman Creek float.

BROOKLYN AEOLIAN SANDSTONE, cont'd

A-63-274	Aeolian Sandstone, coarse graiaed, Deadman Ridge
A-63-168	Aeolian Sandstone near N contact, N Marshall Lake, some magnetite is present
A-63-262	Black siliceous Argillite in contact with Sandstone. Open spaces from the concretions are present.
A-63-304	Closely packed Aeolian Sandstone
A-63-329	Aeolian Sandstone, fine
A-63-321	Aeolian Sandstone, coarse
A-63-331	" " , coarse
A-63-337	" " , looeely packed
A-63-349	Aeolian Sandstone
A-63-301	Aeolian Sandstone

IMPORTANCE OF AEOLIAN SANDSTONE:

Bench 19 of the Ironsides, and Bench 5 of the Idaho have ore which has textures strongly suggesting the replacement of Aeolian Sandstone. Whenever such beds are encountered the assays are/of exceptionally highgrade.

So far in the field no copper mineralized Aeolian Sandstone has been found.

Dr. Little has pointed out that there is a Sandstone on the Footwall of the Motherlode Mine. It may be that all the ore bodies are actually at the same horizon, and that tha Argillite-Aeolian Sandstone Limestone sequence is very important to know in searching for new ore.

Contradicting this concept it must be recalled that a good number of outcrops have been found of Aeolian Sandstone without ore. However, it is still a favourable horizon for exploration.

BROOKLYN MARBLES

The Brooklyn Marbles have been included in the stratigraphic column, not so much because they represent any large bed but because they represent a problem and may be a marker bed. On the FW of the Ironsides pit there is a little Marble above the Aeolian Sandstone. Again on the FW of the Idaho pit there is a much larger unit of Marble. At this mine the Marble is at a fault contact with the ore, although some small blebs of ore have been located in the Marble at its contact. When the bearings of these Marbles are compared with the Brooklyn Limestones, they indicate the hinge area of a cylindrical fold plunging to the North.

There is also a Marble in the Gold Drop area but its relationship to the ore and the above Marbles has not yet been studied.

BROOKLYN SKARNS

"Skarn" is a bad word, something like "greenstone", a catch-all term which becomes more and more meaningless. In pit mapping we have separated the Skarns into Chert Skarn, Limestone Skarn, Argillite Skarn, and Sharpstone Skarn. It has become clear from mapping in the Victora-Gold Drop tunnel that Sharpstone can become increasingly metamorphosed until it is a massive "Skarn"...and, in this case, usually ore. The sequence seems to be that the Limestone fragments are converted to Marble and then rimmed with Pyrite followed by Chalcopyrite, until finally only relicit pebble outlines can be seen. Thus I could well imagine that if Sharpstone Conglomerate beds were interfacing with Limestone, that if ore deposition took place, the Sharpstone would also be replaced. I am rather suspicious of the center "waste" band of the Ironsides pit where large cobbles of marbleized and mineralized limestone are found. This is most likely replaced Sharpstone Conglomerate. However no thin sections have as yet been made of this material.

Mineral zoning in the Ironsides pit has not been carefully studied. We should be able to delineate garnet, epidote, pyrite, hematite, specularite and magnetite zones. Probably this could only be accomplished with a large amount of assaying and petrographic work. Of course the ore zones have been picked out from copper assays but ore shoots in these zones have not been outlined.

HW ARGILLITE WITH PEBBLES

The HW Argillite has been found to be continuous and, in some places, to have pebbles giving a texture that is identical with the Footwall Argillite, although no red Argillites have been found. Since no research has been made on the HW Argillite we cannot tell if it is the same as the FW Argillite. Also, no positive top determinations have been made. There are two possibilities:

1. The HW Argillite is simply a recurring bed. If so, maybe there is a repetition of the HW sequence to be found in the HW area. Or, if two Argillite beds are present, perhaps a second horizon is to be found in the Rawhide area.
2. If the HW Argillite is the same as the FW Argillite then perhaps the whole Ironsides structure is an overturned syncline to the West. After seeing the isoclinical folding in the Brooklyn Limestones, this would not be hard to imagine.

CONCLUSION:

1. A Special effort must be made to make top determinations.
2. A special research study, perhaps on the thermal characteristics, should be made on the Argillites to see if some means of identification can be found. Perhaps trace element patterns are present for the different Argillites?

HANGING WALL SHARPSTONE:

Neither LeRoy nor McNaughton seemed to have been aware of HW Sharpstone. However, in surface and pit mapping the Sharpstone has been positively identified. No studies have been made on this Sharpstone to compare them with the Footwall.Sharpstone. No top determination has been made.

BROOKLYN BASALT

No Basalt has been found between the HW Argillite and HW Sharpstone so this rock unit has been placed above the HW Sharpstone. However, Seraphim points out that "A few lenses of Andesite to Bassaltic rock lie within an unconformity above the Brooklyn Limestone." There seems to be several phases of this rock but no thin sections have been made.

JURA-CRETACEOUS INTRUSIONS

The rocks in mind here are the Marshall Lake and Gilt Edge Grano-Diorites. No petrography work has been done on them so that the name may not be correct.

They have been called Laramide intrusives because I believe they are similar to Seraphim's Laramide intrusion near the Motherlode Mine.

I do not know if these intrusives belong to the Nelson intrusions. (Dr. Little's map 6-1957 would place them as Nelson intrusions) However, there is a possibility that they are the source of the mineral solutions and we should know just as much about them as we do about the Limestones.

Considerable time has been spent mapping the Limestones and following Argillite contacts and no new ore has been found outside of the mine area. Possibly, detailled studies of the igneous rocks, especially the Grano-Diorites and Dacites would find new mines. I consider the Dacite and Mica-Dacite, or Mica shists South of Mt. Attwood, i. e. Lene Star, Lexington Mines, to be favourable for copper deposition. Dr. Little will be presenting a new map of the area showing these Dacites and they should be examined closely.

McNaughton shows a belt of Diorite, Gabbro, Pyroxenite South of Knob Hill. The Winnipeg Mine was in this rock type and I have seen some good looking veins in Forshaw's Wendy group of claims, also in this rock type.

SERPENTINE

Serpentine has not been placed in the Stratagraphic column as none has been found in the mine area. However, Serpentine is near as indicated by McNaughton's map. He considers it to be early Cretaceous, as does Dr. Little (Map 6-1957). However, Seraphim places the Serpentine in the Knob Hill formation. It is possible then that two ages of Serpentine are present.

The Serpentine South and to the West of the Ironsides Mine is in the Knob Hill formation, and again Dr. Seraphim is probably correct.

KETTLE RIVER FORMATION

The Kettle River formation is well exposed in the mine workings and in the Victoria Gold Drop Tunnel. It is well described by Seraphim. The contact with the HW Sharpstone forms a slight angular unconformity. Its structural importance lies in the fact that it too has been displaced by a fault now masked by Pulaskite and the amount of its displacement may help to solve the fault problem.

MIDWAY INTERMEDIATE TO BASIC FLOWS

These flows show differentiation with several types. One is a reddish Feldspar which sometimes looks very similar to Pulaskite; the other is a grey Feldspar porphry with open amygduloids and sometimes round spheroids of magnetite. A tectonic analysis of the penetrative Feldspar lineations is needed to determine the flow pattern. Of course a petrographic study is also needed to differentiate the rock types.

PULASKITE

Three types of Pulaskite have been seen in the Ironsides Mine at the same outcrop. These are feldspar porphyry pulaskite; augite-feldspar-porphyry pulaskite; and mica-augite-feldspar porphyry pulaskite. A petrographic analysis is certainly needed here. The importance lies, I believe, in the fact that some of the Pulaskites have entered fault planes, masking the faults. It becomes very important then to identify the individual dykes.

CONCLUSION:

Six new concepts have been added to the Phoenix Geology:

1. The unit of Argillite with pebbles, Aeolian Sandstone, and Limestone can be used as a horizon marker.
2. That the Pulaskite at the North end of the Ironsides Pit is masking a fault and that the Idaho-Brooklyn Argillite is the same as the Ironsides HW Argillite. This is a working hypothesis and remains to be proven.
3. That silver and gold is related to copper and that silver-gold ratios can be used to express isotherms. And that major deposition is controlled by Newton's Law of Cooling. More is needed on this theory.
4. That the Limestones are isoclinically folded and plunged to the North.
5. That the South Skarn contact is an expression of the Footwall Argillite being folded into synclines and anticlines as well as being faulted.
6. Good fossil collections have been made and mounted by G. Feir.

The dating of the Limestones is based on "Penta-crinus" fossils which are considered to be Triassic. These were found at the Brooklyn Mine area and on the railroad grade to the East near the junction of the Phoenix Road with the highway. This means that all the major Limestones in our area are of the same age.

RECOMMENDATIONS:

1. Mapping on the 1320' scale has not made any improvement over Seraphim's map except that the Argillite contacts have been found. With tight isoclinical folding and contorted rocks it is very hard to do the necessary detail to find the complete structure.

2. We have good 400 scale maps now (although they do not exactly agree with LeRoy's) and these maps should be used for detail. Structural analysis techniques should be used on all bedding and "B" and "L" structures. Direction of lava flows could be determined from the "L" lineation of the preferred orientation of the Feldspars.

3. Extensive use of the petrographic microscope should be made to define all phases of metamorphism and of our igneous rocks.

4. All the Limestones in the Phoenix area shonld be covered by ground magnetometer and probably an E-M survey to detect any possible mineralization zones on the Argillite contact.

5. The Gilt-Edge area should receive a detailed study by stripping and diamond drilling. This is a mineralized grano-diorite having the same copper, gold, silver ratios as the ore in the Ironsides. It is possible that a porphyry type deposit is present.

6. All Grano-diorites and Granites and especially Mica-Schists from Dacites should be especially detailed with petrographic studies to differentiate the rock types. I feel the emphasis should shift from Limestone exploration to the igneous rocks for new mines in our area.

RECOMMENDATIONS cont'd:

7. A section needs to be core drilled between the Idaho-Brooklyn HW to locate the Western missing Argillite and possible ore on this contact.

8. A special project must be simply to make top determinations. At present for the whole mine area we have two. This will mean a patient search of all bedding with a large number of polished sections for study. The data from this study would provide the whole key to our structure.

<u>In Conclusion</u>: There is more new ore to be found in our immediate area. It will be found through sophisticated geological techniques of structural analysis, petrology and astute observations, coupled with standard geophysical surveys and a follow-up of core diamond drilling. Except for the Dacite Mica Schists, and Grano-Diorites, it is our immediate area which has the greatest potential. It is in this area that maximum detail is needed. I have no doubt that a systemmatic geological program will produce new ore.

IRONSIDES THEORETICAL STRUCTURE - 100 SCALE

SECTION 49,172

STAGE 1: Folding of the Argillite-Limestone sequence into overturned isoclinal folds, perhaps on a Sharpstone decollement.

STAGE 2 - NORMAL FAULTING OF THE FOLDED BED:

STAGE 3: Erosion, deposition of the Kettle River Series. It will be seen that the upper limb has been cut off by the Kettle River. However, Eastward the Argillite again occurs forming the Footwall of the Rawhide ore.

Originally, only one fold was planned as the center band Argillites do not have pebbles, (as far as we know) and does not look like the Footwall Argillite, nor is it as thick. However, when one considers the ore outline, the thin bedded ore, and the location of the center Argillites; the double fold fits quite well. GS53 was drilled in an ideal location to test this theory. Unfortunately, the "Skarn" above the footwall is so altered that Argillite beds can no longer be identified by ordinary means.

PHOENIX 400 SCALE SURFACE GEOLOGY MAP

ACKNOWLEDGEMENT:

In examining this map (August 1964) it must be remembered that most of the contacts have been taken from LeRoy's and Seraphim's maps. However, there are six main changes in this map.

1. The identification of a Pulaskite dyke masking a fault at the North of the Ironsides Pit. This dyke is seen in the pit (and going Westward) the South end of the Idaho pit, and on the RR grade off this map area. Eastward, the dyke was seen again on the road to the Rawhide pit. It has not been seen cutting the Midway volcanics as a waste dump covers most of the area. Pulaskite has been mapped in the North Snowshoe underground workings, in the face of the lowest Snowshoe bench, and a small dyke is present in the RR cut North of the Snowshoe pit. Thus, after the Rawhide road showing, the location of the Pulaskite seems to be scattered.

2. An Argillite, with pebbles, to the West of the Marshall Lake Limestones has been correlated with the Ironsides FW Argillite. Also, a Hanging Wall Argillite in the Ironsides has been correlated with the Argillite in the Idaho-Brooklyn Mine. The Apparent Westward displacement of the Pulaskite fault is 1600 feet.

3. A small amount of green Argillite, with pebbles, has been found North of the Stemwinder Mine. South of this there is a Pulaskite dyke which may be the same as that on the East side (only) of the Brooklyn Mine. Perhaps this dyke is masking another E-W fault. Certainly, the Brooklyn HW Argillite is slightly displaced to the East.

4. A Hanging Wall Sharpstone Conglomerate has been definitely identified in the Ironsides Mine. It is possible then that some of the Sharpstone to the West of the Rawhide Mine is also Hanging Wall Sharpstone and that ore will be found under it. (See Sec. 48,300N)

5. The South Skarn contact is found to be on Argillite, probably the same Argillite as the Ironsides FW. This Southern Argillite was found to be contorted with small folds and then cut with many N-S normal faults. The Argillite contact through the Rawhide pit is the outcrop pattern on the bottom of the pit. Of course, this same Argillite is under all the skarn.

6. Several windows are present in the Midway Volcanics indicating that it is thin in the Northern map area. Also to the South, underground workings come near to the surface under the volcanics indicating that it is also thin here.

IRONSIDES THEORETICAL STRUCTURES - 400 SCALE

GENERAL:

Nothing is known of the bottom of any of the structures. For example, what happens to the Kettle River formation to the East is unknown. Also, what happens at the Knob Hill contact is also unknown. As cleavage folding is probably taking place, the hinges of the folds should be larger than the limbs and have especially good ore. 4

SECTION 47,600: On this section the antiforms and synforms of the Rawhide area have been mapped and projected onto the next two sections. A plunge of 15° and 22°N has been used, but no corrections have been made for the rake which would be to the East.

SECTION 49,172: The Rawhide Argillite has been projected onto this section, and there seems to be the possibility of a Skarn zone under the Hanging Wall Sharpstone. This section also shows the Pulaskite dyke cutting through everything.

SECTION 51,000N: This section is North of the Pulaskite dyke, and as the Ironsides Hanging Wall Argillite has moved Westward 1600 feet to the Idaho-Brooklyn HW Argillite, the projected Rawhide Argillite was also moved 1600 feet. It comes right under the Stemwinder' area. Actually, 600 feet North of this section an Argillite with pebbles was found. (Now called the Stemwinder Argillite)

DIAGRAMMATIC SEQUENCE OF ORE DEPOSITION AT PHOENIX, B.C.

AND THE PHOENIX FAULT PROBLEM

GENERAL: Through pit mapping it has been recognized that the Pulaskite dyke cuts off the ore at the North end of the Ironside Pit. Also, in recent mining, Pulaskite has been found cutting the ore at the South end of the Idaho and North end of the Snowshoe Pit. It is then becoming clear 5
that the Pulaskite dyke masks a fault plane. The solution of this fault could lead to new ore.

Recent mapping has also located similar argillite beds which are used in the solution of this problem. The Idaho-Brooklyn HW argillite is considered to be the same as the Ironsides HW argillite. A study of silver-gold ratios also points out the sequence of ore deposition. Finally, the same Pulaskite is considered to be cutting off all the ore bodies; there has probably been two movements on the fault plane, one of which was during or after the major mineralizing period; there may have been three periods of ore deposition.

STAGE 1 (Fig. 1) Perhaps the structure of the limestones was much the same as it is today with tight isoclinical folding. Centers of mineralization probably started at the contact of the argillite and limestone. It is likely that this surface marks an unconformity. The centers of mineralization were probably due to pre-conditioning of the limestones by syngenetic pyrite and iron oxides which formed at this contact.

STAGE 1 (Fig. 1) cont'd.

That the mineralization is found rimming the limestone is due to the unconformity being brought to surface at at these places by anticlines and synclines, as well as normal faulting. Thus the whole unconformity has possibilities of ore.

STAGE 2 (Fig. 2) A flat dipping fault (E-W - 30°N) moved the limestone block to the West, placing the Idaho-Brooklyn HW argillite nearly opposite the Ironsides Footwall. Major deposition took place forming the Ironsides and Idaho-Brooklyn ore. Near the close of mineralization another movement on the fault may have taken place. It is possible then that some of the Idaho ore was dragged along the fault or that some of the fault was replaced. (No search has been made for this type of ore.)

STAGE 3 (Fig. 3) After the second fault movement more mineralization moved from the Ironsides FW area into a fractured zone forming the Stemwinder ore.

SILVER-GOLD RATIO DATA

Graphs have been made of the relationships of silver and gold to copper. It is assumed that the gold areas are in the high temperature zones and that low silver-gold ratios represent high temperatures. For the Stemwinder Mine there are fifty-one sets of assays, mostly from ddh's (a set consists of Cu. Au. Ag.) Idaho-Brooklyn 27 sets; and 31 sets from the Ironsides Mine.

GRAPH 1 Theoretical Gold to Copper Graph:

The trend lines for all the mines has been plotted showing a sequence of Ironsides, Idaho-Brooklyn and Stemwinder. In the latter case two trends may be present. However, both are lower than the Idaho-Brooklyn value.

GRAPH 2 Theoretical Silver to Copper Graph:

The rate of increase for the Stemwinder and Ironsides is quite similar. However, the Idaho-Brooklyn Mine has the highest rate of increase.

GRAPH 3 Theoretical Silver-Gold Ratios for Ironsides, Idaho-Brooklyn, and Stemwinder Mines:

These ratios are calculated from the above Silver and Gold graphs. It is interesting to note that the Idaho-Brooklyn and Stemwinder Mines have trends opposite to that of Ironsides. This is interpreted to mean that the Ironsides ore was deposited with increasing heat while those of the other mines during decreasing heat.

ORE POSSIBILITIES:

(1) Small centers of mineralization are probably present at many places on the argillite unconformity. It is therefore important to know exactly where this contact is. The Idaho- or Brooklyn FW should be drilled for this purpose.

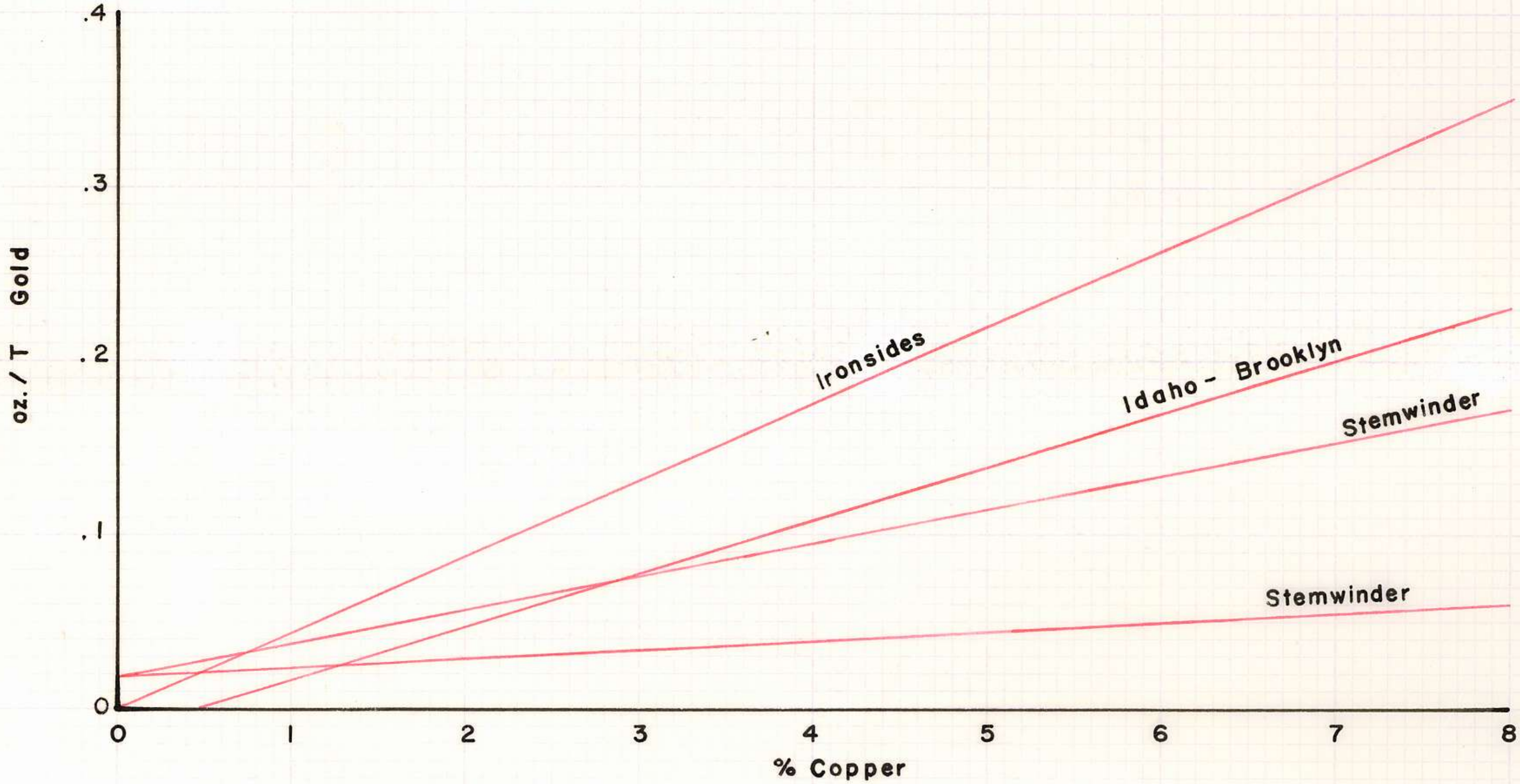
(2) Should ore have been emerging while fault movement took place then some of the ore should have replaced the fault and, in turn, been dragged towards the Idaho Mine. This area should be investigated.

ORE POSSIBILITIES cont'd

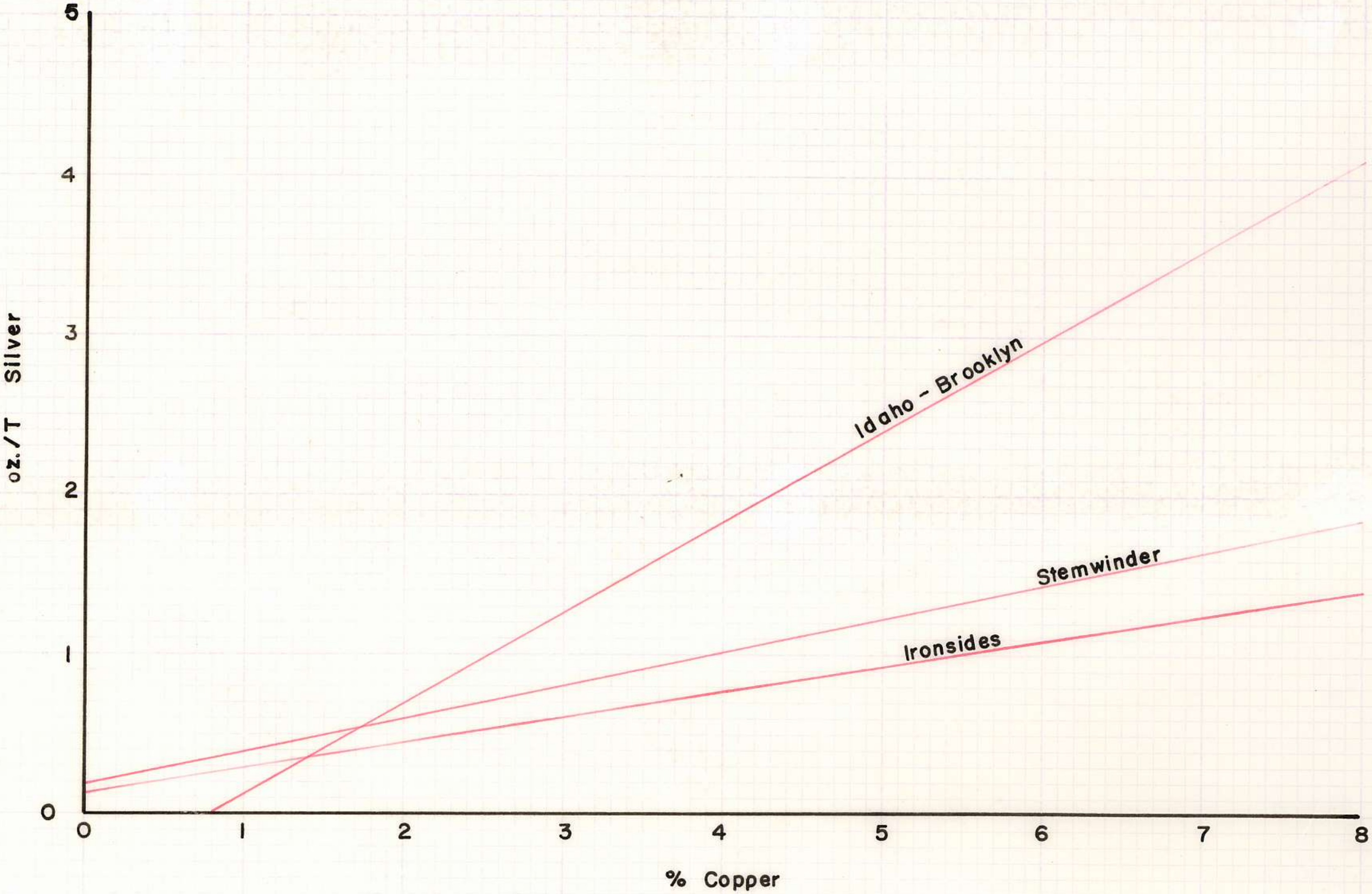
(3) If this sequence of ore deposition is correct then on the axis of the Brooklyn and Stemwinder Mine a shear zone should be found which may carry ore. The small pits East of Marshall Lake may be on such an axis.

July 29, 1964

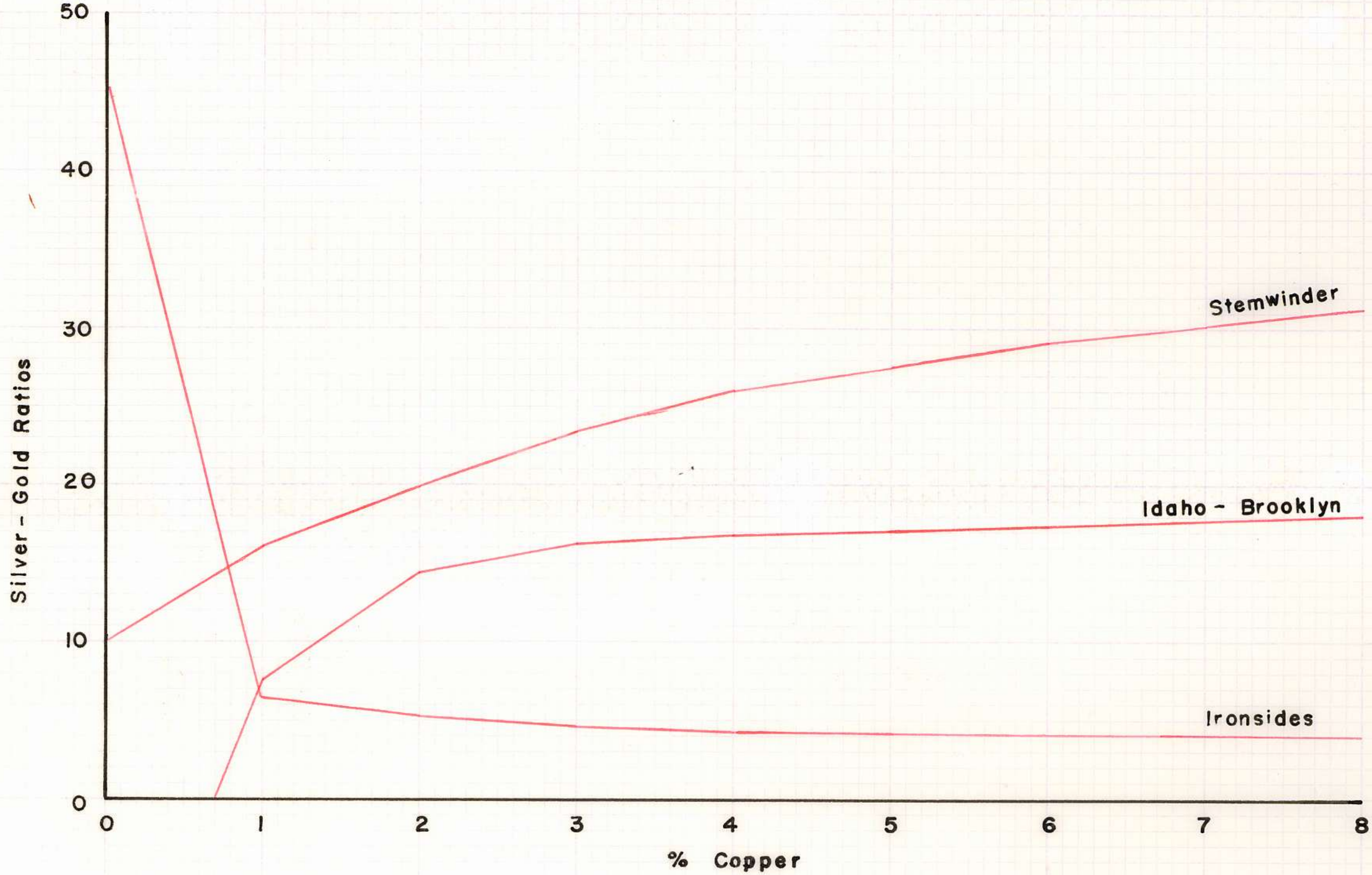
George Addie, Geologist,
Phoenix Copper Division



Graph I. Gold to Copper

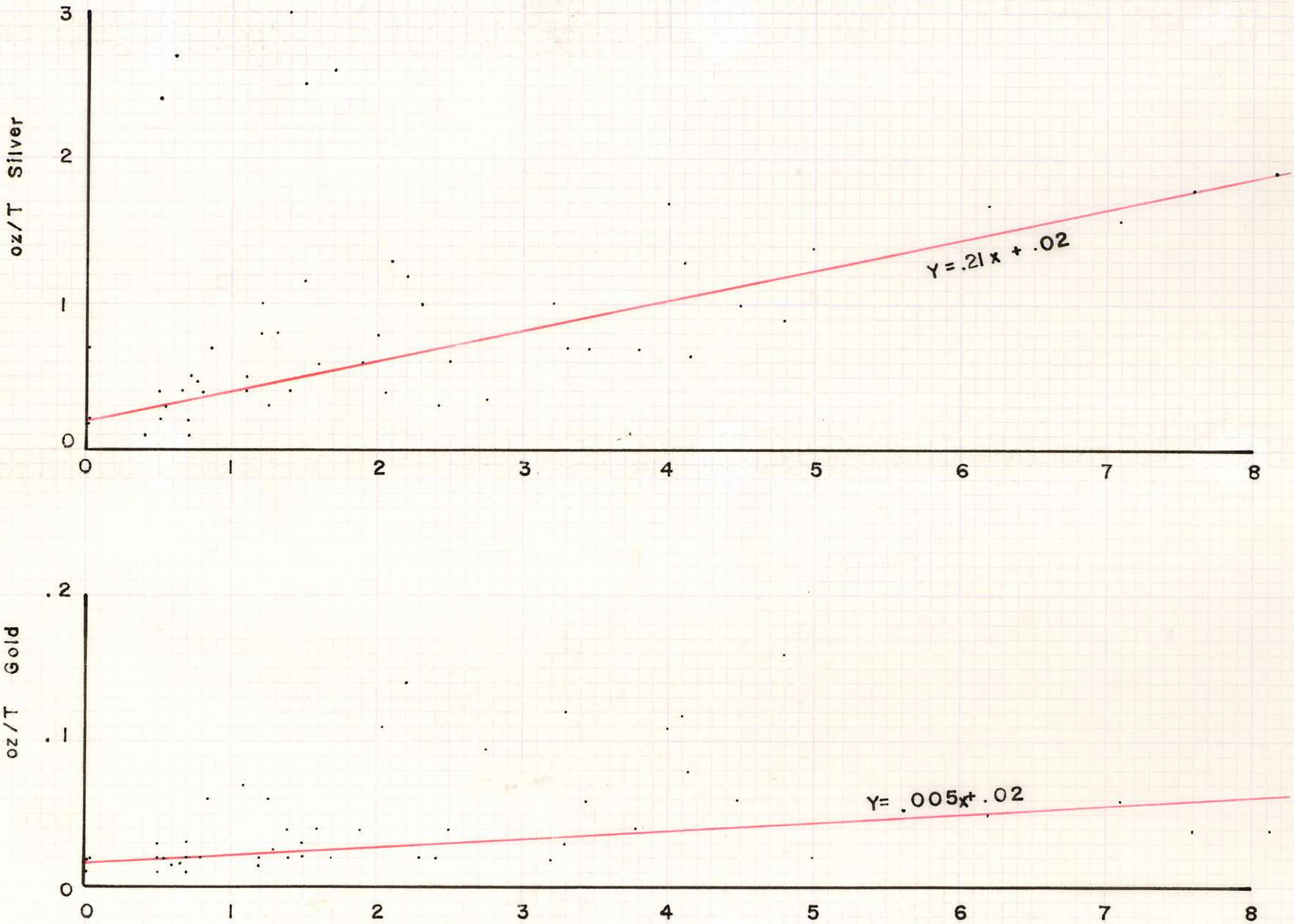


Graph 2. Silver to Copper



Graph 3. Silver/ Gold Ratios to Copper

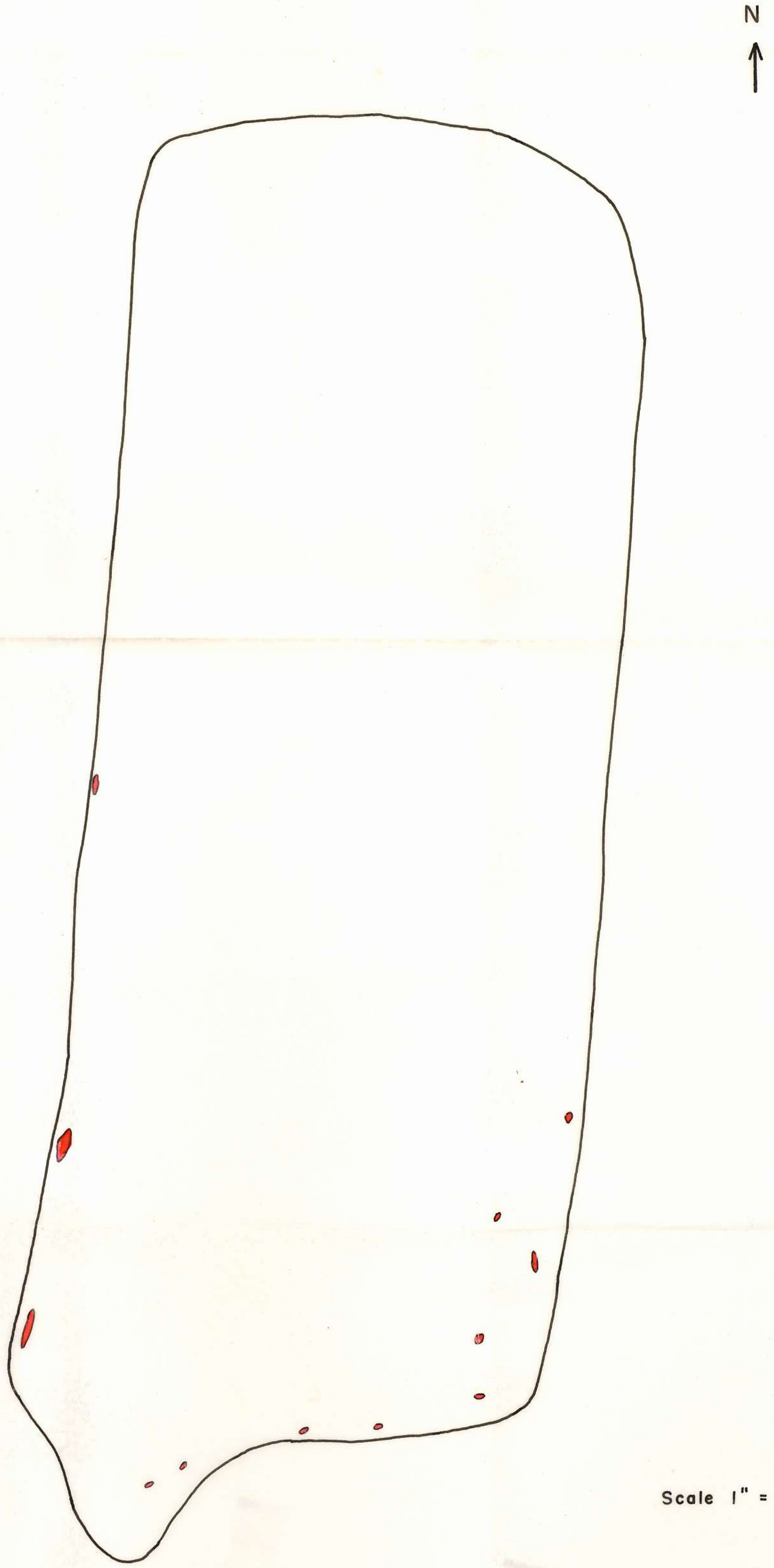
SHEET NO. ____ OF ____
JOB NO. ____
SUBJECT ____
BY ____ DATE ____
CHKD. BY ____ DATE ____



Stemwinder Assays

Diagrammatic Sketch of Phoenix Ore Deposition

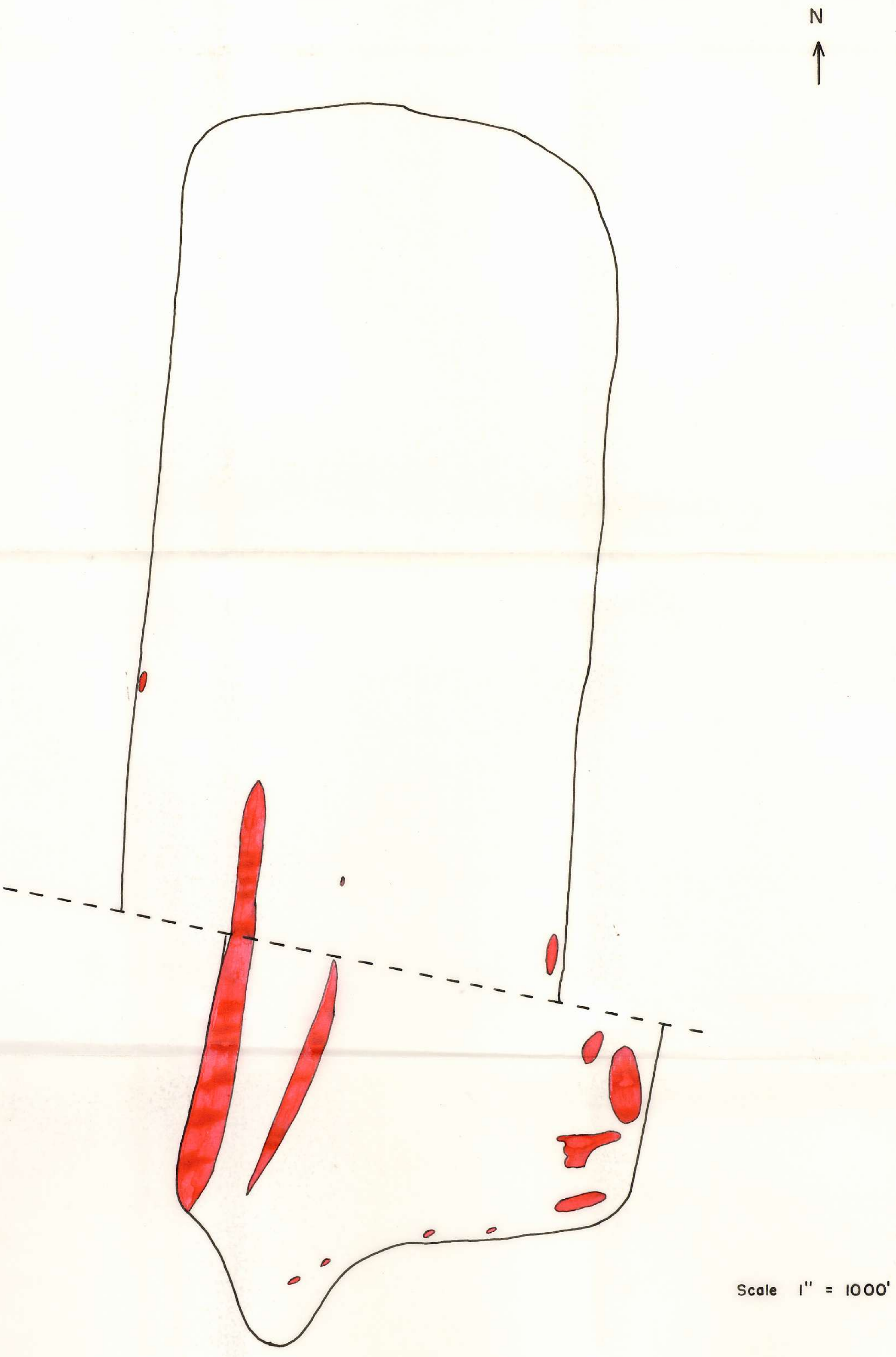
Fig I. Development of Centers of Mineralization



Scale 1" = 1000'

Diagrammatic Sketch of Phoenix Ore Deposition

Fig 2. **Main Ore Deposition**



Diagrammatic Sketch of Phoenix Ore Deposition

Fig 3. Final Stage

Scale 1" = 1000'

IRONSIDES TECTONIC STUDY

Following an analysis of an Attwood map of the Ironsides pit at Phoenix, B. C. (see Map 1) where conical cross-folding was indicated, a detailed study was made of the individual bench plans to determine what, if any, affect the cross-folding would have as an ore control. All poles have been plotted on the lower sphere using a Lambert Net.

Fig. 1a The bedding pole points from Map 1 have been contoured and a maximum is found at N-S -35°E. It is noted that most of the bedding shown on this map is from the foot-wall area and it is suggested that the low dip is due to flattening of dip due to a curvilinear plane. This would help to explain the spread around the maximum. Probably cross-folding also distorts the maximum concentration point.

Fig. 1b 125 Bedding pole points used for the contouring in Fig. 1. (Data is found in Appendix 1) Note the small circle pattern of the points. It is on this that the original theory of conical cross-folding was based. Haman[1] points out, "In circular conical folds the fold girdle follows the path of a small circle."

Fig. 2a 200 Bedding pole points have been contoured from Benches 11, 12, 13 on grid 47800E-49200E and 49000N-5000N)see Map 1). The maximum of N28°E-37°E is considered to be the bearing of the Hanging Wall zone.

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1. Haman, P.J. (1961) "Manual of the Stereographic Projection," West Canadian Research Publications, Calgary, Alberta, p. 32.

Ironsides Tectonic Study cont'd

<u>Fig. 2b</u> Bedding pole points for benches 11, 12, 13, used in Fig. 2a. (Data is found in Appendix 2)

<u>Fig. 3a</u> 171 Bedding pole points have been contoured from benches 11-19 in grid 47800E-49200E and 48000N to 49,000N. The maximum is at N11°E-43°E. It would seem, then, that as one moves Southward the HW beds change in strike from East to West, perhaps forming a basin shape.

<u>Fig. 3b</u> Bedding pole points used in Fig. 3a. (Data in Appendix 3)

<u>Fig. 4a</u> Composite of all Hanging Wall pole points. Maximum is N18°E-44°E.

<u>Fig. 4b</u> Plot of 371 bedding pole points used in Fig. 4a.

<u>Fig. 5</u> The maxima for HW and FW beds from Fig. 4a and Fig. 1a, and the vertical plane maximum from Fig. 4b have been used to locate the axial plane. (This is using the theory that we have an overturned syncline structure) This plane is found to have a bearing of N13°E-41°E and plunges 30°N.

<u>Fig. 6a</u> Small synforms and antiforms (plications) have been observed during pit mapping of the HW.

<u>Fig. 6b</u> The HW plication poles (27) have been plotted. (Data in Appendix 4)

<u>Fig. 6c</u> Although only 27 plication poles are available two maxima are present. Referring to Fig. 5, one maximum occurs near the "β" area, and the second maximum occurs nearly 90° from "β" on the axial plane.

Fig. 6c cont'd — It is suggested that the second maximum is from cross-folding. They are too few in number to determine if they are conical cross folds or not.

Fig. 7a — Data from Appendix 1 has been assembled in groups of 10 and their points of intersection plotted. The number of intersections increase by the formula $\frac{N(N-1)}{2}$ where N is the number of beds. Thus each ten beds gives 45 points so that this plot has approximately 500 points. (See Appendix 5)

Fig. 7b — The points from 7a have been contoured and fit the axial plane derived from Fig. 5. Weiss and Turner[2] give a warning of why such a technique may be meaningless: "The uncritical use of "β" intersections is particularly suspect where folding is extremely weak so that the S-surfaces are broadly homoclinal. The characteristic pattern of "β" for such domains is an unusually perfect girdle in the plane of the uniformly dipping S, generally with scattered maxima: and the corresponding S pole diagram shows a single maximum, perhaps with recognizable elongation on a great circle normal to one of the "β" maxima".

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2. Turner, F.J. and Weiss, L.E. (1963) "Structural Analysis of Meta-Morphic Tectonites," McGraw-Hill Book Co., p. 157

It is noted that intersections are not only on the axial plane but the lowest contour is following a small circle indicating that conical cross-folding is taking place[3], or that secondary folding is by flexural slip[4]. "Where the second folding is by flexural slip of S, the earlier lineations follow small circle paths in projection, as described by Sandner."

<u>Fig. 8a</u> A synform structure was examined on the HW of Bench 12. " " is on the main axial plane (Fig. 5) and is probably a cross fold. (Data in Appendix 6) The two limbs have bearings of N70°W-74°NW and N13°E-38°E.

<u>Fig. 8b</u> Plot of poles used in 8a.

<u>Fig. 9a</u> Contour of Ironsides slickenside striations on the beds of 8a (see Data in Appendix 6) On the beds dipping E the slickensides have a maximum at S59°E-51° and on the beds West a maximum at S77°W-56°.

<u>Fig. 9b</u> Plot of striation poles used in Fig. 9a.

<u>Fig. 9c</u> HW Striations in relation to the main " " axis when the West dipping striations are rotated about the "B" axis (From Fig. 5) the striations are found to be the sameas the East dipping striations. It is proposed then that these striations are part of the flexure folding mechanisms and were present at the time that the main structure was plunged to the North. This would mean that the cross folds had developed before the last major fold and plunge.

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3. Haman, P.J., loc. cit.

4. Weiss, L.E., (1959) "Geometry of Superposed Folding," Bull. G.S.A. Vol. 70, p.91

<u>Fig. 10a</u> FW striations were also found to plunge to the SE, much the same as those on the HW beds.

<u>Fig. 10b</u> Plot of 18 bench 12 FW striations. (Data in appendix 7)

<u>Conclusion for Conical Cross-Folds</u>

<u>Fig. 11</u> The plotting of the data from the Attwood map gave a dramatic indication of conical cross-folding.

<u>Fig. 12</u> The relation of folding to dip of the beds was found to be a linear function with the equation $Y=0.5\ (90-X)$ where Y is the amount of folding and "X" is the amount of dip.

However, in pit mapping covering part of the same area no clear indication of conical cross-folding was found.

By taking the dip data to the nearest five degrees small circle groupings did arise. The relationship of folding to dip was found to be exactly the same as in Fig. 12.

The final conclusion then is that the conical cross folds found from the Attwood map is purely a function of their mapping, i.e. they recorded dips to the nearest five degrees.

<u>Conclusion for Ironsides Structure:</u>

A structure of an overturned syncline has been assumed. If this is so then this study has defined the axial plane and axis. An Argillite in the HW has been found which may be FW Argillite. So far no conclusive top determinations have been made nor has there been any analysis of the Argillites. Only when this data is available can a positive conclusion be made. Fig. 7b suggests that part of the movement during fold is flexure which should give some conical folds.


48200 E
48400 E
48600 E
48800 E
49000 E
49200 E
49400 E
49600 E
49800 E
49600 N
49400 N
49200 N
49000
48800 N
48600 N
48400 N
48200 N
48000 N
47800 N
47600 N
47400 N
47200 N
DATA FROM ATWOOD'S MAP
200' SCALE


48200 E
48400 E
48600 E
48800 E
49000 E
49200 E
49400 E
49600 E
49800 E
49600 N
49400 N
49200 N
48800 N
48600 N
48400 N
48200 N
48000 N
47800 N
47600 N
47400 N
47200 N
DATA FROM ATWOOD'S MAP
200' SCALE

Fig 1a

Contours of Attwood S1 poles

Contours at 0.8%
4%
8%
12%
16%
20% 25%

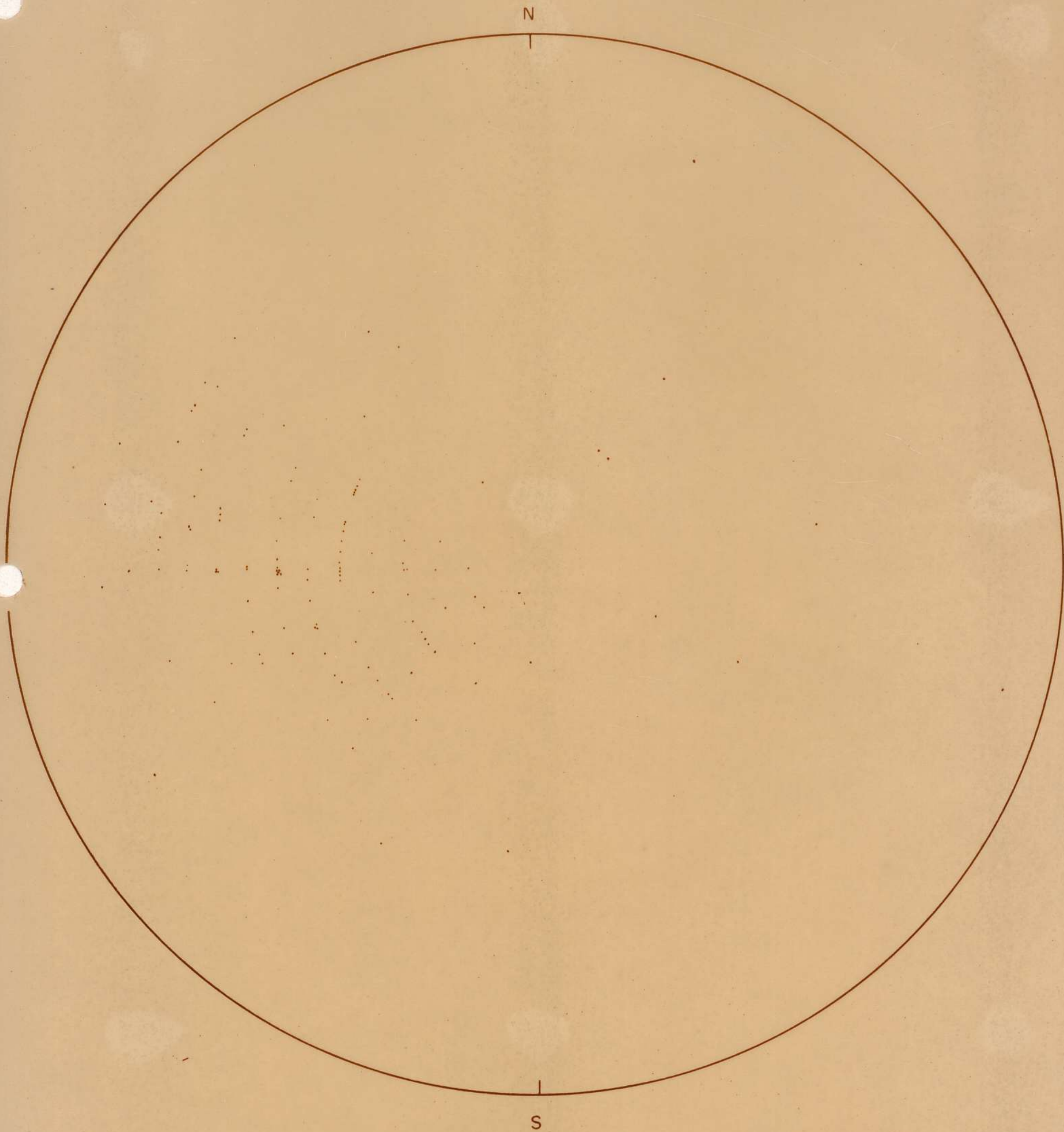


Fig 1b

125 Attwood S_1 poles

Fig 2a

Ironsides H.W. Benches 11 12 13 S1 Contours

Contours at 0.5%
2.5%
5.0%
7.5%
10.0%
12.5%
15.0%

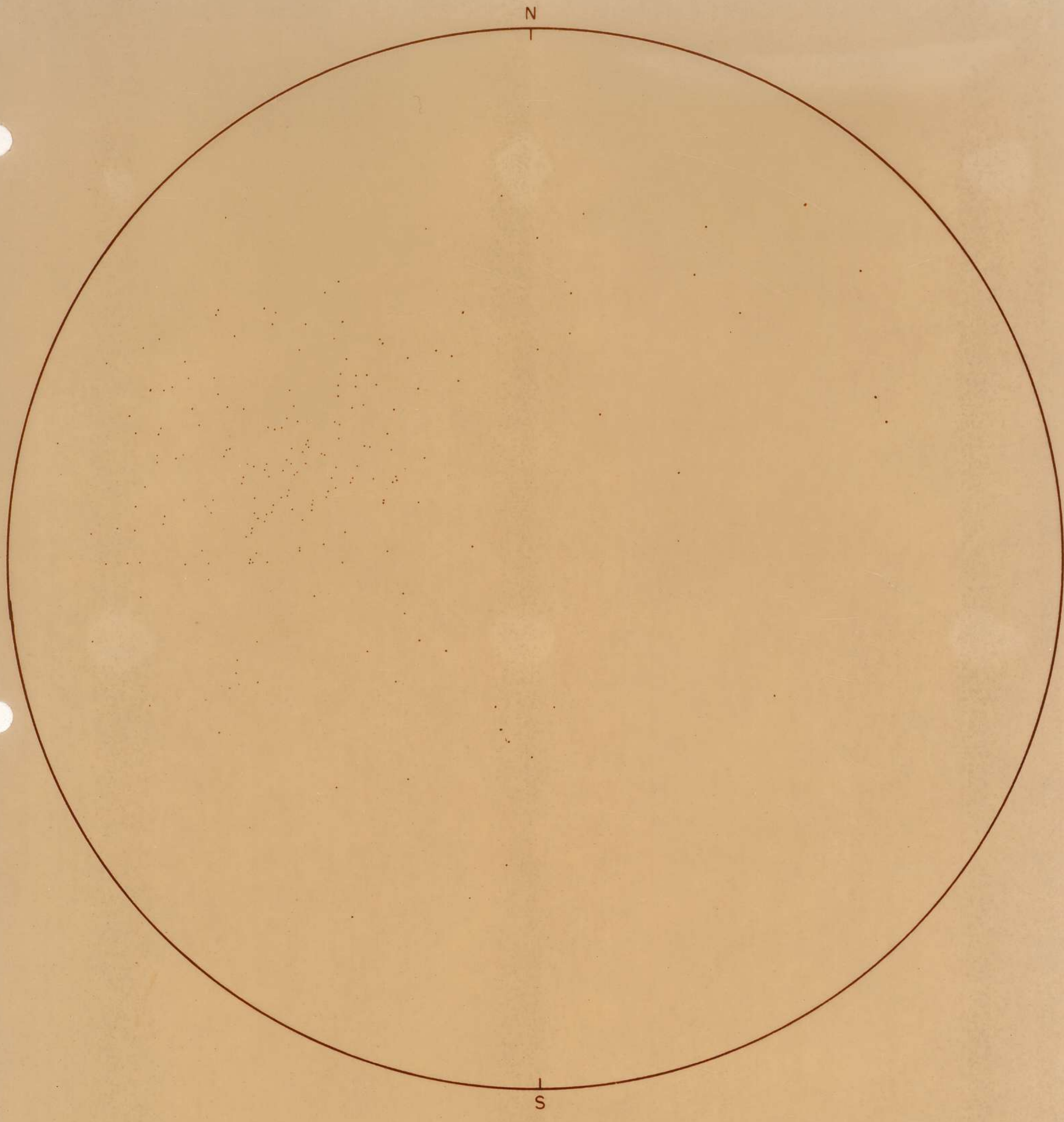
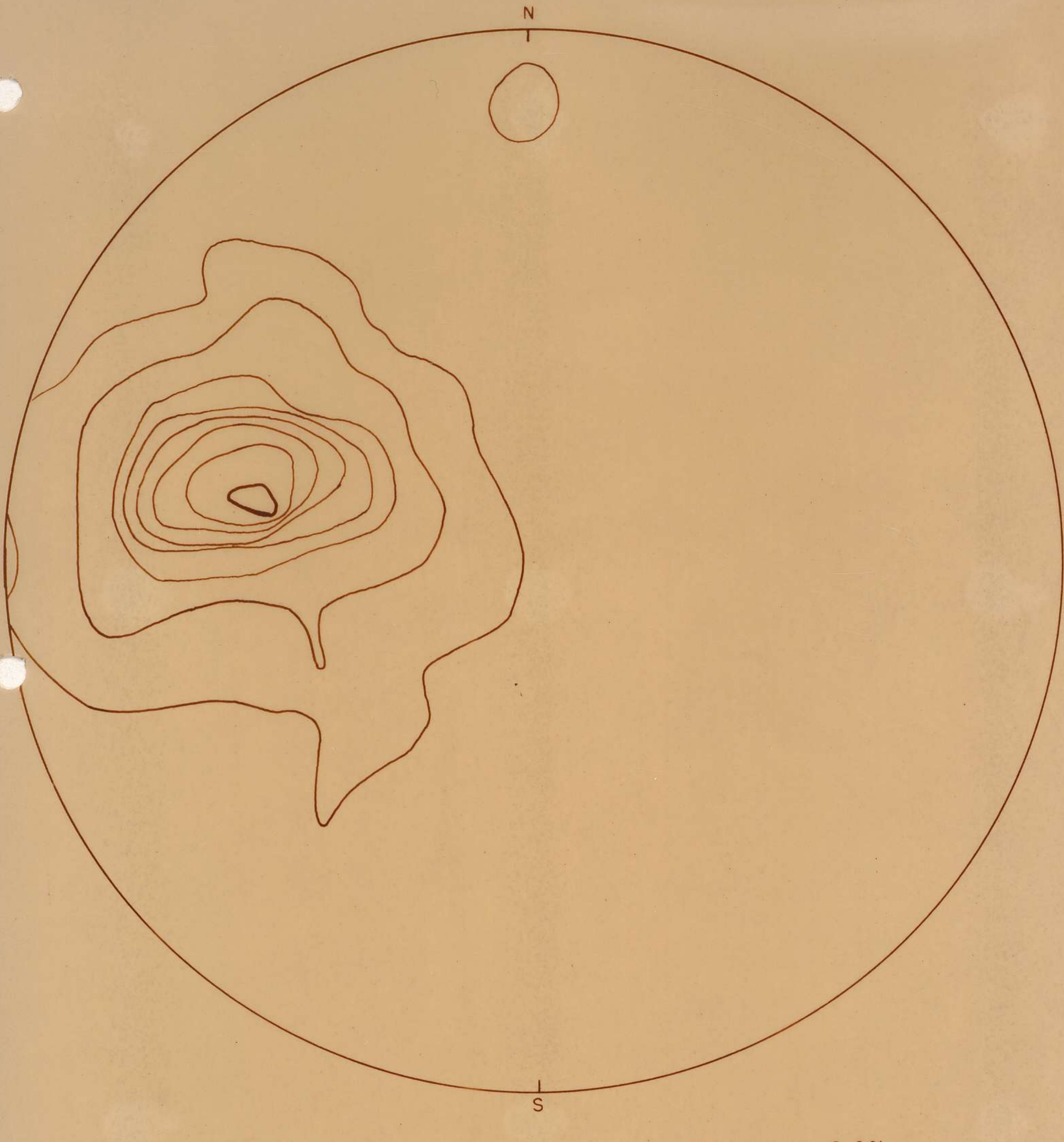


Fig 2b

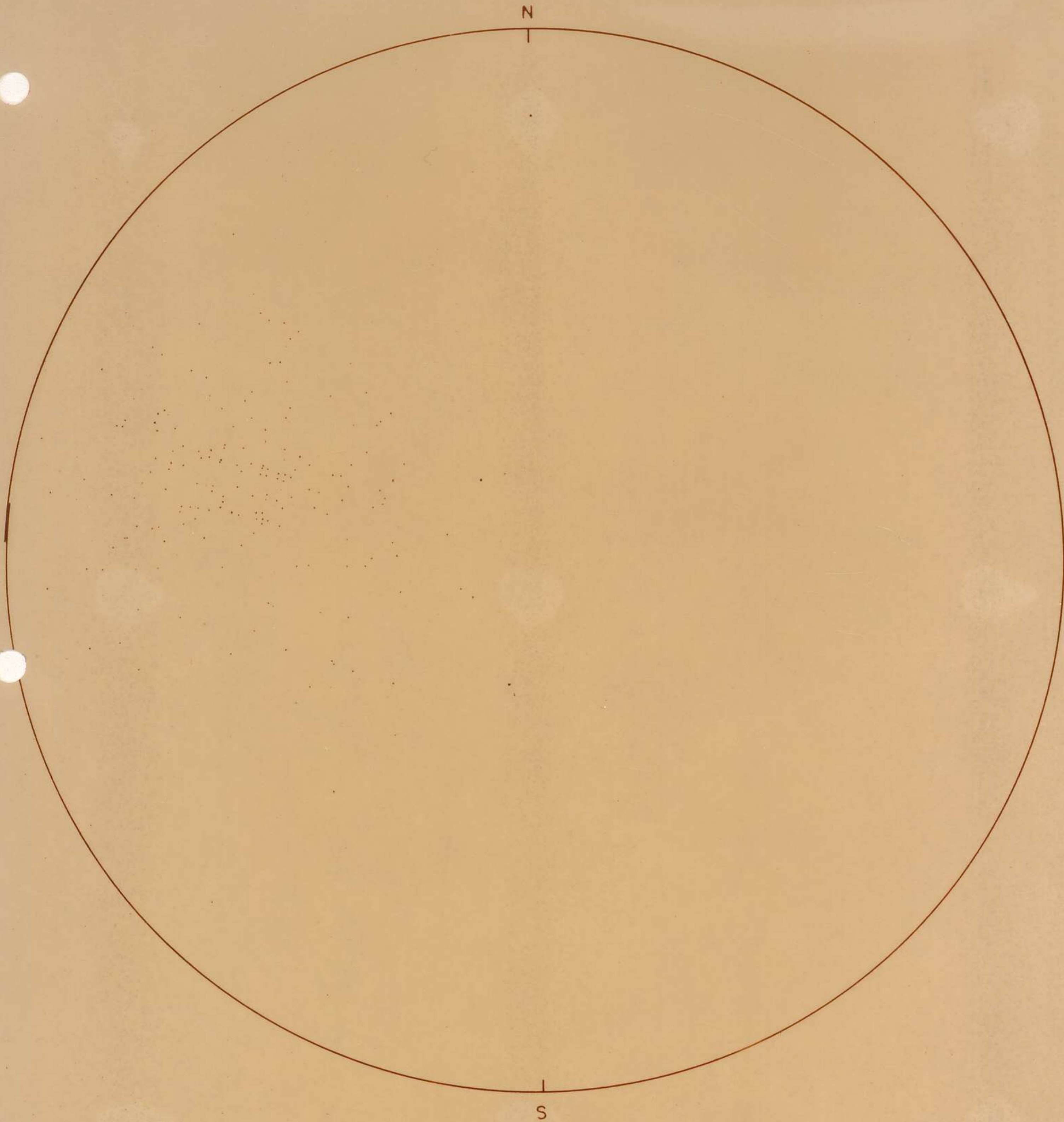
200 Ironsides H.W Benches 11 12 13 S1 poles



Ironsides H.W. Benches 11 - 19 S1 Contours

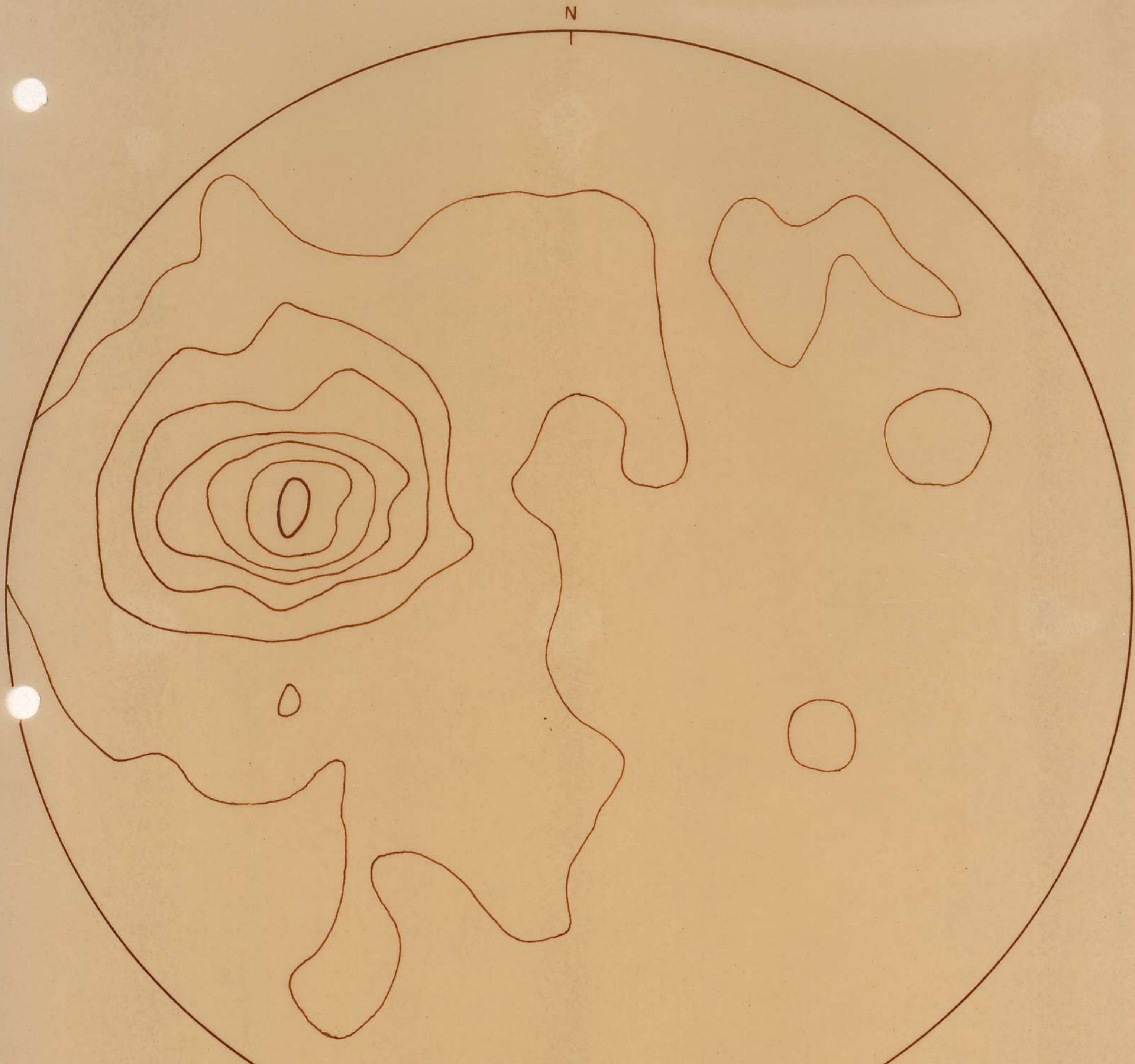
Contours at 0.6%
2.9%
6.5%
8.2%
11.1%
14.6%
17.0%
20.5%

Fig 3a



171 Ironsides H.W. Benches 11-19 S_1 poles

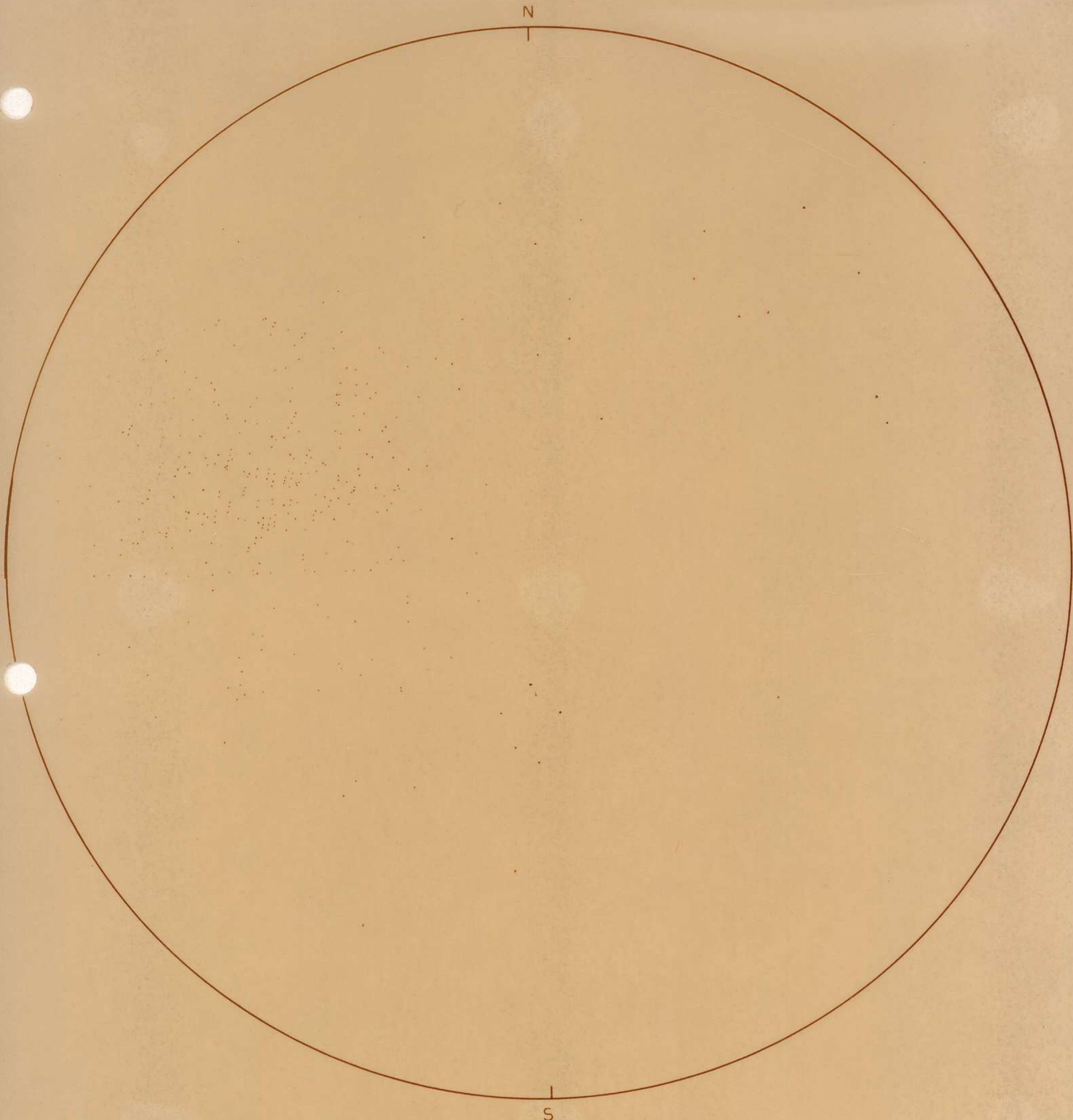
Fig 3b



Contours of all Ironsides H.W. Si poles

Contours at 0.27%
2.7 %
5.4 %
8.1 %
10.8 %
13.5 %
16.2 %

Fig 4a



371 Ironsides S_1 H.W. poles

Fig 4b

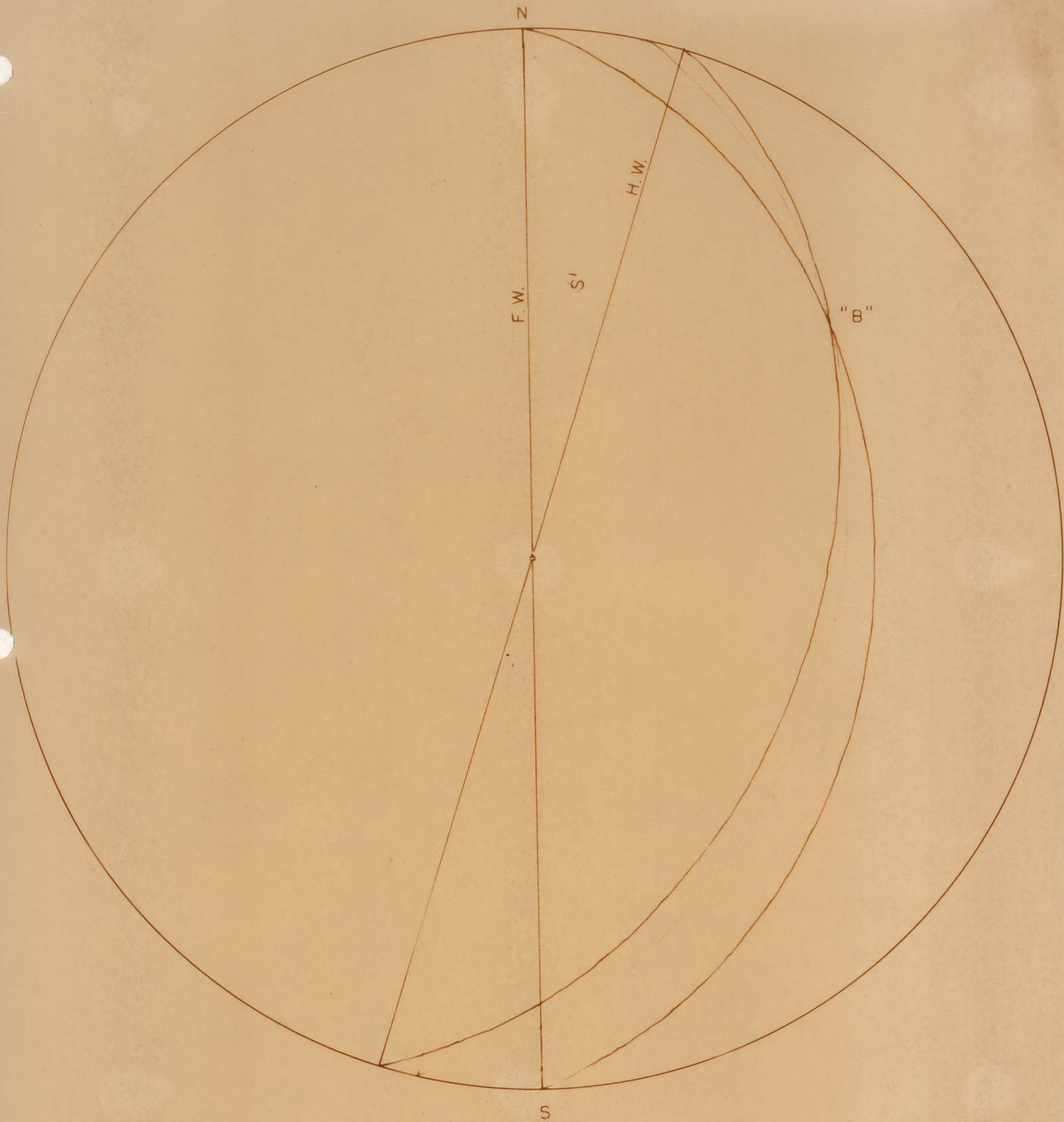


Fig 5

Ironsides Axial Plane S' and Axis "B"

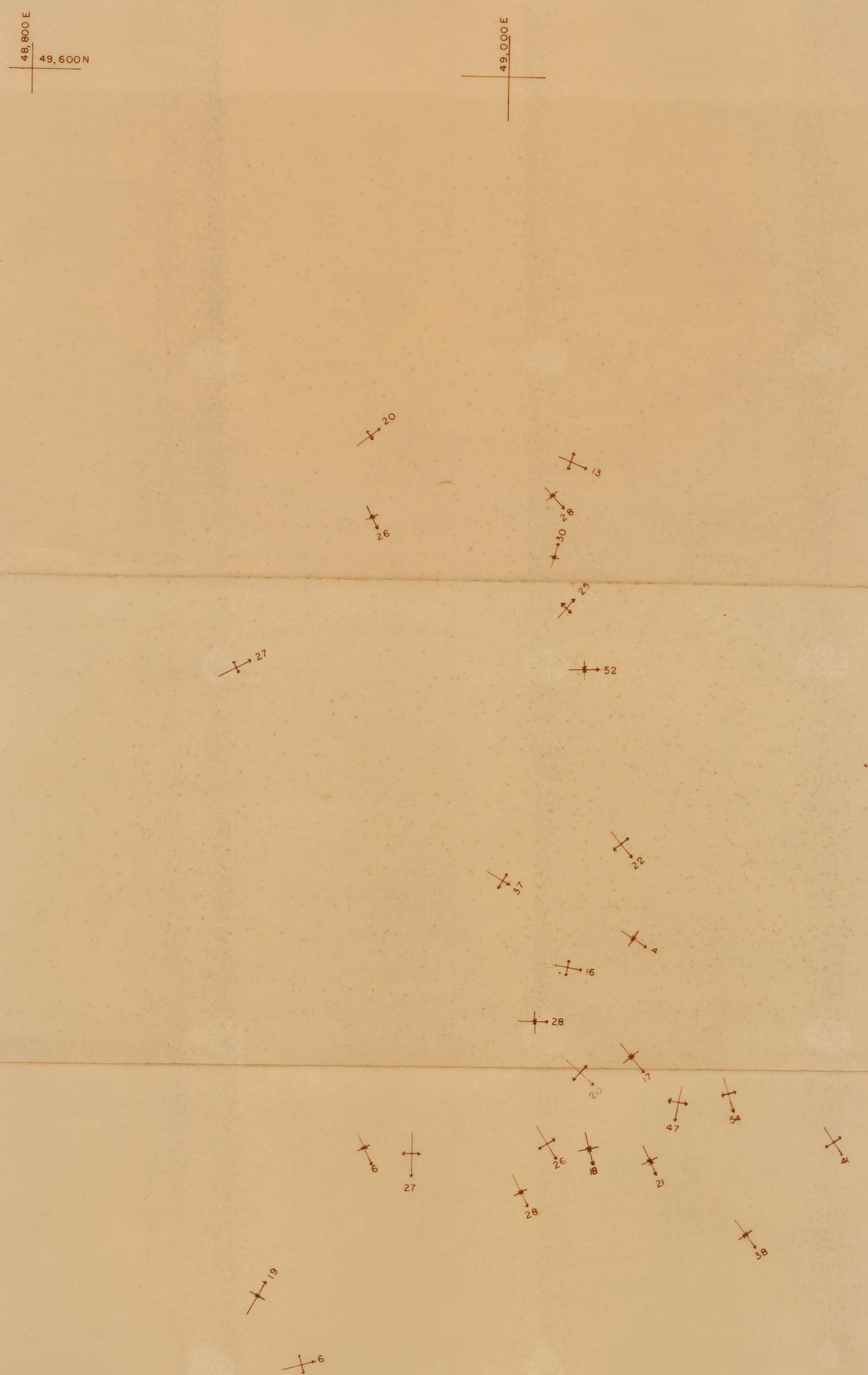


Fig 6a Ironsides H.W. Benches 11 12 13 Plications

Scale 1" = 40'

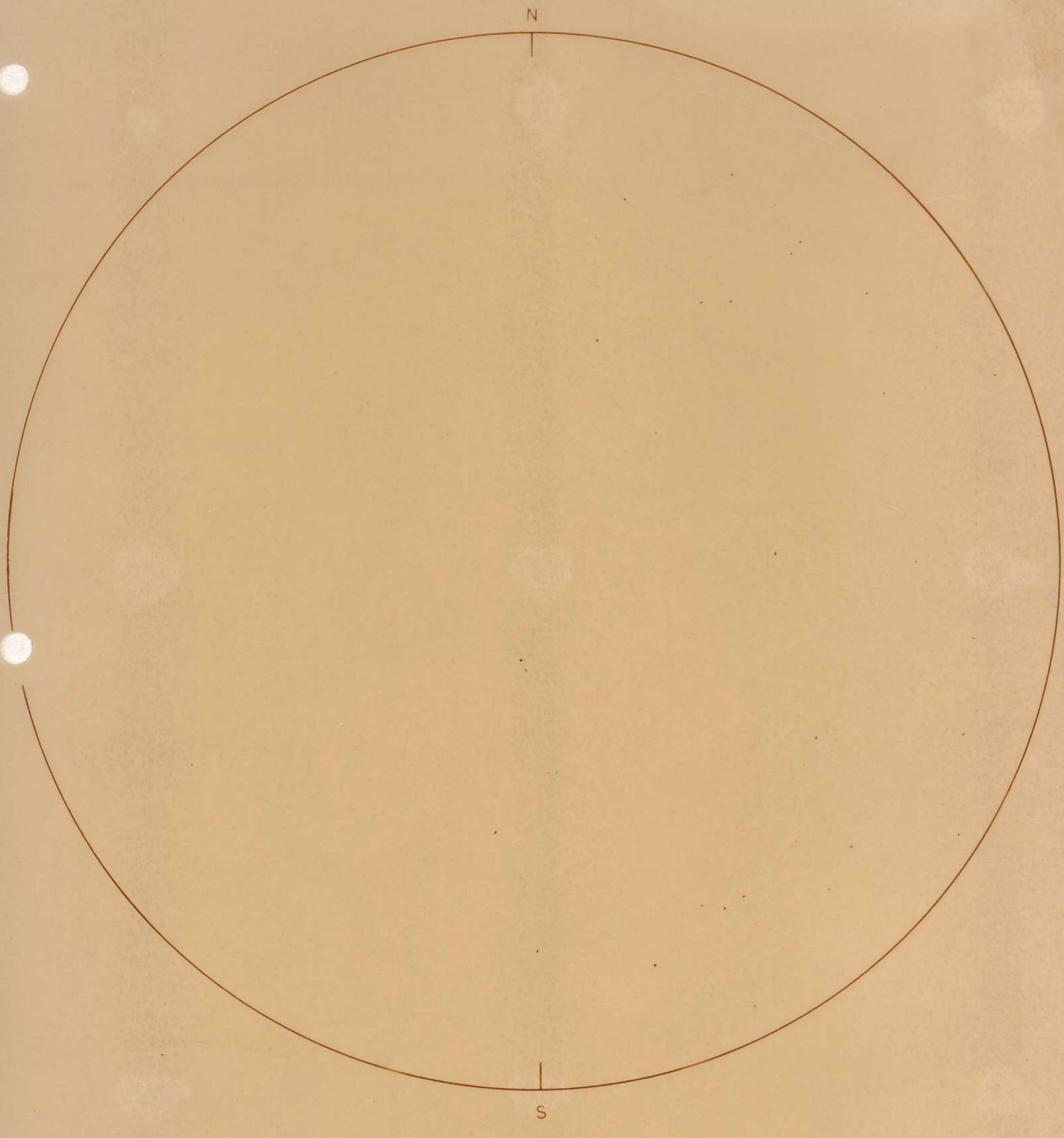


Fig 6b Ironsides H.W. Plication Axii

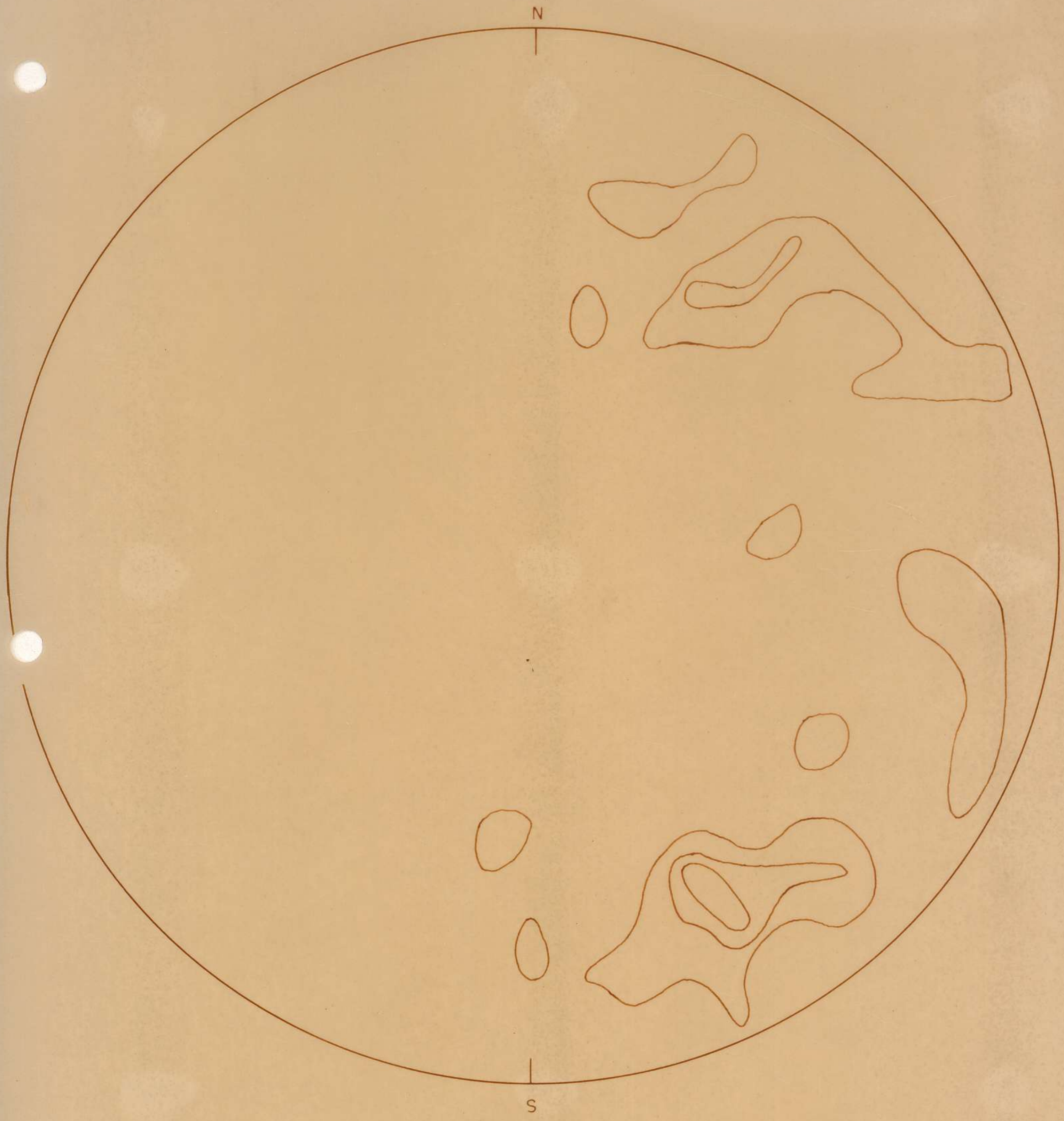


Fig 6c Contours of 27 Ironsides H.W. Plications from Benches 11 12 13

Contours at 3.7%
7.5 %
11.0%

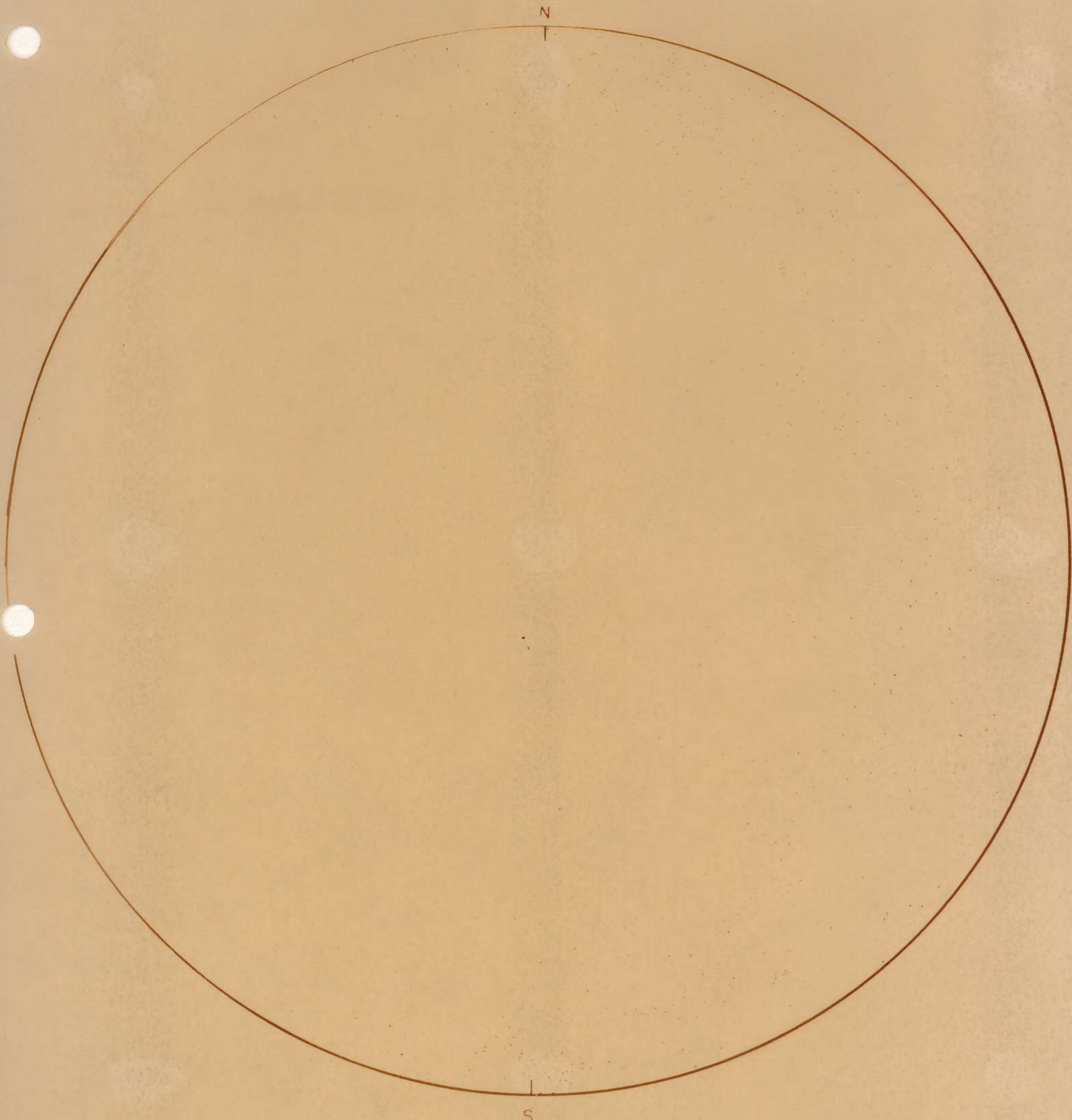
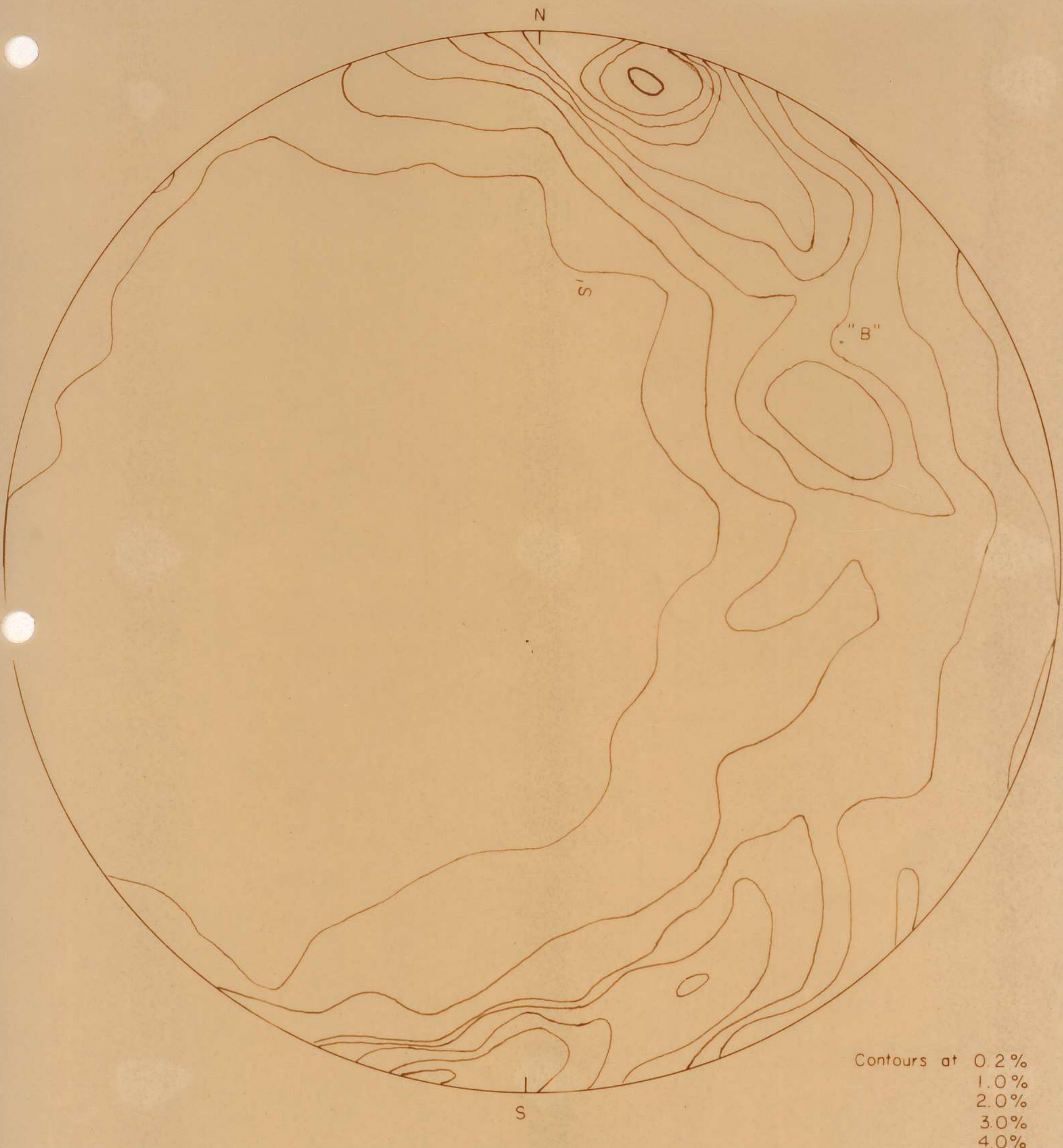


Fig 7a 500 Attwood Bedding Intersections



Contours at 0.2%
1.0%
2.0%
3.0%
4.0%
5.0%
6.0%
7.0%

Fig 7b Contours of Attwood Bedding Intersections

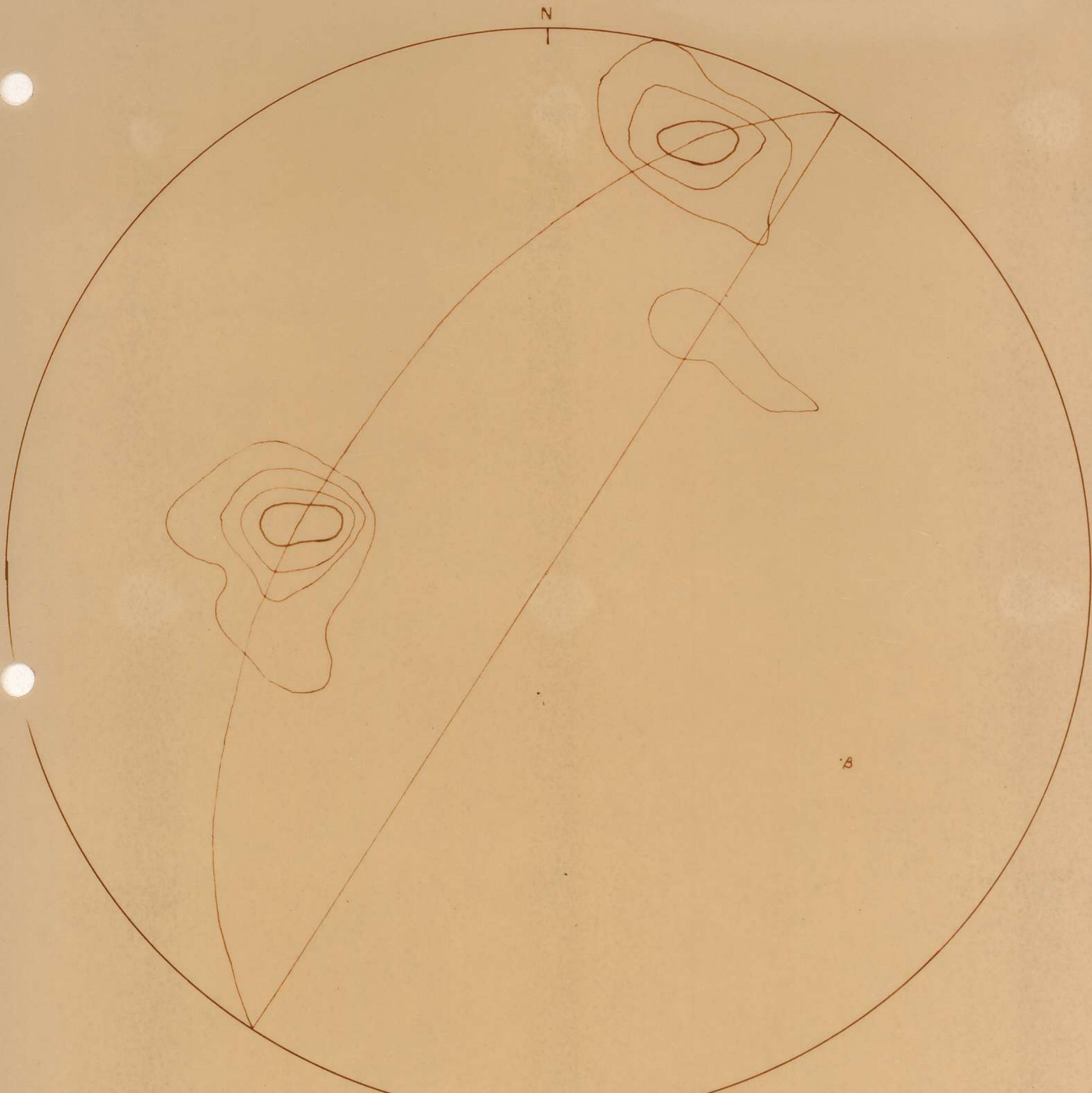


Fig 8a Contours of a small syncline on Bench 12, H.W, Ironsides

Contours at 5.2 %
10.5 %
15.8 %
21.0 %
26.4 %

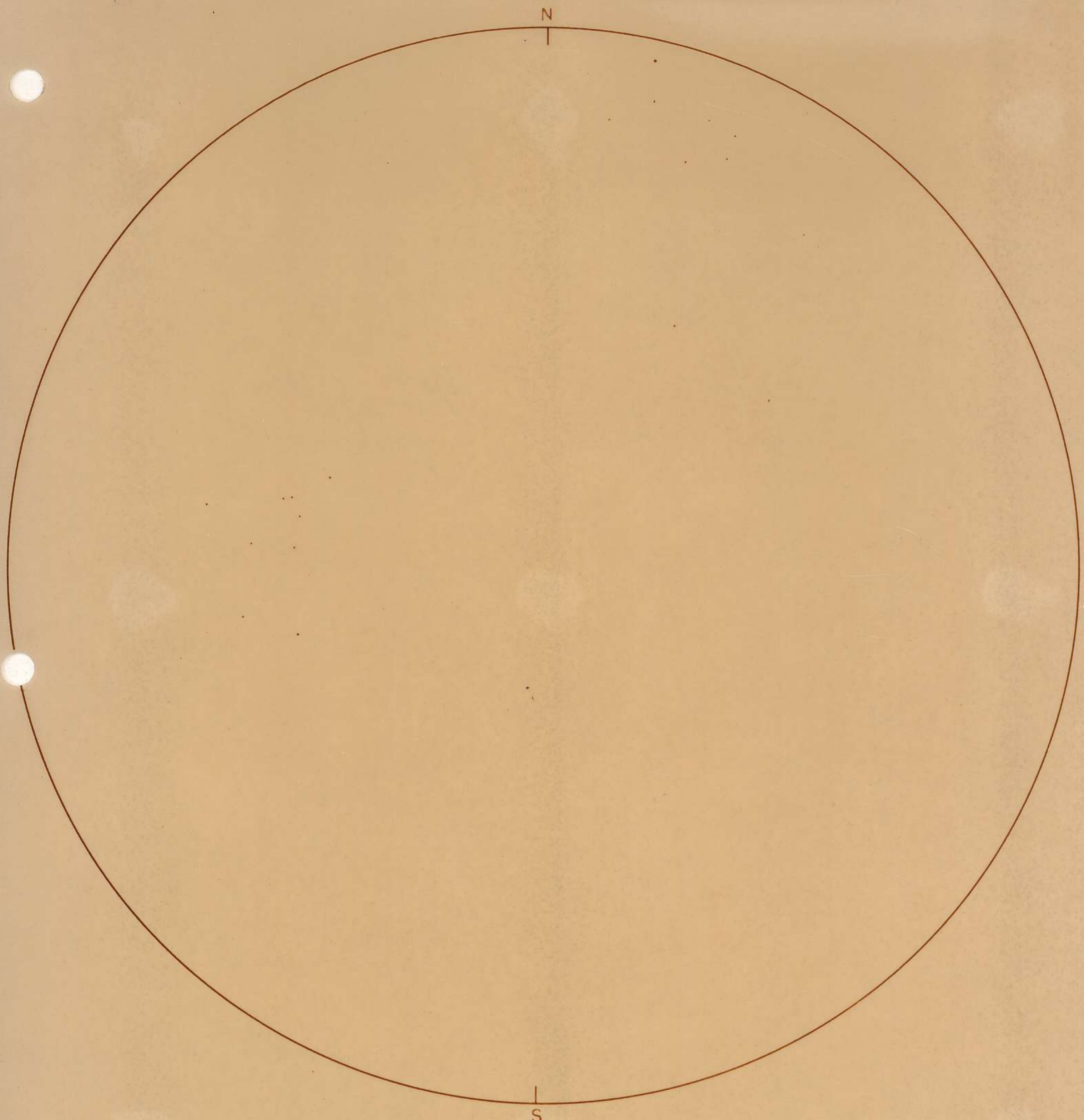


Fig 8b 19 S_1 poles for Ironsides H.W. Syncline

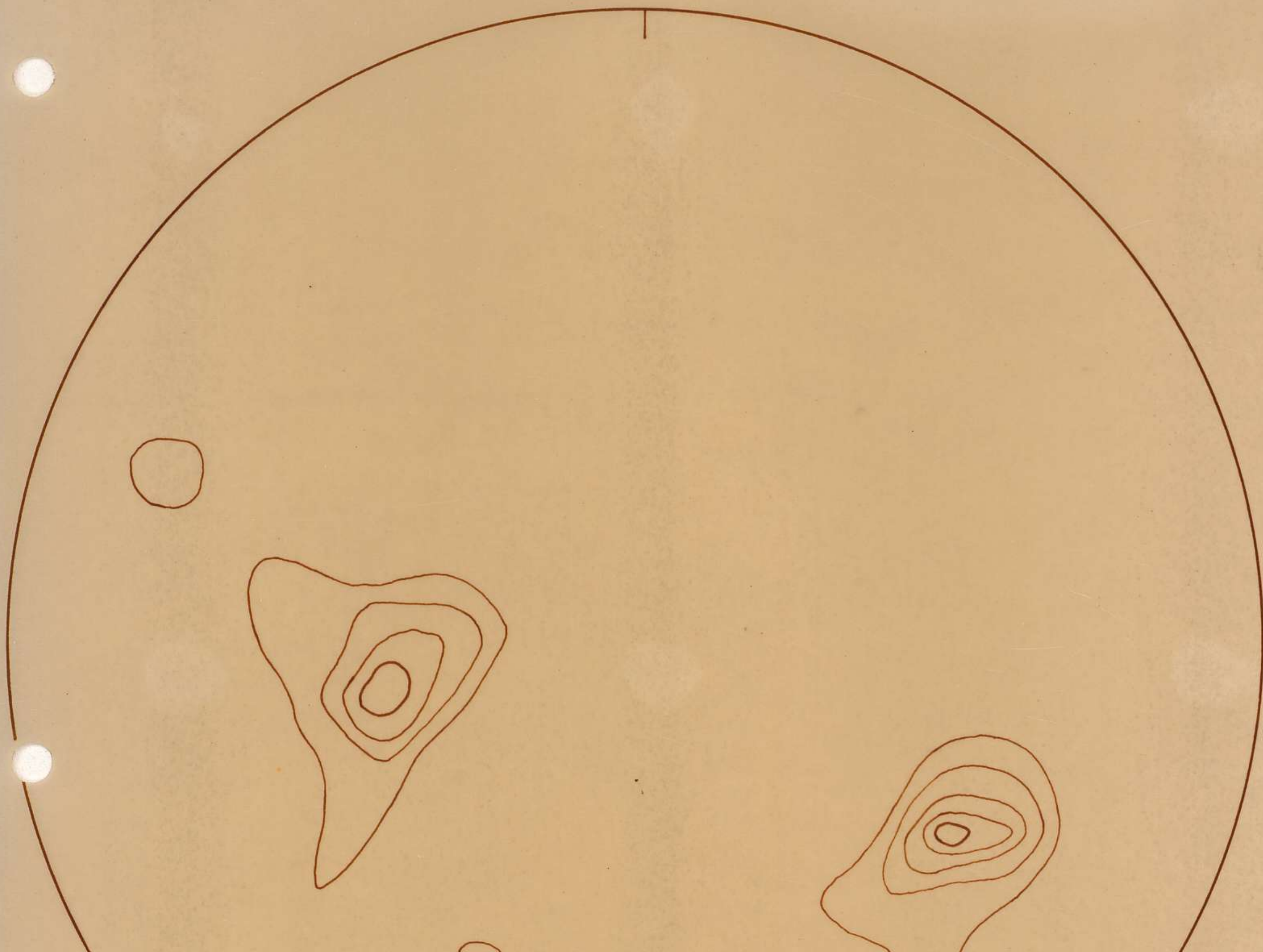


Fig 9a Contours of striations on S₁ planes. Bench 12, Ironsides H.W.

Contours at 5.2 %
10.5 %
15.8%
21.0%
26.4%

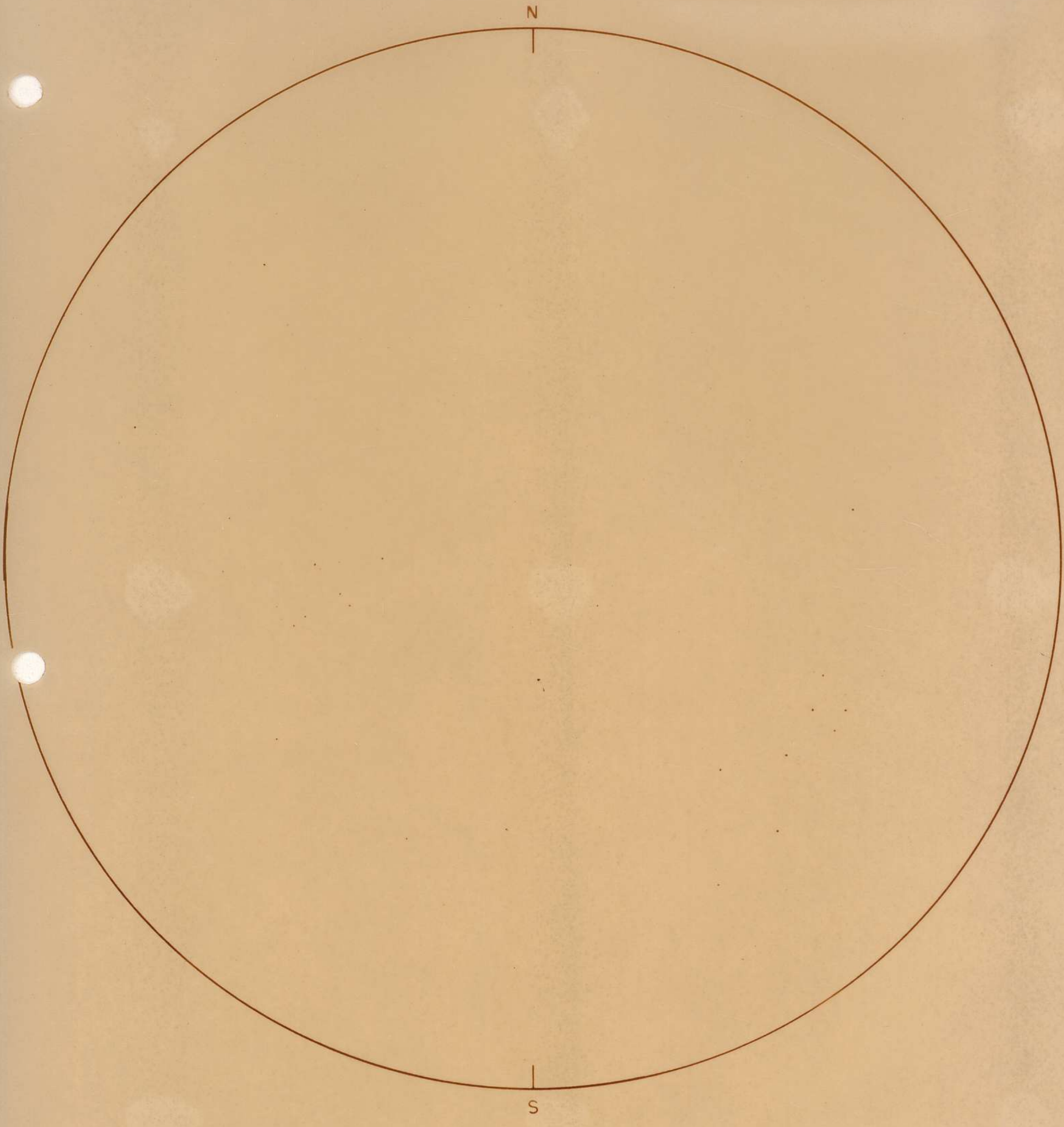


Fig 9b 19 Striation poles on S_1 planes. Bench 12, Ironsides H.W.

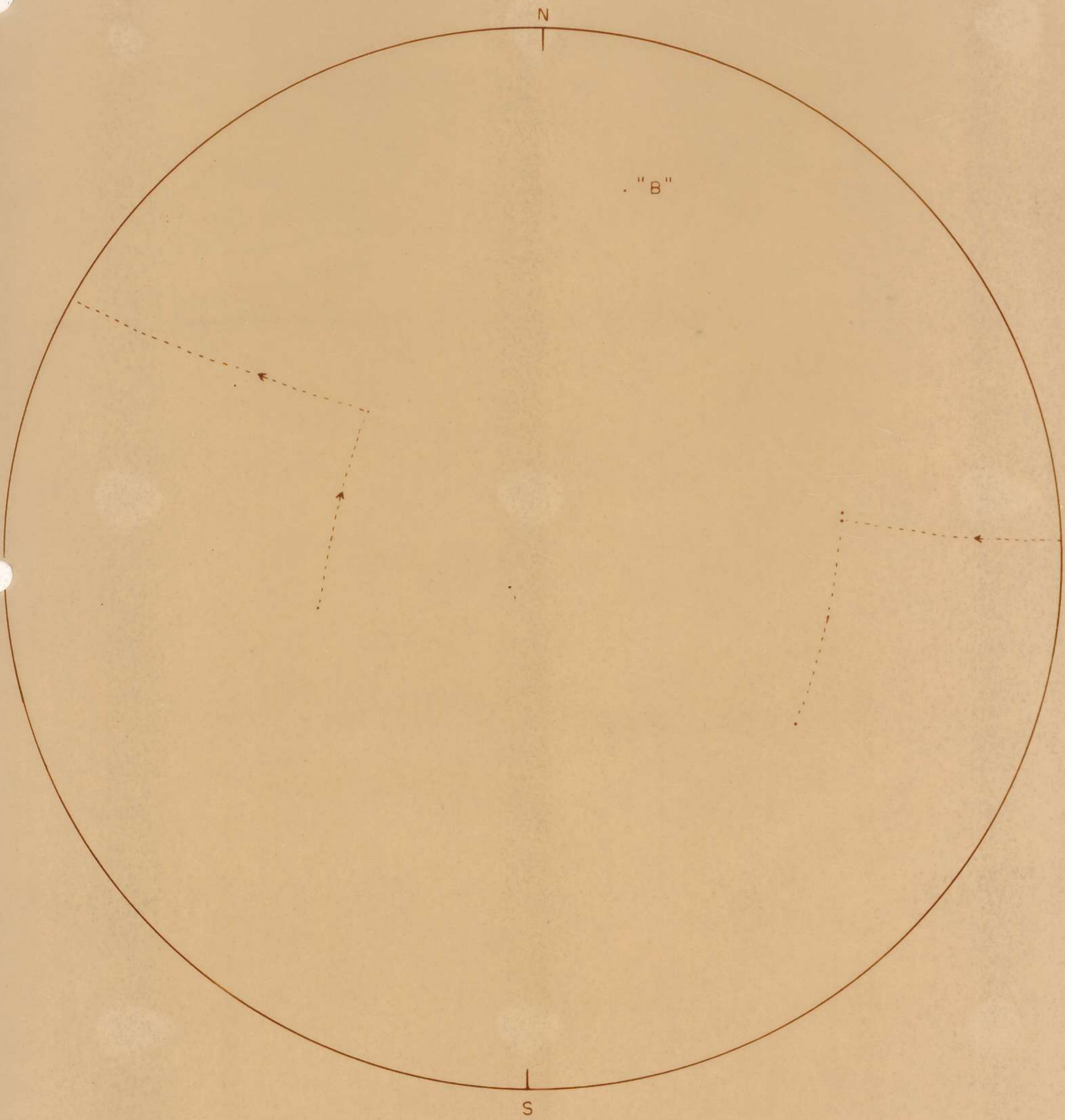


Fig 9c West Striations rotated about "B"

Fig 10a Contours of Striatiations from Bench 12, F. W., Ironsides

Contours at 5.5%
11.1%
16.6%
22.0%
27.6%
33.4%

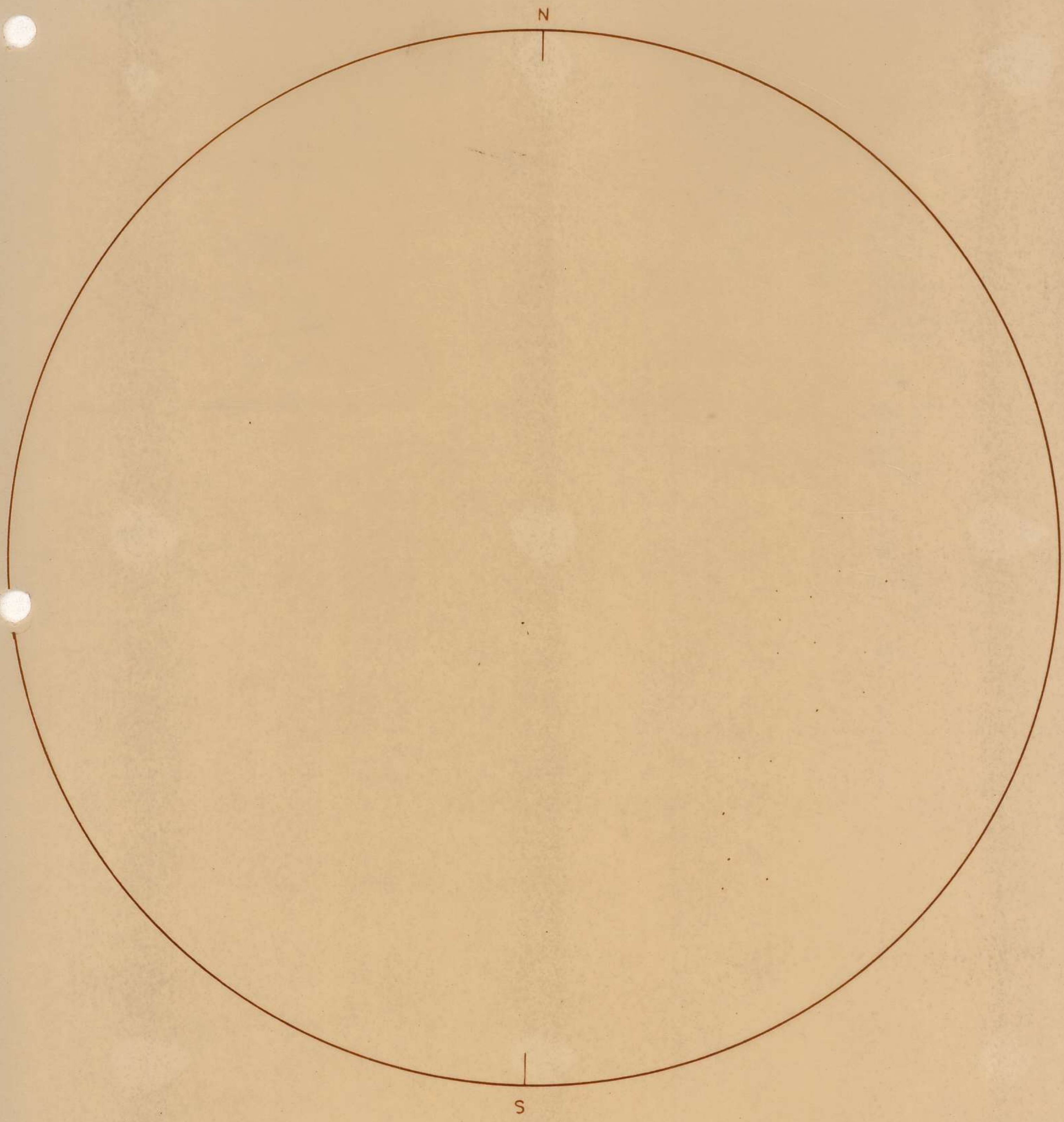
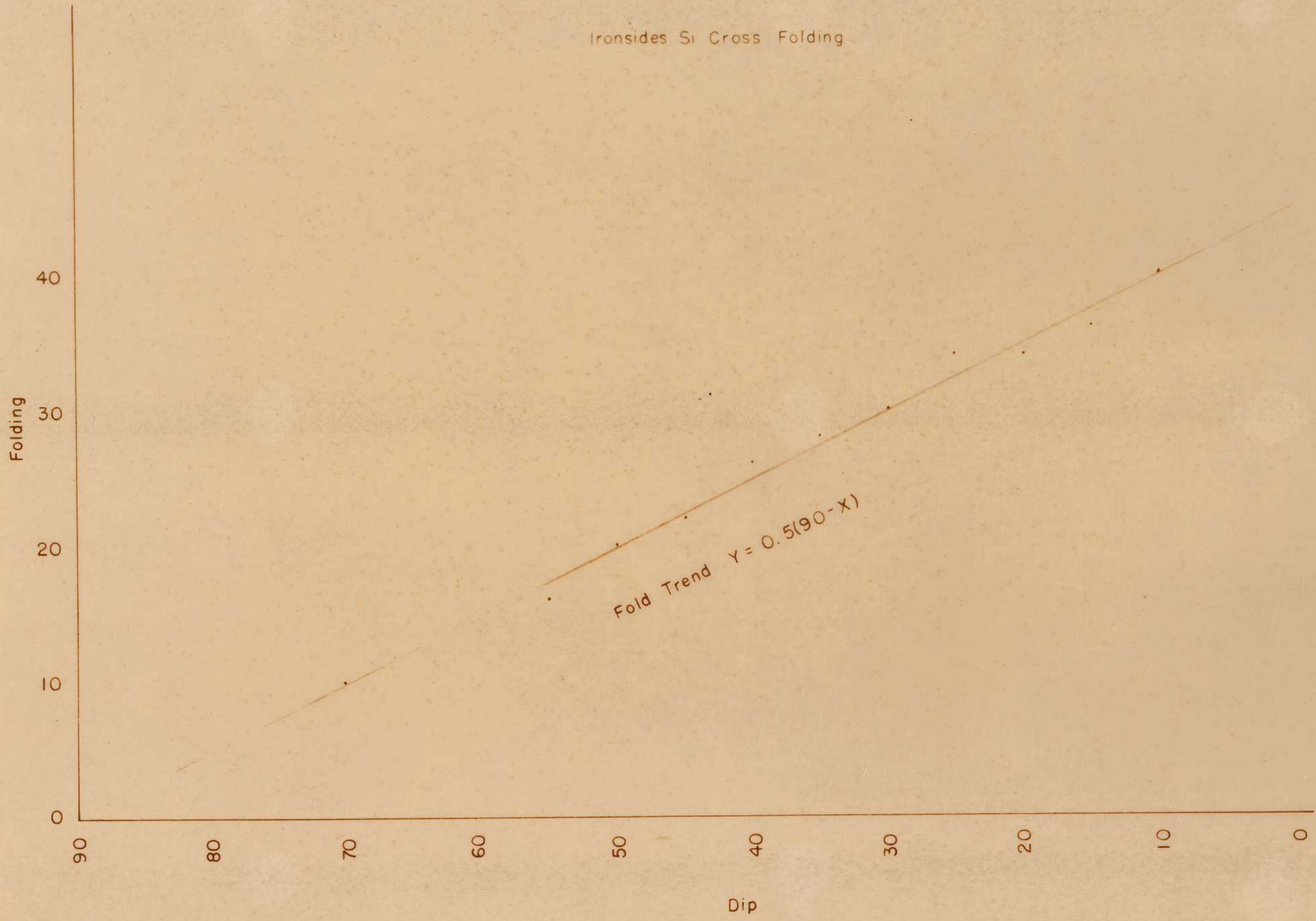


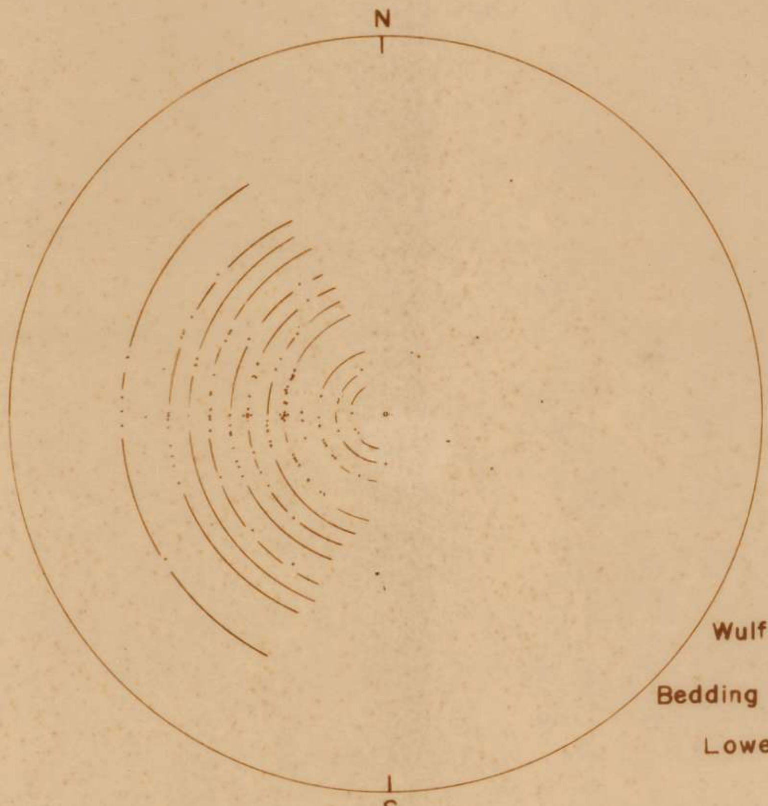
Fig 10b Striation poles from Bench 12 F.W., Ironsides

Fig 12

Ironsides Si Cross Folding



Ironsides Bedding Analysis



Wulff Stereonet

Bedding Poles are on the Lower Hemisphere

Fig 11

APPENDIX 1 -

ATTWOOD BEDDING DATA

ATTWOOD BEDDING DATA

N23°E-30°E
N17°E-70°E
N-S-55°E
N22°W-30°NE
N12°E-20°E
N25°E-60°E
N84°W-45°N
N-S - 40°E
N-S - 40°E
N15°W-35°E
N19°W-45°E
N28°W-70°E
N30°E-60°E
N-S - 40°E
N-S - 10°E
N55°W-35°W (syncl.)
N18°E-35°E "
N15°E-80°W
N1o°E-62°E
N20°E-40°E
N30°W-35°E
N26°W-10°E
N27°E-30°E
N-S - 40°E
N3°E- 40°E
N-S - 40°E
N60°- 15°S
N25°E-50°E
N9°E -60°E
N31°E-45°E
N12°W-45°E
N-S - 40°E
N38°E-60°E
N56°W-20°W
N11°E-30°E
N44°W-40°E
N-S - 45°E
N 3°E-60°E
N28°E-35°E
N 6°E-40°E
N-S - 15°E
N55°E-45°S
N 2°W-70°E
N68°W-70°W
N-S - 65°E
N-S - 50°E
N20°E-60°E
N 6°E-25°E
N-S - 30°E
N14°W-60°E
N42°E-35°E
N13°E-30°E
N22°E-30°E
N23°E-40°E
N59°E-40°SE
N30°W-30°NE
N 9°E-70°E
N14°E-30°E

N13°E-35°E
N17°W-45°E
N 2°W-30°E
N14°W-60°E
N 2°E-30°E
N 9°E-50°E
N29°W-20°E
N14°W-60°E
N 2°E-40°E
N 6°W-45°E
N62°W-20°NE
N35°W-20°E
N11°W-20°E
N33°W-20°E
N13°W-40°E
N15°W-35°E
N 7°E-55°E
N11°E-40°E
N26°E-50°E
N25°E-30°E
N24°E-30°E
N 4°W-50°E
N-S -20°E
N17°E-55°E
N30°E-58°E
N36°W-10°E
N35°W-30°E
N51°W-30°NE
N40°W-30°NE
N26°E-60°E
N19°W-40°E
N60°W-50°N
N-S -35°E
N 7°E-55°E
N17°W-50°E
N-S -20°E
N22°E-20°W
N10°E-50°E
N23°W-20°E
N 8°W-45°W
N51°W-15°NW
N36°W-40°E
N42°W-30°E
N 5°E-30°E
N 8°W-35°E
N 8°W-25°E
N 5°E-60°E
N-S- 30°E
N22°W-35°E
N41°W-35°E
N40°W-25°E
N30°W-35°E
N11°E-50°E
N-S -60°E
N-S -50°E
N-S -50°E
N 8°E-30°E
N-S -45°E

ATTWOOD BEDDING DATA

N16°E-15°E
N 3°W-30°E
N25°E-35°W
N14°W-35°E
N22°W-55°E
N87°W-15°NE
N62°W-20°SW
N24°W-15°E
N12°E-55°E
N 3°E-20°E
N40°W-20°NE

APPENDIX II

IRONSIDES BEDDING DATA FOR BENCHES 11,12,13

Grid 47800E - 49200E
49000 - 5000N

IRONSIDES

HANGING WALL BENCH 11, 12 13

STRIKE	DIP
N74°W	24° N
N19°E	34°E
N22°W	51°E
N20°W	-67°E
N28°W	-58°E
N29°E	-25°E
N25°E	-40°E
N10°E	-37°E
N14°E	-36°E
N35°E	-37°E
N41°E	-30°E
N-S	-45°E
N28°E	-31°E
N65°E	-36°E
N15°E	-40°E
N-S	-42°E
N 9°W	-35°E
N 5°E	-33°E
N14°E	-41°E
N27°E	-37°E
N 8°E	-68°E
N28°E	-57°E
N19°E	-47°E
N19°E	-52°E
N15°E	-63°E
N13°E	-55°E
N14°E	-82°E
N62°W	-65°E
N82°W	-41°S
N30°E	-65°E
N18°W	-50°E
N88°W	-31°N
N24°E	-60°E
N29°E	-83°SE
N28°W	-30°E
N22°W	-22°E
N20°W	-51°E
N23°W	-48°E
N22°W	-53°E
N-S	-45°E
N48°E	-47°E
N24°E	-68°E
N20°E	-40°E
N27°E	-37°E
N73°W	-89°SW
N62°W	-59°SW
N60°W	-51°SW
N45°W	-20°N
N34°W	-22°N
N85°E	-58°SE
N52°W	-72°SW
N66°W	-24°SW
E-W	-50°S
N27°E	-20°E

IRONSIDES HANGING WALL BENCH 11, 12, 13

STRIKE	DIP
N43°E	-23°E
N16°E	-40°E
N44°E	-39°E
N17°E	-34°E
N23°E	-39°E
N28°E	-45°E
N74°E	-40°SE
N32°E	-36°E
N27°E	-28°E
N10°E	-53°E
N25°E	-42°E
N40°E	-40°E
N 2°E	-44°E
N12°E	-10°E
N30°E	-43°W
N56°E	-32°SE
N11°E	-52°E
N 9°E	-44°E
N81°W	-35°S
N21°W	-60°W
N50°W	-50°W
N15°E	-36°E
N3°W	-52°E
N-S	-55°E
N52°E	-54°SE
N20°E	-70°E
N39°E	-65°E
N23°E	-31°E
N22°E	-41°E
N 7°E	-45°E
N82°E	-23°NW
N 3°E	-37°E
N30°E	-59°E
N10°E	-45°E
N38°E	-28°E
N31°E	-43°E
N46°E	-40°E
N58°E	-37°E
N19°E	-64°E
N31°E	-25°E
N6°E	-60°E
N-S	-56°E
N43°E	-59°E
N25°E	-34°E
N15°E	-48°E
N44°E	-57°E
N20°E	-52°E
N19°E	-48°E
N5°W	-64°E
N10°W	-74°E
N-S	-64°E
N24°E	-31°E
N46°E	-52°E
N27°E	-46°E
N-S	-70°E
N22°E	-58°E

IRONSIDES HANGING WALL BENCH 11, 12, 13

STRIKE	DIP
N20°E	-42°E
N27°E	-47°E
N16°E	-60°E
N 9°E	-52°E
N 8°E	-65°E
N27°E	-55°E
N30°E	-25°E
N42°E	-36°E
N47°E	-43°E
N22°E	-42°E
N35°E	-38°E
N12°E	-42°E
N 9°E	-30°E
N 6°E	-45°E
N35°E	-47°E
N47°E	-32°E
N40°E	-37°E
N16°E	-48°E
N48°E	-39°E
N42°E	-50°E
N33°E	-45°E
N41°W	-70°W
N28°E	-63°E
N37°E	-60°E
N16°W	-46°E
N55°E	-41°E
N-S	-30°E
N55°E	-54°E
N67°E	-30°SE
N51°E	-48°SE
N72°E	-55°SE
N25°W	-60°SW
N82°W	-55°S
E-W	-32°S
N44°E	-42°SE
N38°E	-65°SE
N25°E	-78°E
N25°E	-66°E
N 2°E	-53°E
N42°E	-56°SE
N27°E	-40°E
N20°E	-33°E
N 4°E	-23°E
N34°E	-32°E
N55°E	-42°SE
N28°E	-40°E
N84°W	-49°E
N48°E	-76°SE
N68°E	-34°SE
N13°E	-36°SE
N27°E	-40°E
N22°E	-34°E
N9°E	-43°E
N-S	-52°E
N42°E	-51°E
N31°E	-71°E
N12°E	-39°E

IRONSIDES HANGING WALL

STRIKE	DIP
N80°W	-29°N
N30°E	-45°E
N21°E	-25°E
N20°E	-40°E
N11°E	-42°E
N17°E	-59°E
N20°E	-45°E
N 5°E	-46°E
N40°W	-29°E
N13°W	-21°E
N10°E	-43°E
N5°E	-68°E
N-S	-66°E
N-S	-29°E
N 3°E	-37°E
N10°E	-57°E
N 5°E	-65°E
N 7°E	-60°E
N 4°E	-73°E
N28°E	-52°E
N48°E	-37°E
N19°E	-45°E
N20°E	-52°E
N18°E	-44°E
N16°E	-63°E
N11°E	-64°E
N35°E	-31°E
N59°W	-40°E
N48°W	-48°E
N26°E	-65°E
N20°E	-64°E
N21°E	-25°E

APPENDIX III

IRONSIDES BEDDING DATA FOR BENCHES 11 - 19

Grid 47,800E - 49,200E

IRONSIDES BEDDING DATA, B-7 MAPS BENCHES 11-19 HW

	STRIKE	DIP
Bench 11	N20°E	-47°E
	N19°E	-52°E
	N14°E	-63°E
	N14°E	-55°E
	N15°E	-85°E
Bench 12	N16°E	-60°E
	N10°E	-52°E
	N10°E	-65°E
	N27°E	-55°E
	N31°E	-25°E
	N27°E	-47°E
	N28°E	-58°E
	N19°E	-42°E
	N-S	-70°E
	N 6°W	-64°E
	N10°W	-74°E
	N-S	-64°E
	N43°E	-59°E
	N24°E	-34°E
	N15°E	-48°E
	N43°E	-57°E
	N43°E	-52°E
	N25°E	-46°E
	N23°E	-31°E
	N21°E	-52°E
	N18°E	-48°E
	N30°E	-63°E
Bench 13	N39°E	-51°E
	N30°E	-71°E
	N20°E	-64°E
	N11°E	-43°E
	N10°E	-69°E
	N 4°E	-66°E
	N 4°E	-66°E
	N 3°E	-68°E
	N48°E	-72°E
	N12°E	-64°E
	N16°E	-63°E
	N19°E	-44°E
	N6°E	-60°E
	N-S	-73°E
	N19°E	-59°E
	N22°E	-49°E
	N20°E	-45°E
	N 6°E	-46°E
	N25°E	-43°E
	N 7°E	-44°E
	N10°E	-44°E
	N16°E	-39°E
	N21°E	-65°E
	N46°E	-37°E
	N30°E	-52°E

IRONSIDES B-7MAPS BENCHES 11-19 HW

	STRIKE	DIP
Bench 13 cont'd	N26°E	-26°E
	N14°E	-45°E
	N14°E	-43°E
	N29°E	-32°E
	N45°E	-52°E
	N34°E	-31°E
	N19°E	-45°E
	N19°E	-52°E
	N-S	-29°E
	N-S	-37°E
	N39°W	-29°E
	N11°W	-21°E
	N33°E	-45°E
	N24°E	-25°E
	N20°E	-40°E
	N10°E	-42°E
	N10°E	-57°E
	N23°E	-64°E
	N22°E	-25°E
	N28°W	-40°E
	N48°W	-48°E
Bench 14	N15°E	-60°E
	N2[illegible]°W	-81°E
	N19°E	-37°E
	N 9°E	-43°E
	N43°E	-32°E
	N10°E	-43°E
	N16°E	-58°E
	N 8°W	-42°E
	N24°E	-38°E
	N 8°W	-57°E
	N13°E	-40°E
	N48°E	-42°E
	N58°E	-15°E
	N-S	-60°E
	N20°E	-70°E
	N22°E	-65°E
	N19°E	-35°E
	N28°E	-50°E
	N-S	-26°E
	N25°E	-40°E
	N42°E	-32°E
	N 8°E	-29°E
	N22°E	-40°E
	N25°E	-33°E
	N15°E	-43°E
	N 6°E	-64°E
	N19°E	-14°E
	N13°E	-50°E
	N19°W	-41°E
	N 9°E	-57°E
	N 2°E	-25°E
	N20°E	-41°E

IRONSIDES B-7 MAPS BENCHES 11-19 HW

	STRIKE	DIP
Bench 14 cont'd	N37°E	-48°E
	N 9°E	-22°E
	N11°E	-75°E
	N12°E	-60°E
Bench 15	N25°E	-78°E
	N23°E	-70°E
	N 4°E	-59°E
	N13°E	-52°E
	N38°E	-25°E
	N47°E	-32°E
	N13°W	-45°E
	N 6°W	-50°E
	N-S	-35°E
	N14°W	-66°E
	N10°W	-68°E
	N 7°E	-56°E
	N14°E	-33°E
	N30°E	-69°E
	N 9°E	-81°E
	N44°E	-55°E
	N31°E	-45°E
	N20°E	-44°E
	N20°E	-45°E
	N28°W	-11°E
	N30°W	-33°E
	N12°W	-34°E
	N 4°E	-21°E
	N18°E	-12°E
Bench 16	N12°E	-50°E
	N10°E	-55°E
	N19°E	-70°E
	N21°E	-52°E
	N19°E	-49°E
	N14°E	-52°E
	N21°E	-61°E
	N10°E	-47°E
	N-S	-49°E
	N 9°E	-40°E
	N10°E	-48°E
	N 5°E	-52°E
	N19°E	-56°E
	N30°E	-60°E
	N19°E	-54°E
	N19°E	-71°E
	N19°E	-31°E
	N36°E	-66°E
	N38°E	-35°E
	E-W	-72°S
	N 6°E	-61°E
	N11°W	-44°W
	N25°W	-35°E

	STRIKE	DIP
Bench 17	N20°E	-42°E
	N25°E	-52°E
	N32°E	-52°E
	N40°E	-41°E
	N38°E	-52°E
	N15°W	-30°E
Bench 18	N14°E	-41°E
	N10°E	-54°E
	N20°E	-26°E
	N15°E	-35°E
	N18°E	-55°E
Bench 19	N18°E	-60°E
	N 8°E	-54°E
	N25°W	-35°E
	N11°E	-50°E

APPENDIX IV

"B" STRUCTURES IN IRONSIDES H.W.

Appendix IV

"B" Axis on Bench 11, 12, 13, Ironsides

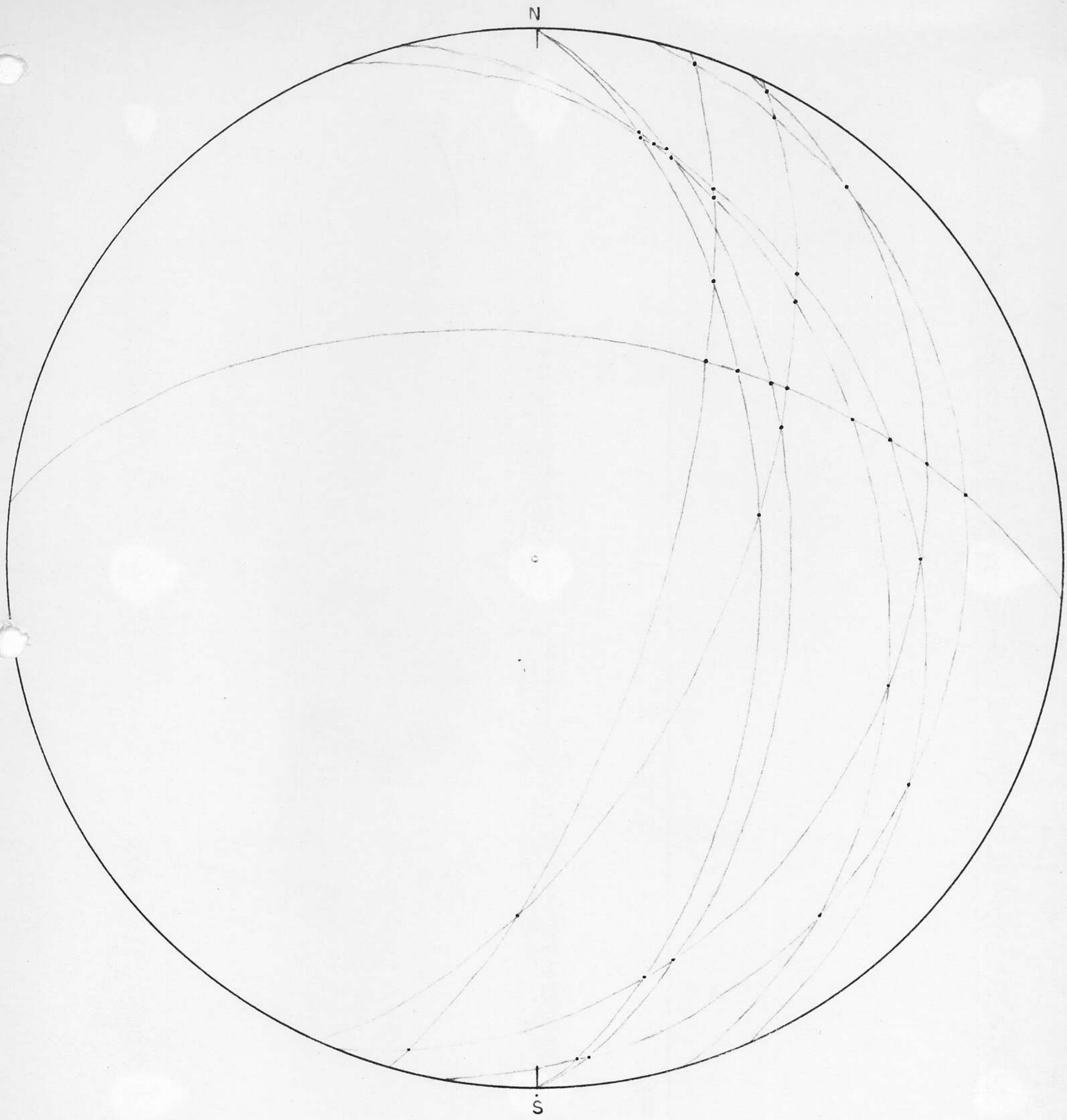
	STRIKE	DIP
Bench 11	N51°E	-20°
	S29°E	-26°
	S58°E	-37°
Bench 12	S68°E	-13°
	S43°E	-28°
	N64°E	-27°
	N14°E	-30°
	N40°E	-25°
	N88°E	-52°
	S40°E	-22°
	S57°E	- 4°
	S80°E	-16°
	E-W	-28°
	S 8°W	-47°
	S16°E	-21°
	S13°E	-18°
	S32°E	-26°
	S26°E	-28°
	S -N	-27 °
	S26°E	- 6°
	N27°E	-19°
	N68°E	- 6°
Bench 13	S48°E	-20°
	S42°E	-17°
	S16°E	-54°
	S33°E	-41°
	S37°E	-38°

APPENDIX V

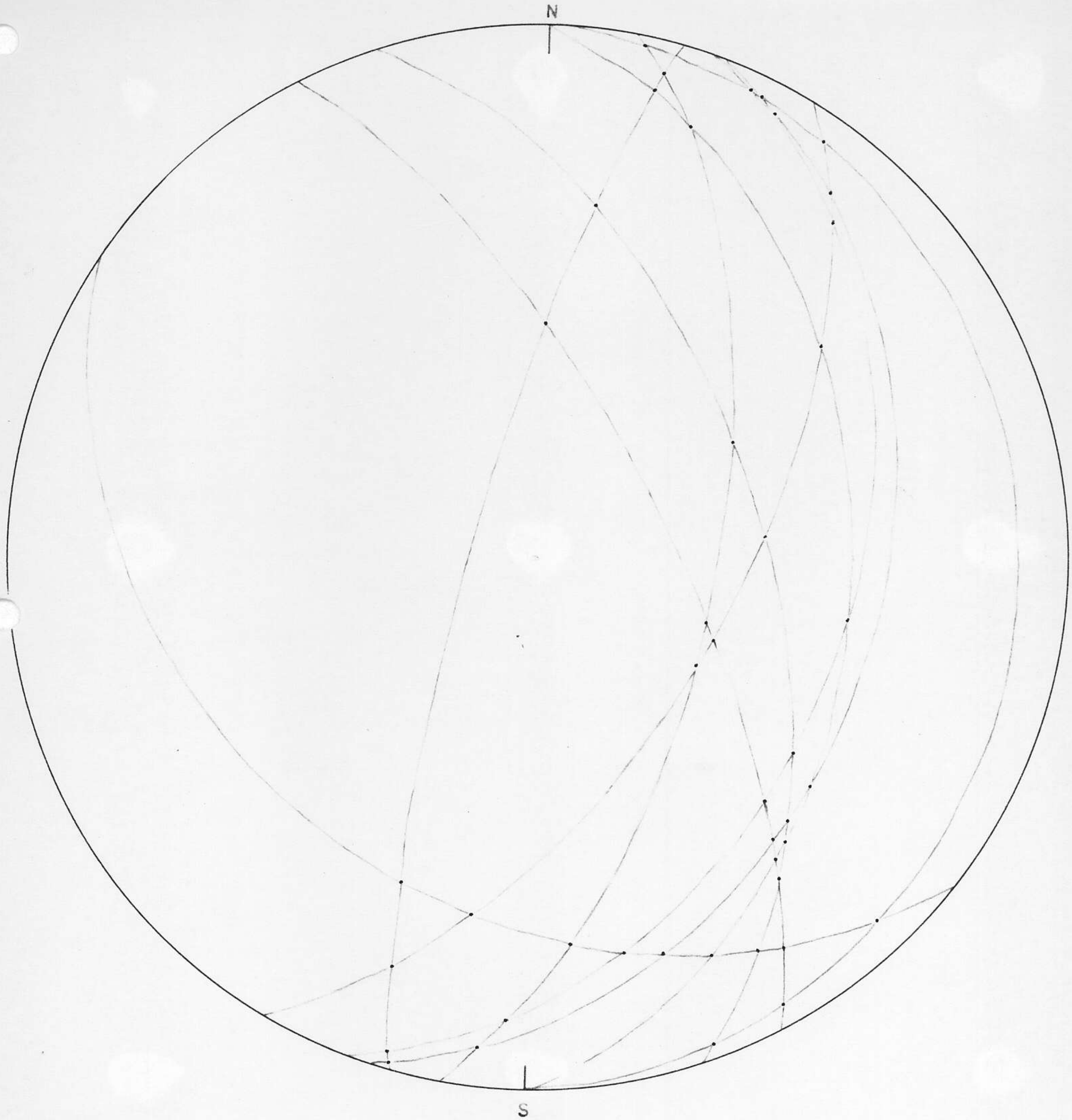
CYCLOGRAPHIC TRACES OF BEDS FROM THE DATA IN

APPENDIX I

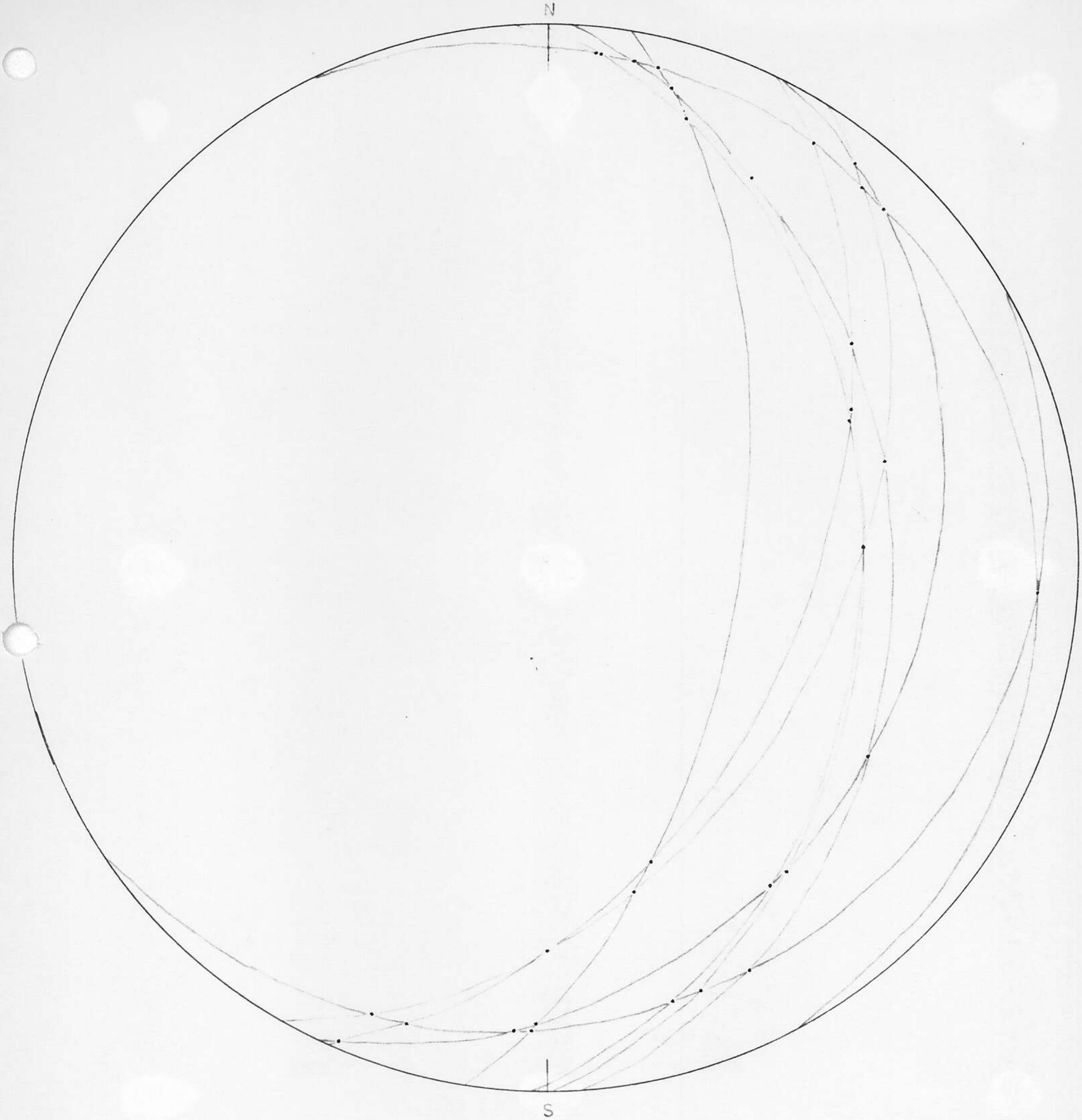
GROUPED 10 BEDS PER NET



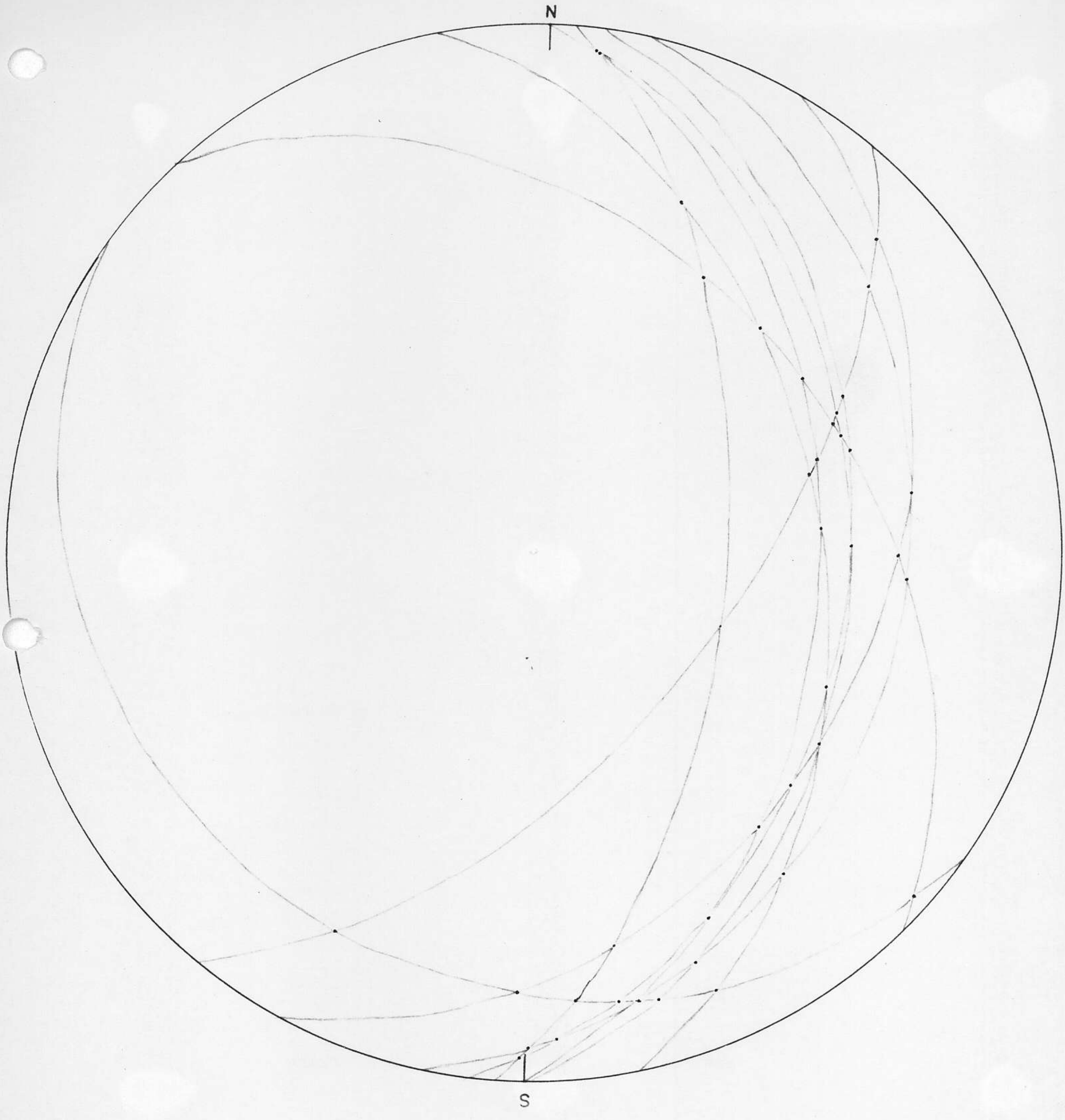
Appendix 5 Intersections of Cyclographic Projections of 1st 10 Attwood Beds



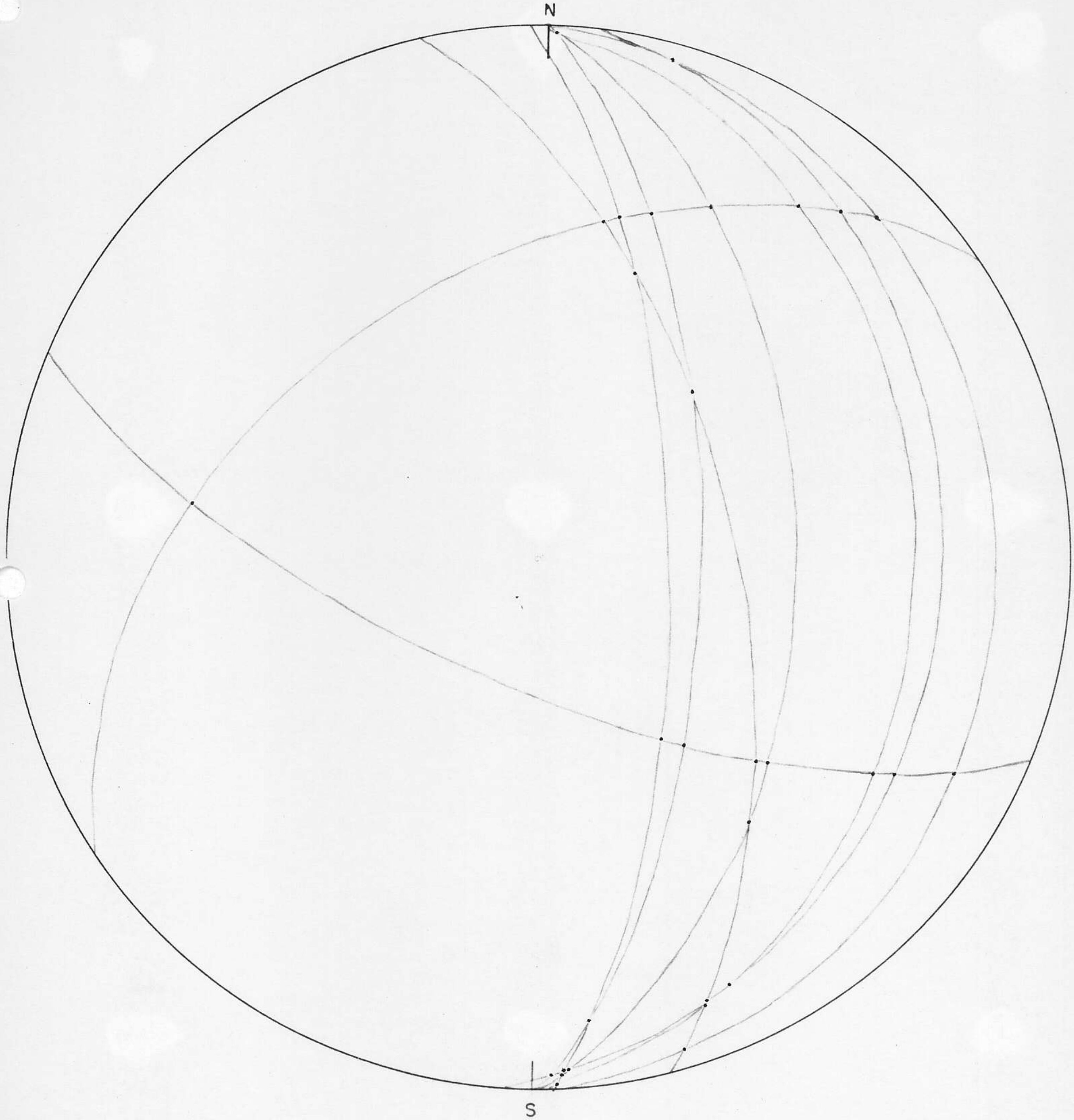
2 nd 10 Attwood Beds



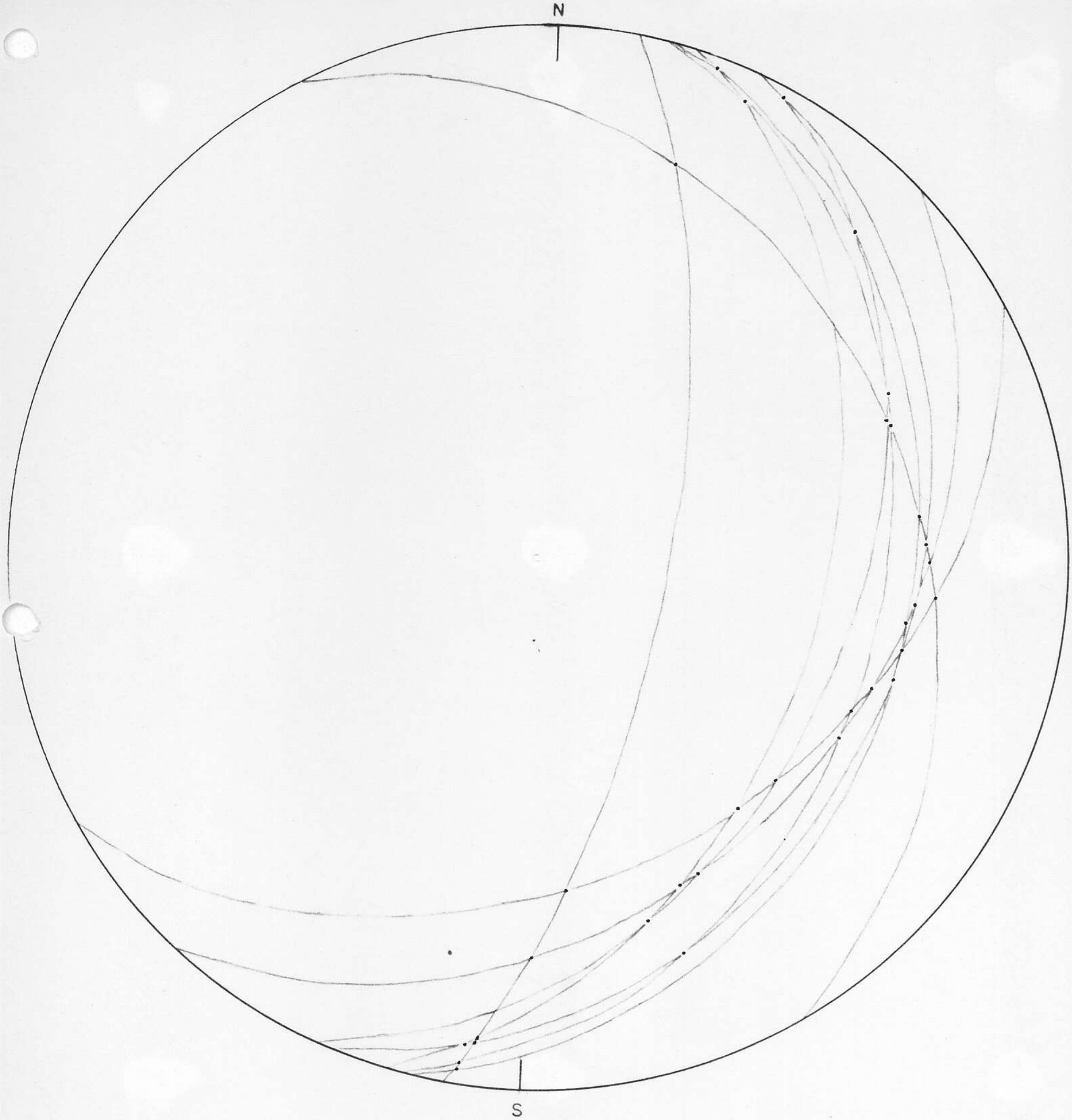
3rd 10 Attwood Beds



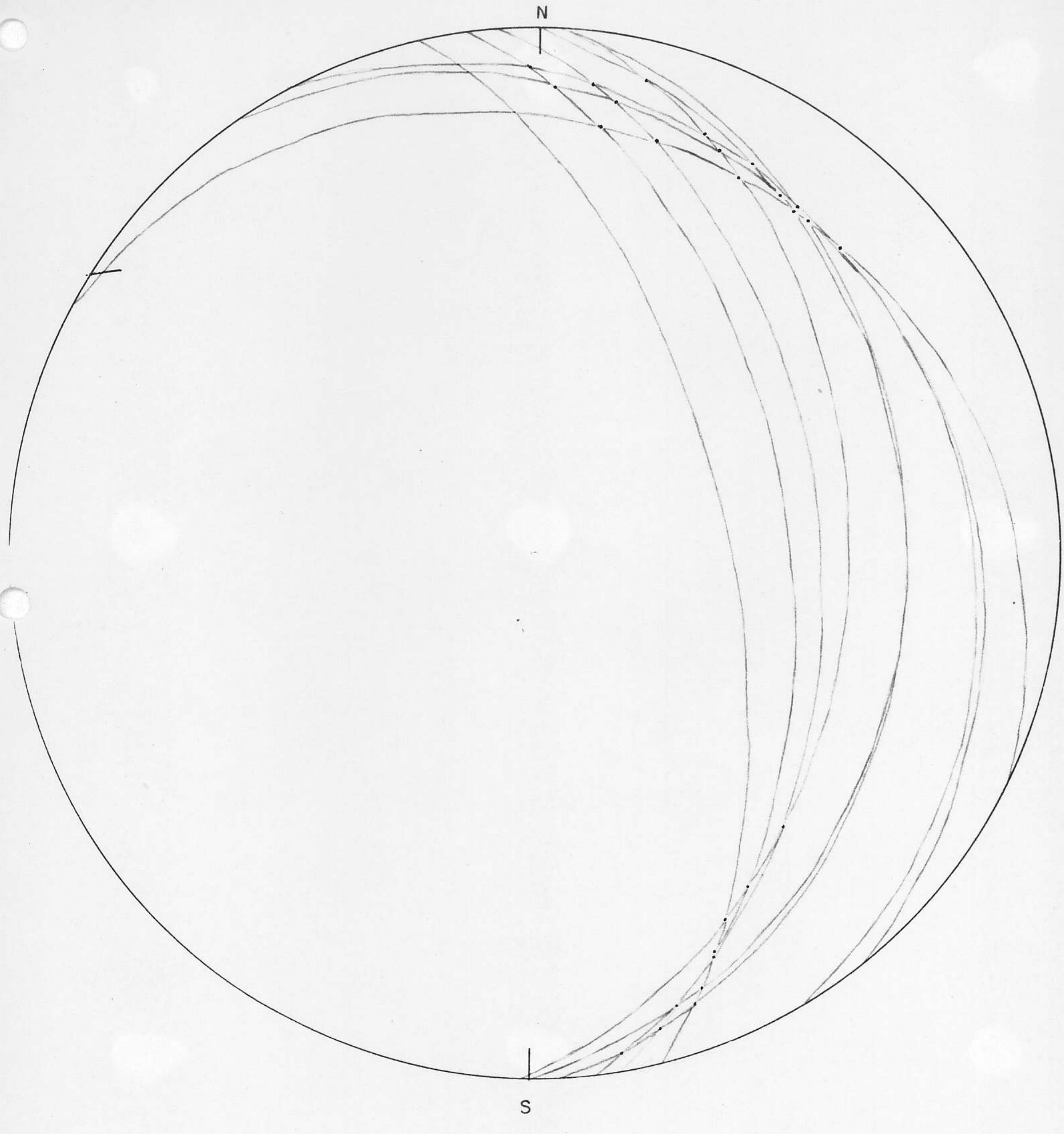
4th 10 Attwood Beds



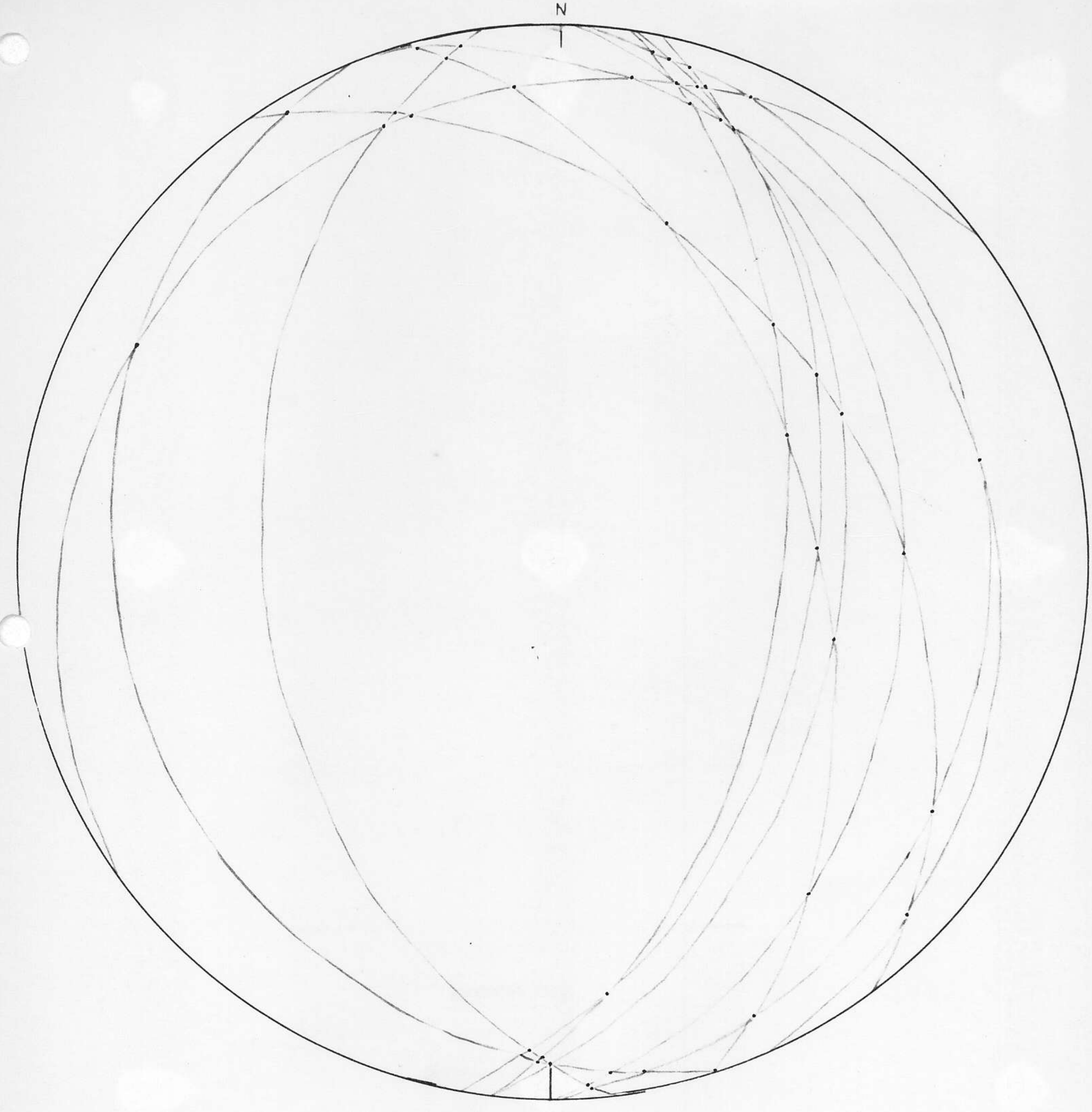
5th 10 Attwood Beds



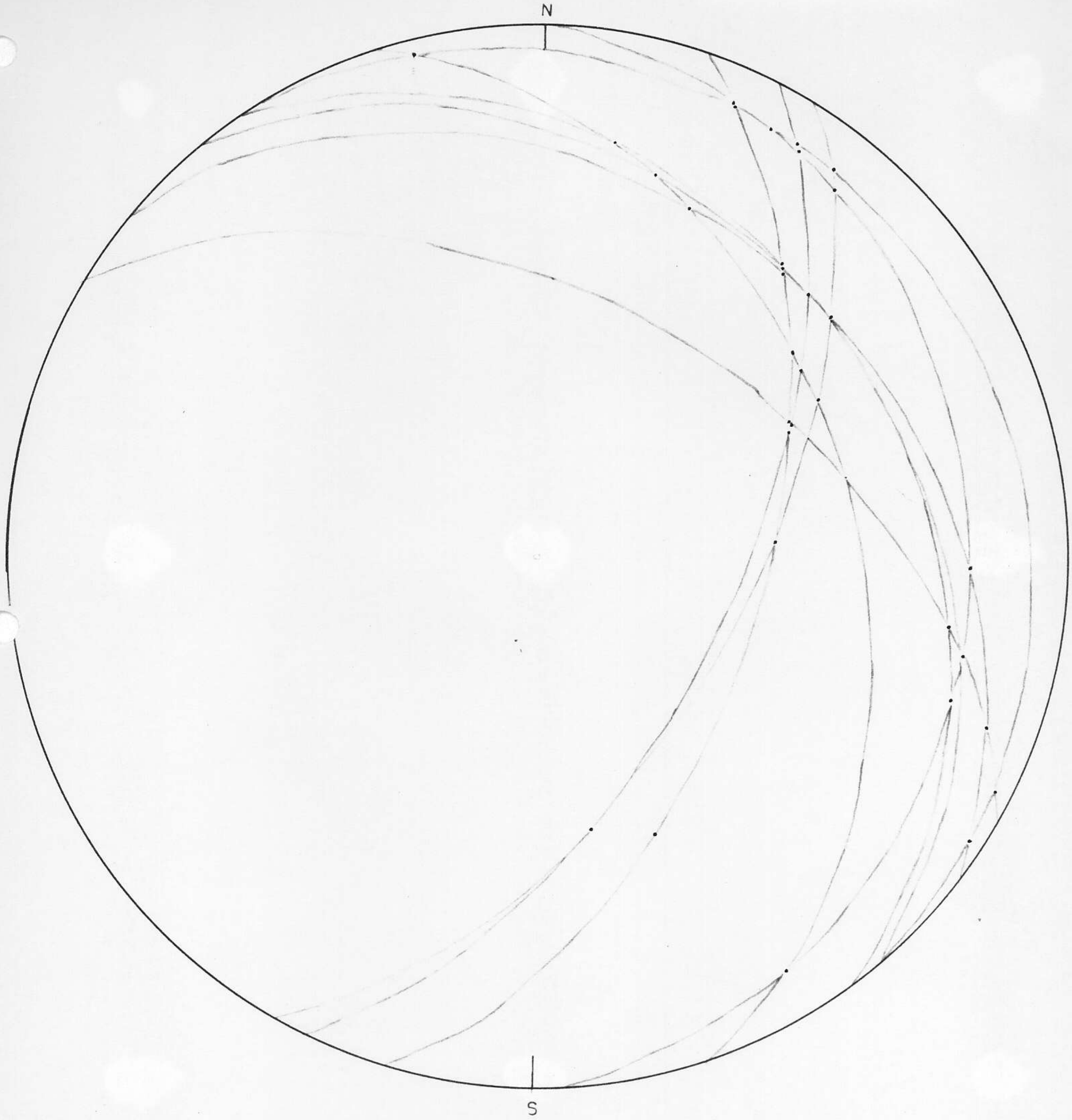
6th 10 Attwood Beds



7th 10 Attwood Beds

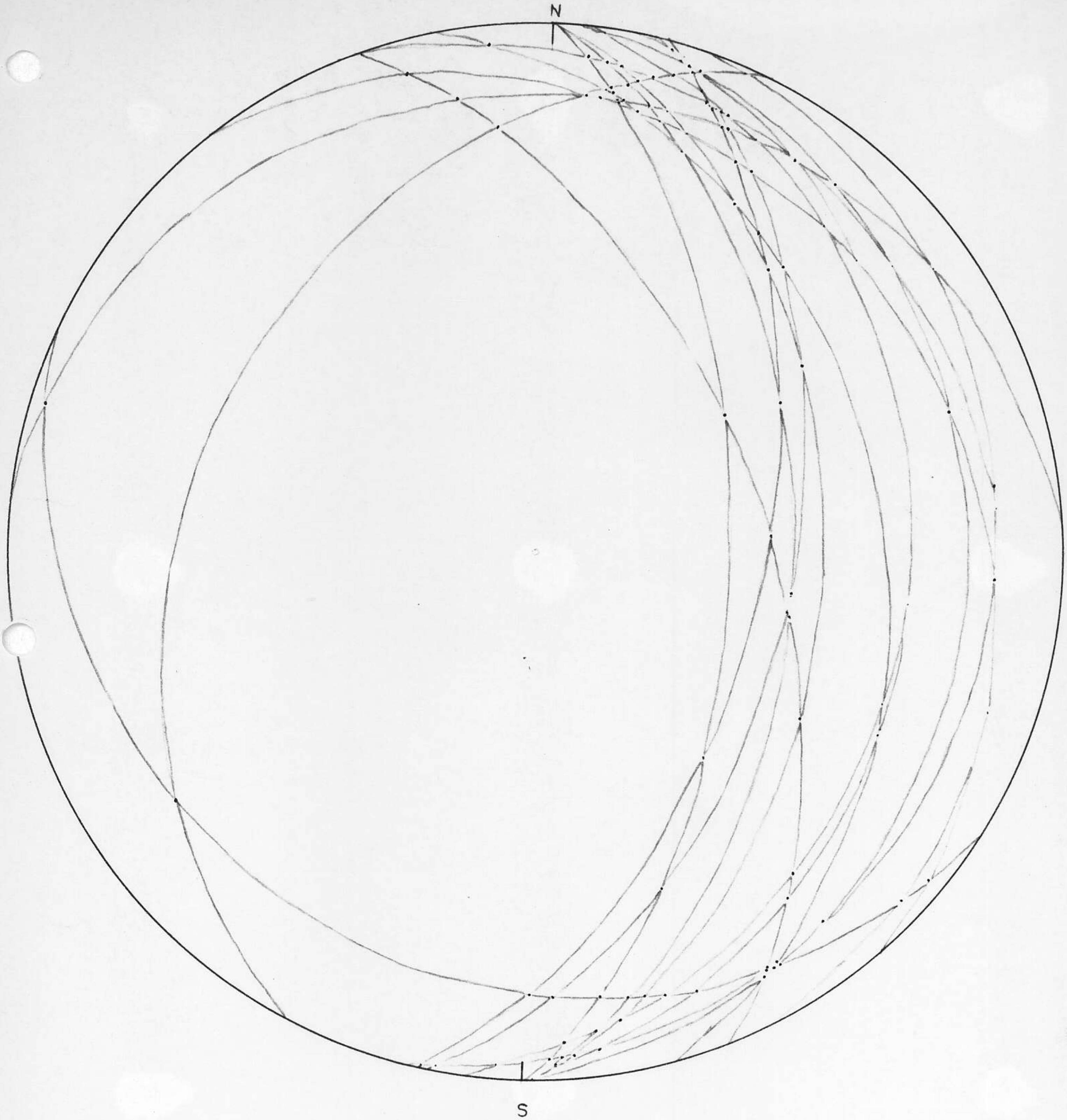


8th 10 Attwood Beds

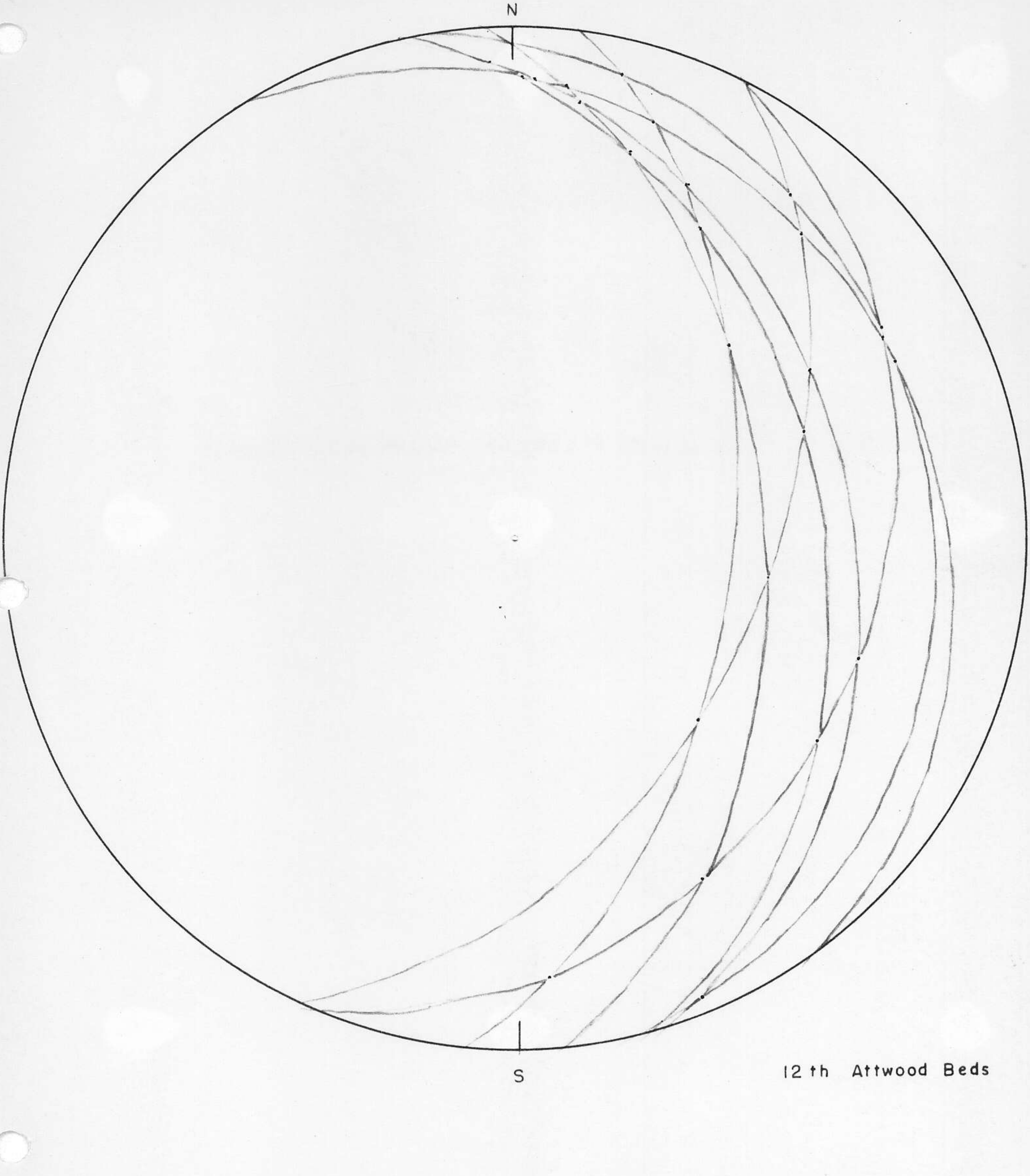


9th 10 Attwood Beds

10 th 10 Attwood Beds



11th 10 Attwood Beds



12 th Attwood Beds

APPENDIX VI

IRONSIDES SYNCLINE CROSS STRUCTURE ON BENCH 12 H.W.

APPENDIX VI IRONSIDES SYNCLINE CROSS STRUCTURE ON BENCH 12 HANGING WALL

STRIKE	DIP	STRIATIONS
N57°W	-43°S	74°W
N62°W	-42°S	88°E
N66°W	-71°S	57°W
N70°W	-77°S	43°W
N71°W	-68°S	-60°W
N78°W	-85°W	-67°W
N66°W	-76°S	-23°W
N52°W	-67°S	-64°W
N82°W	-72°S	-55°W
N77°W	-77°S	-62°W
N10°W	-47°E	-62°S
N10°E	-53°E	-65°S
N 4°E	-38°E	-70°S
N15°E	-40°E	-53°S
N11°E	-38°E	-60°S
N22°E	-35°E	-88°S
N 4°E	-45°E	-65°S
N16°W	-39°E	-85°S
N14°E	-41°E	-85°S

APPENDIX VII

IRONSIDES F. W. STRIATIONS

IRONSIDES F. W. STRIATIONS

STRIKE	DIP	STRIATIONS
N8°W	-42°E	-83°S
N 1°E	-53°E	-53°S
N 2°E	-53°E	-62°S
N14°W	-62°E	-38°S
N16°W	-54°E	-33°S
N 3°W	-43°E	-67°S
N20°W	-50°E	-55°S
N 5°W	-53°E	-38°S
N34°W	-40°E	-60°S
N11°W	-53°E	-75°S
N13°W	-55°E	-53°S
N34°W	-47°W	-52°S
N22°W	-42°E	-55°S
N27°W	-57°E	-70°S
N50°W	-74°E	-52°S
N 7°W	-85°E	-60°S
N18°W	-49°E	-73°S
N38°W	-47°E	-68°S

LIMESTONE TECTONIC ANALYSIS

INTRODUCTION:

In the Phoenix Mine area there are three major blocks of Limestone:

1. The Stemwinder-Idaho-Brooklyn-Marshall Lake Limestones. (See Map A)
2. The Phoenix Mine ore. (See Map A)
3. The R. R. Grade Limestones or B.C. Basin Limestones. (See Map B)

The original problem was to find the structure of the Ironsides Pit. As these Limestones are now skarn and ore beds it would be very difficult to make top determinations. The first group of Limestones are in close proximity to the Ironsides and less altered. It was hoped that an understanding of their structures could be used in interpreting the Ironsides structure. Further to the East is another set of Limestones, identical to the Marshall Lake Limestones. The structure was again examined. Here, tight overturned isoclinal folds were seen, and it is this tight folding which probably gives the key to our structure. Subsequent to this study, "penta-crinus" fossils were found on the 2nd R.R. Grade which are identical to those found near the Brooklyn Mine. Thus, it is concluded that all the Limestones are the same and that the structures of one section can be applied to the other sections. Finally, all the data has been put on one stereonet (see Fig. 10a) and the result indicates recumbent (to West) isoclinal folding or a homoclinal structure with some isoclinal folding.

Limestone Tectonic Analysis cont'd

The fold girdle is weak but a definite plunge of 40°-50° to the North is indicated. This is much higher than expected, and remains to be explained. In the following study small units are examined separately and then combined to make a final overall structural interpretation.

Fig. 1a Contours of N. Marshall Lake Limestones showing isoclinal folding with 40°plunge to the North. The axial line has a bearing of N20°E.

Fig. 1b Plot of 54 poles for Fig. 1a. Data is found in Appendix I.

Fig. 2a Contours of Brooklyn Mine Limestones, showing a plane bearing N8°E at 80°E.

Fig. 2b Plot of 49 poles for Fig. 2a. Data in Appendix II.

Fig. 3a Contours of Stemwinder Limestone Breccia showing isoclinal folds or vertical beds with strike N7°E.

Fig. 3b Plot of 52 poles for Fig. 3a. Data in Appendix III.

Fig. 4a Contours of Idaho Ore beds showing isoclinal folding with a weak fold girdle showing a plunge of 20°N with axial/plane N6°E.

Fig. 4b Plot of 62 poles for Fig. 4a. Data in Appendix IV.

Fig. 5a Contours of Idaho Marbles showing a fold girdle with a plunge of 60°N with axial plane probably N13°E.

Fig. 5b Plot of 24 poles for Fig. 5a. Data in Appendix V.

Fig. 6a Contours of Limestone composite made from Marshall Lake, Brooklyn, Idaho,Marbles, Idaho Ore and Stemwinder Limestones. The composite shows isoclinal folding with a weak girdle indicating a plunge of 40-70°North on an axis N20°E.

Fig. 6b Plot of 241 poles for Fig. 6a.

Limestone Tectonic Analysis cont'd

Fig. 7a Contours of 1st R.R. Grade Limestones showing an axial plane N8°E plunging 40°North.

Fig. 7b Plot of 92 poles for Fig. 7a. Data in Appendix VI.

Fig. 8a Contours of 2nd R.R. Grade Limestones showing isoclinal folding with N-S axis and plunge 40°North.

Fig. 8b Plot of 190 poles for Fig. 8b.

Fig. 8c Contours of 2nd R.R. Grade Limestone, indicating a girdle plunging 60°N on an axis N18°E.

Fig. 8d 98 poles from 2nd R.R. Grade Limestones, Appendix VII

Fig. 9a Contours of Brooklyn Limestones and R.R. Grade Limestones showing an axis N9°E with 50°N.

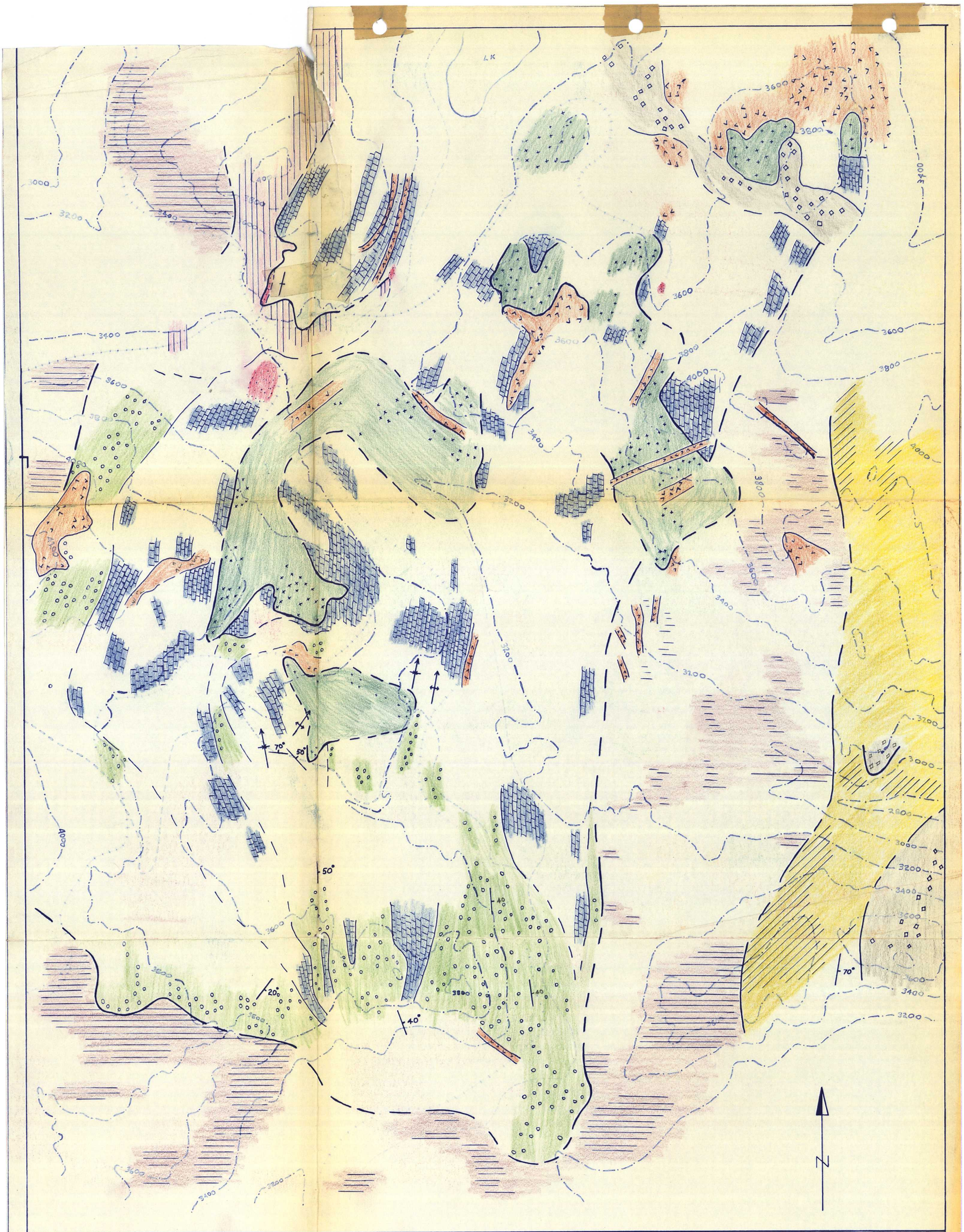
Fig. 9b Plot of 431 poles for Fig. 9a.

Fig. 10a Contours of all Limestones including Ironsides Ore Beds, showing a strong homocline structure bearing N13°E-45°E with isoclinal folding with a plunge of 40°-50°N, at recumbent (to West) isoclinal folding.

Fig. 10b Plot of 802 poles for Fig. 10a.

CONCLUSION:

All the Limestones examined belong to the same major structure. Isoclinal folding is present with a plunge of at least 40°to the North.



LEGEND

Same as on accompaning map.

NOTE

This map is north west of and ajoins part of the Phoenix map at corner indicated on west border.

SCALE

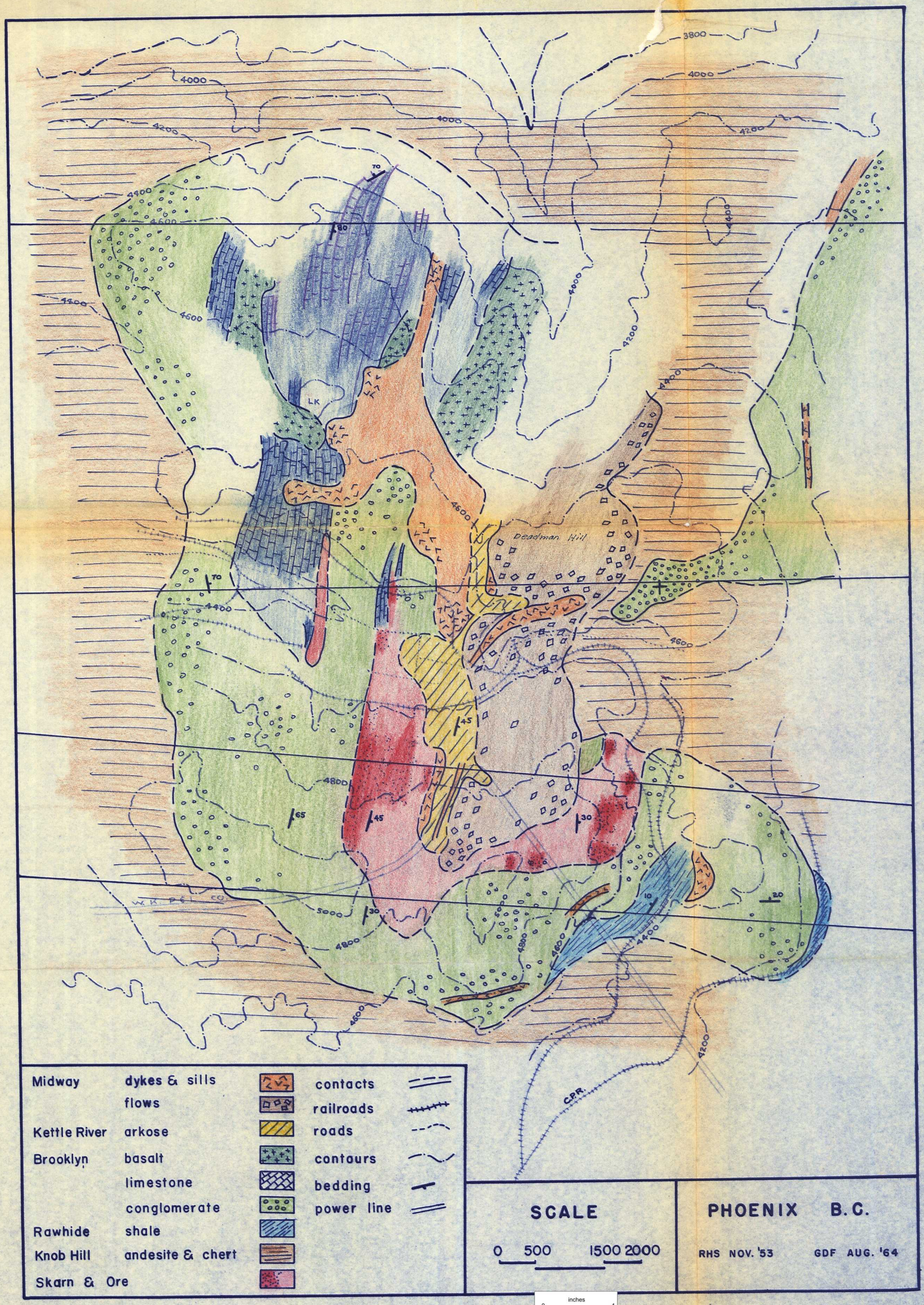
0 500 2000 2500

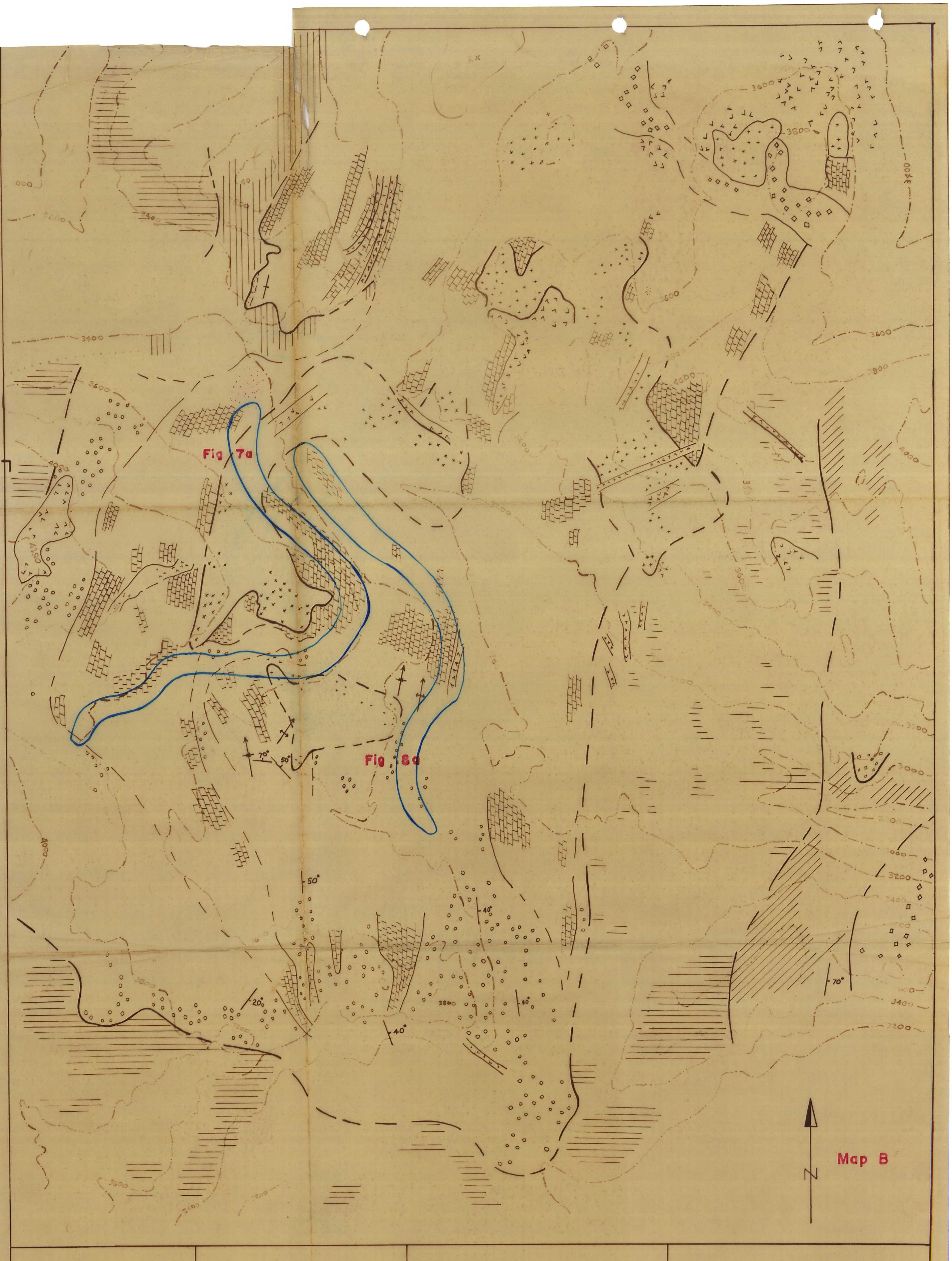
FEET

BC BASIN AREA

RHS NOV '53

COPY BY GA SEPT '64


3800
4000
4200
4400
4600
4800
5000
LK
Deadman Hill
C.P.R.
Midway dykes & sills
flows
Kettle River arkose
Brooklyn basalt
limestone
conglomerate
Rawhide shale
Knob Hill andesite & chert
Skarn & Ore
contacts
railroads
roads
contours
bedding
power line
SCALE
0 500 1500 2000
PHOENIX B.C.
RHS NOV. '53
GDF AUG. '64



LEGEND

Same as on accompaning map.

NOTE

This map is north west of and ajoins part of the Phoenix map at corner indicated on west border.

SCALE

0 500 2000 2500

FEET

BC BASIN AREA

RHS NOV '53

COPY BY GA SEPT'61

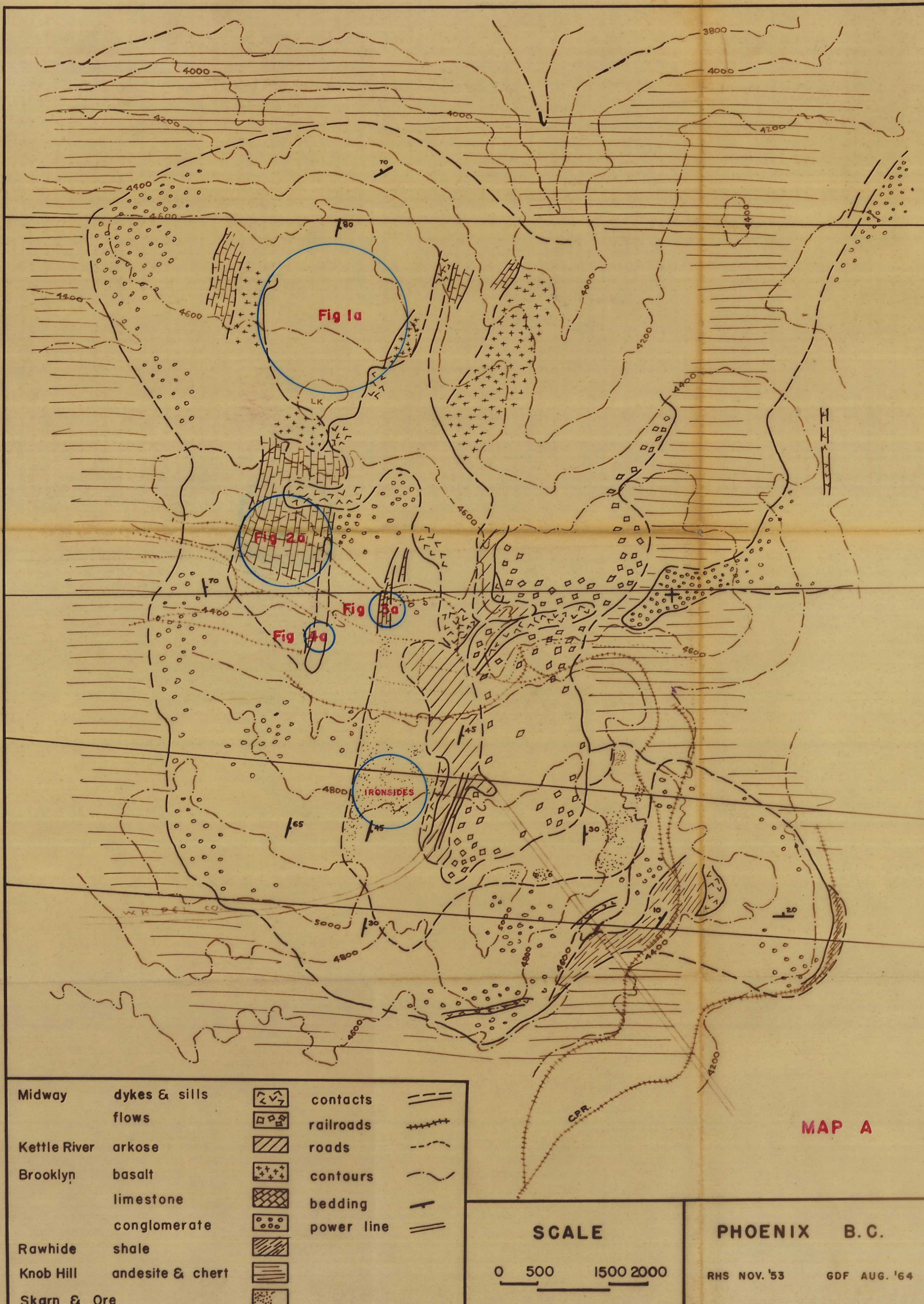


Fig 1a
Fig 2a
Fig 3a
Fig 4a
IRONSIDES
LK
C.P.R.
3800
4000
4200
4400
4600
4800
5000
MAP A
Midway dykes & sills
flows
Kettle River arkose
Brooklyn basalt
limestone
conglomerate
Rawhide shale
Knob Hill andesite & chert
Skarn & Ore
contacts
railroads
roads
contours
bedding
power line
SCALE
0 500 1500 2000
PHOENIX B.C.
RHS NOV. '53
GDF AUG. '64

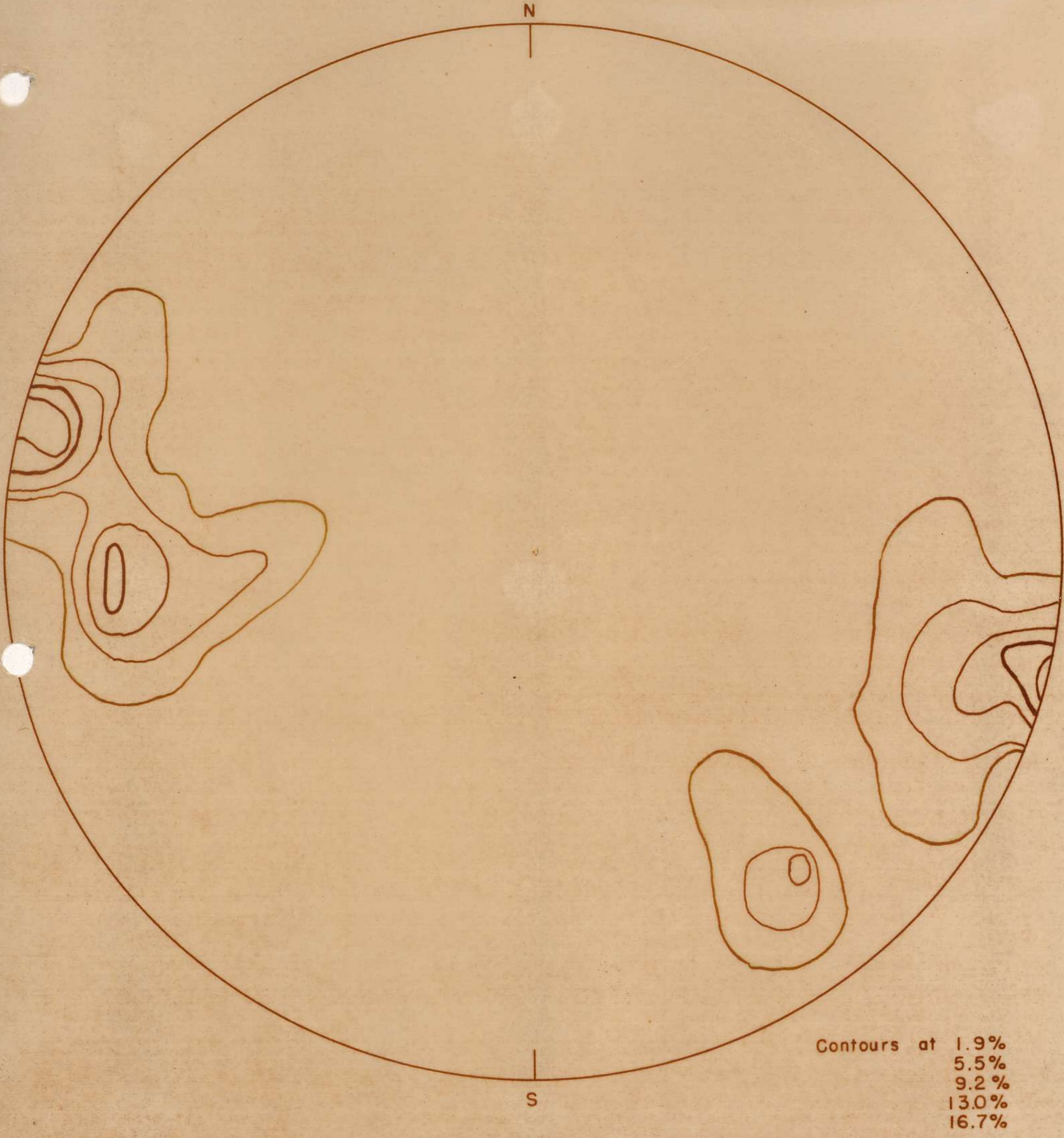


Fig 1a

Contours of N. Marshall Lake Limestones

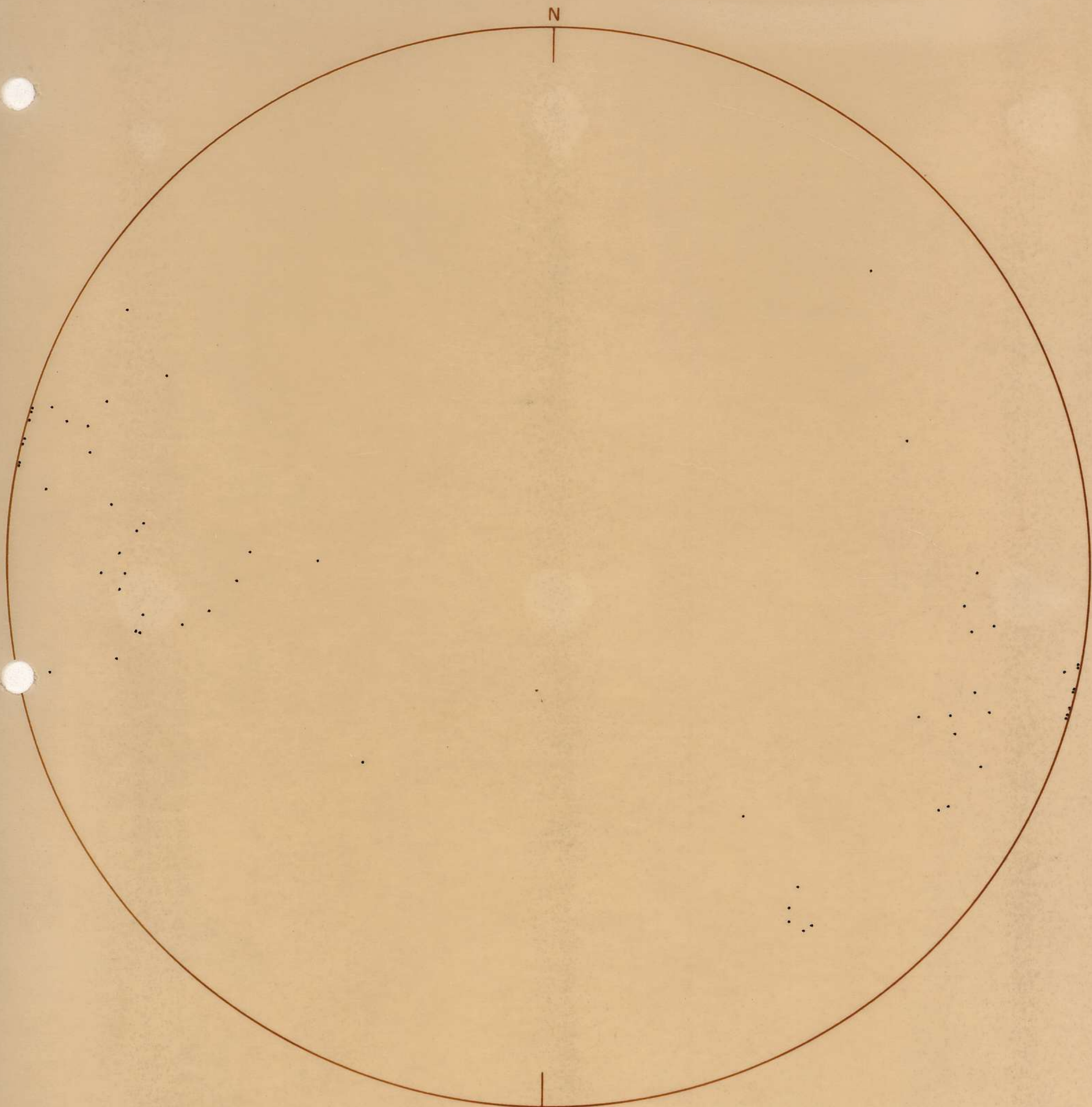


Fig 1b

54 Poles from N. Marshall Lake Limestones

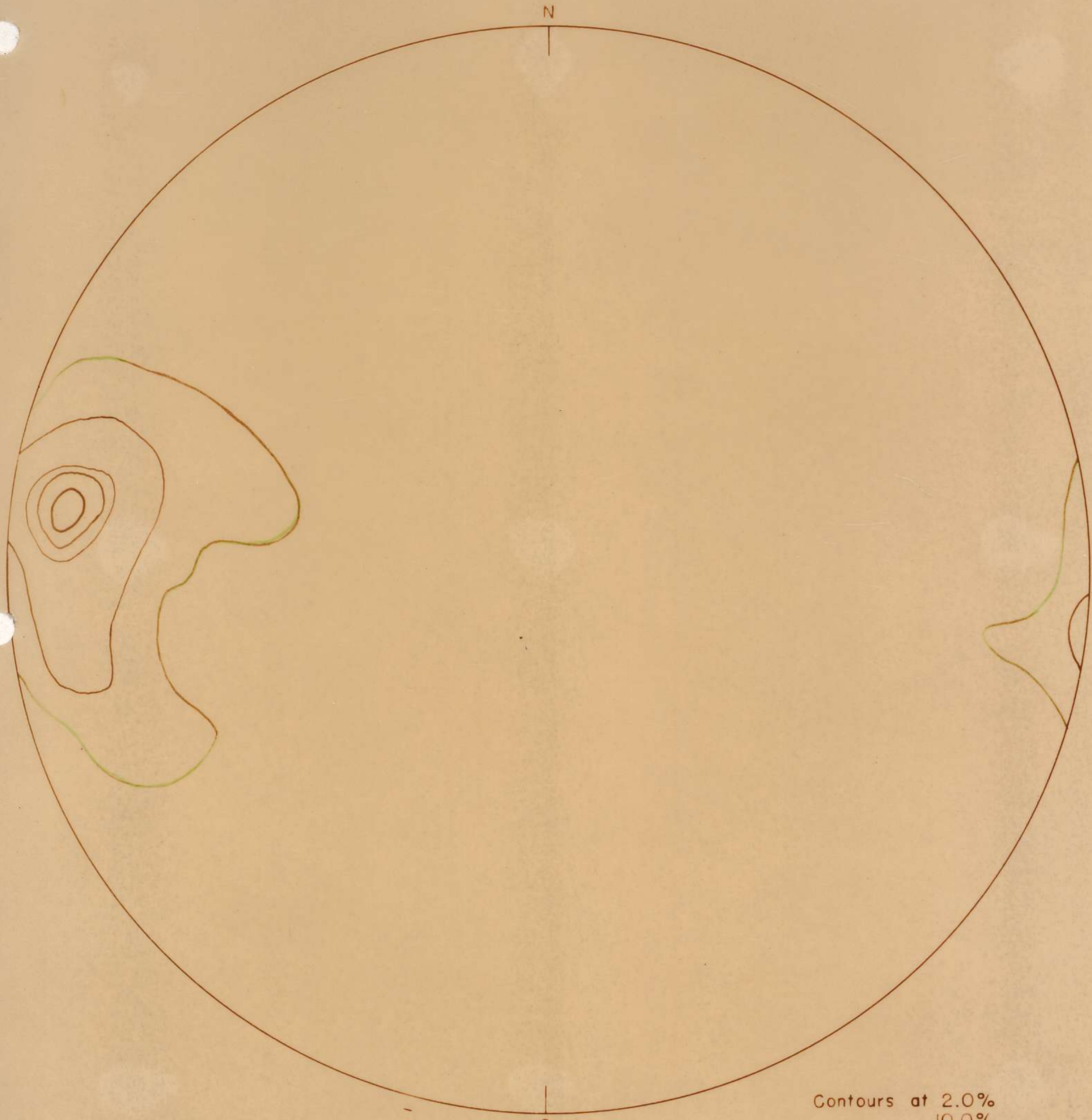


Fig 2a

Contours of Brooklyn Mine Bedding Poles

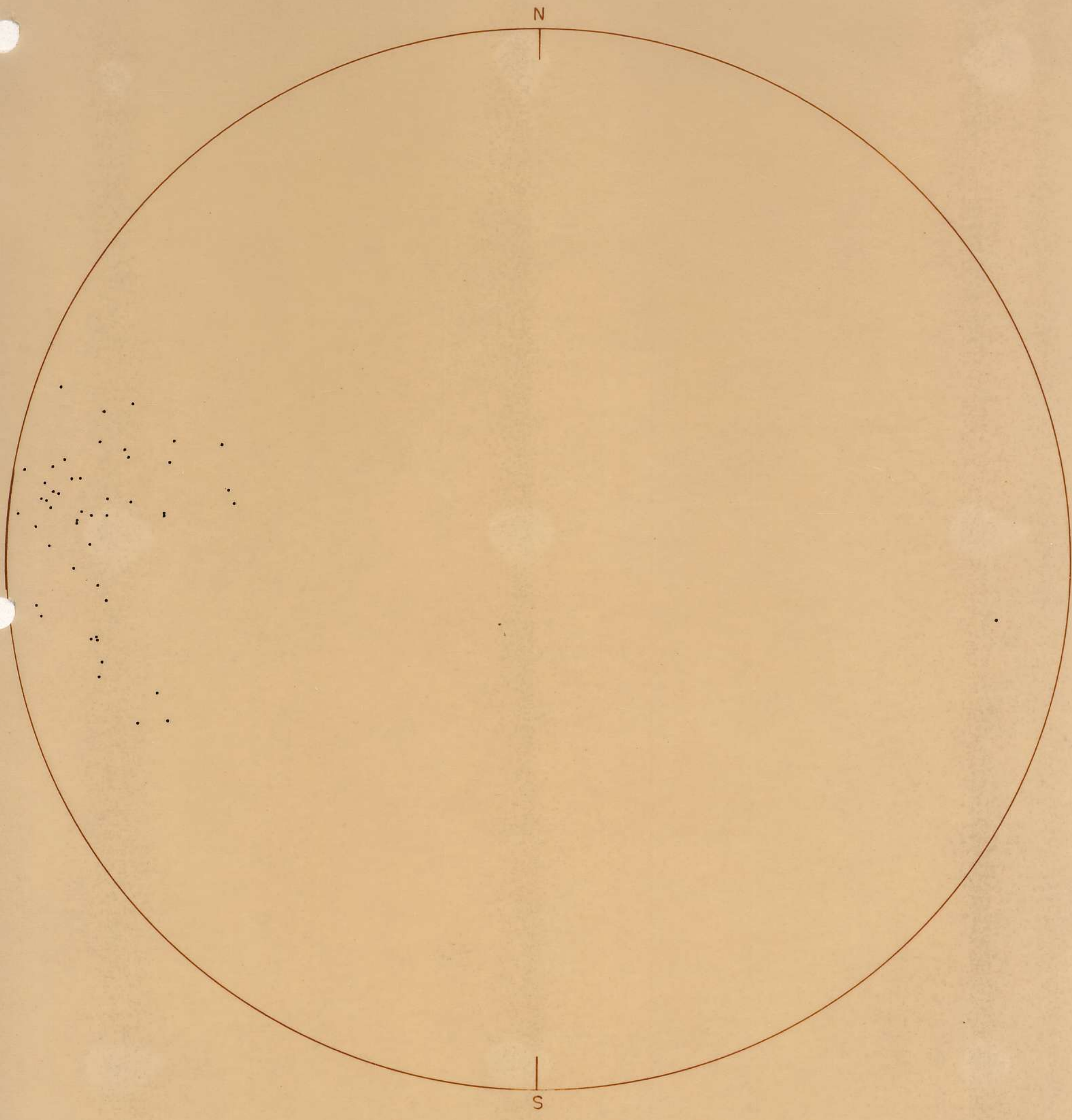


Fig 2b

49 Poles Brooklyn Mine

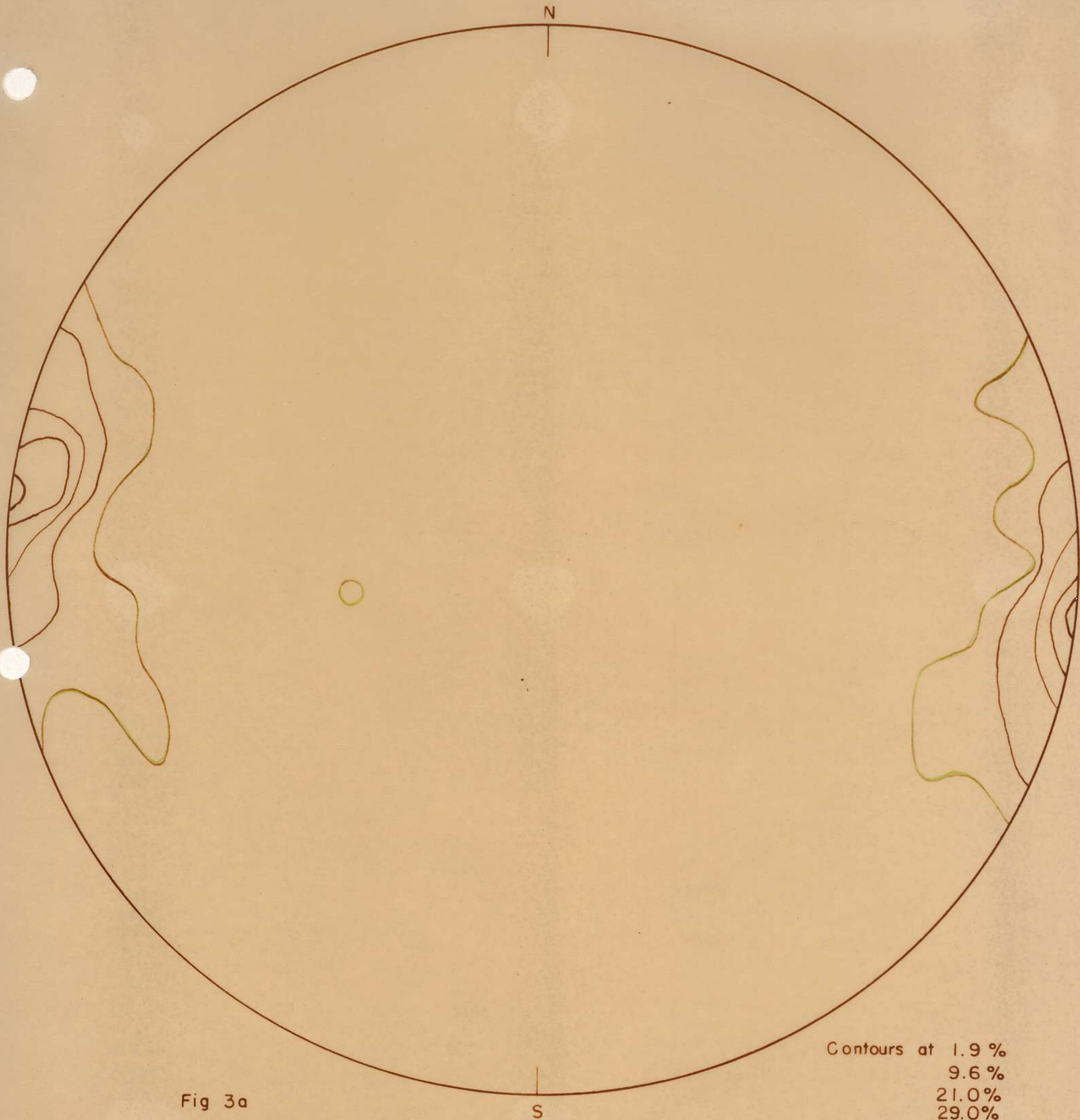


Fig 3a

Contours of Stemwinder Beds

Contours at 1.9 %
9.6 %
21.0%
29.0%
36.5%

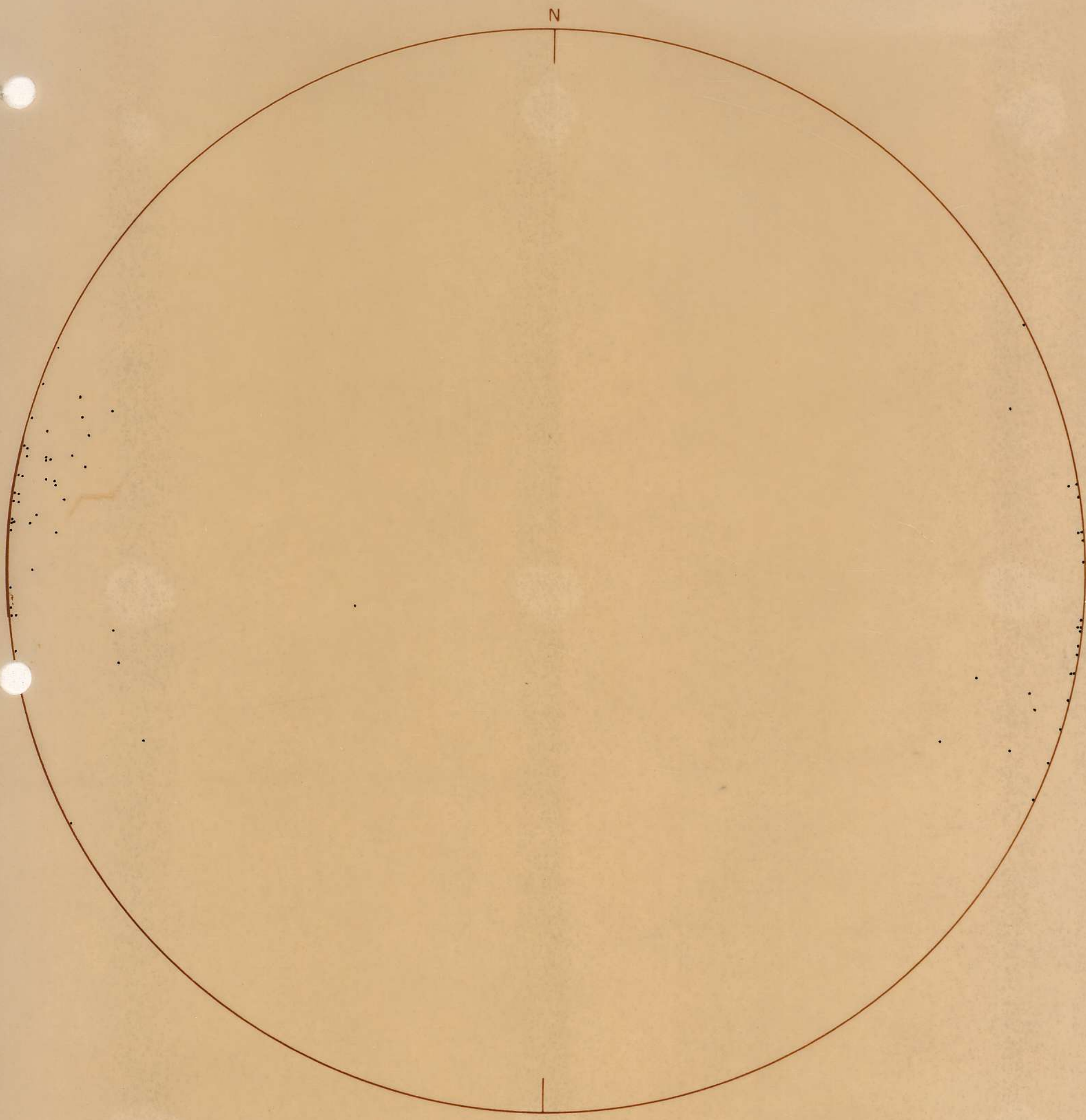


Fig 3b
52 Poles from Stemwinder Mine

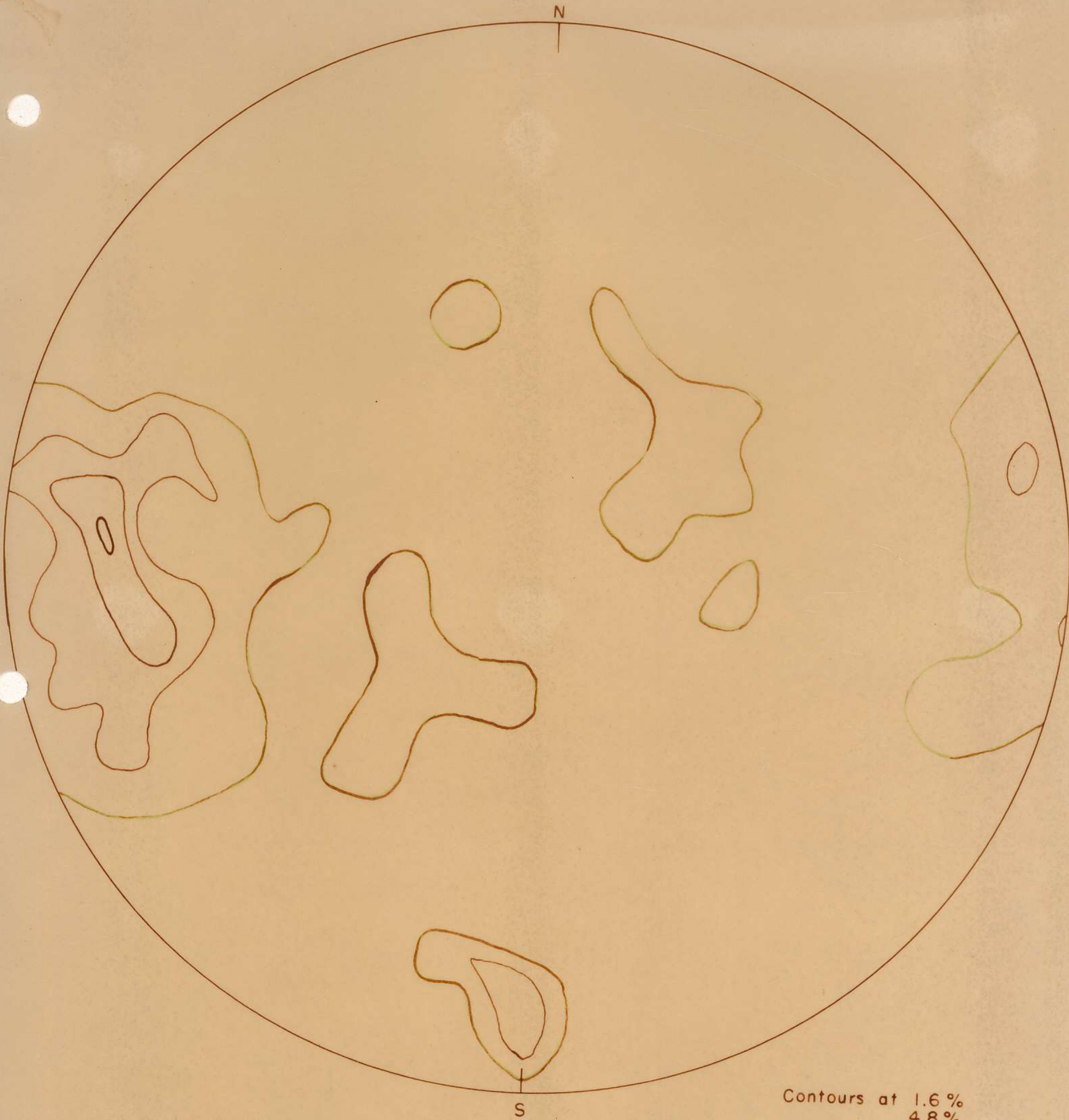


Fig 4a

Contours of Idaho Ore Bedding Poles

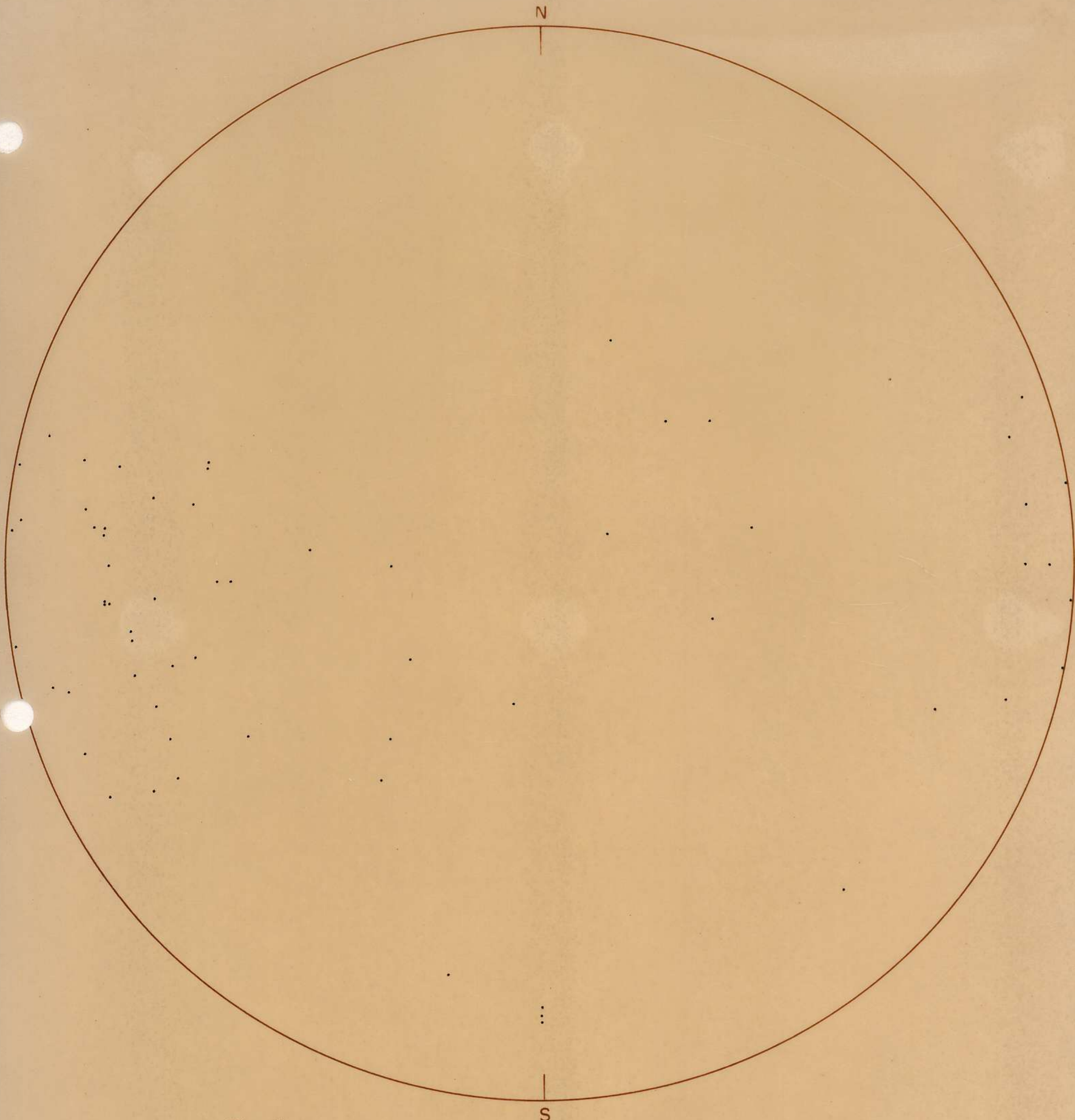


Fig 4b

62 Idaho Ore Bedding Poles

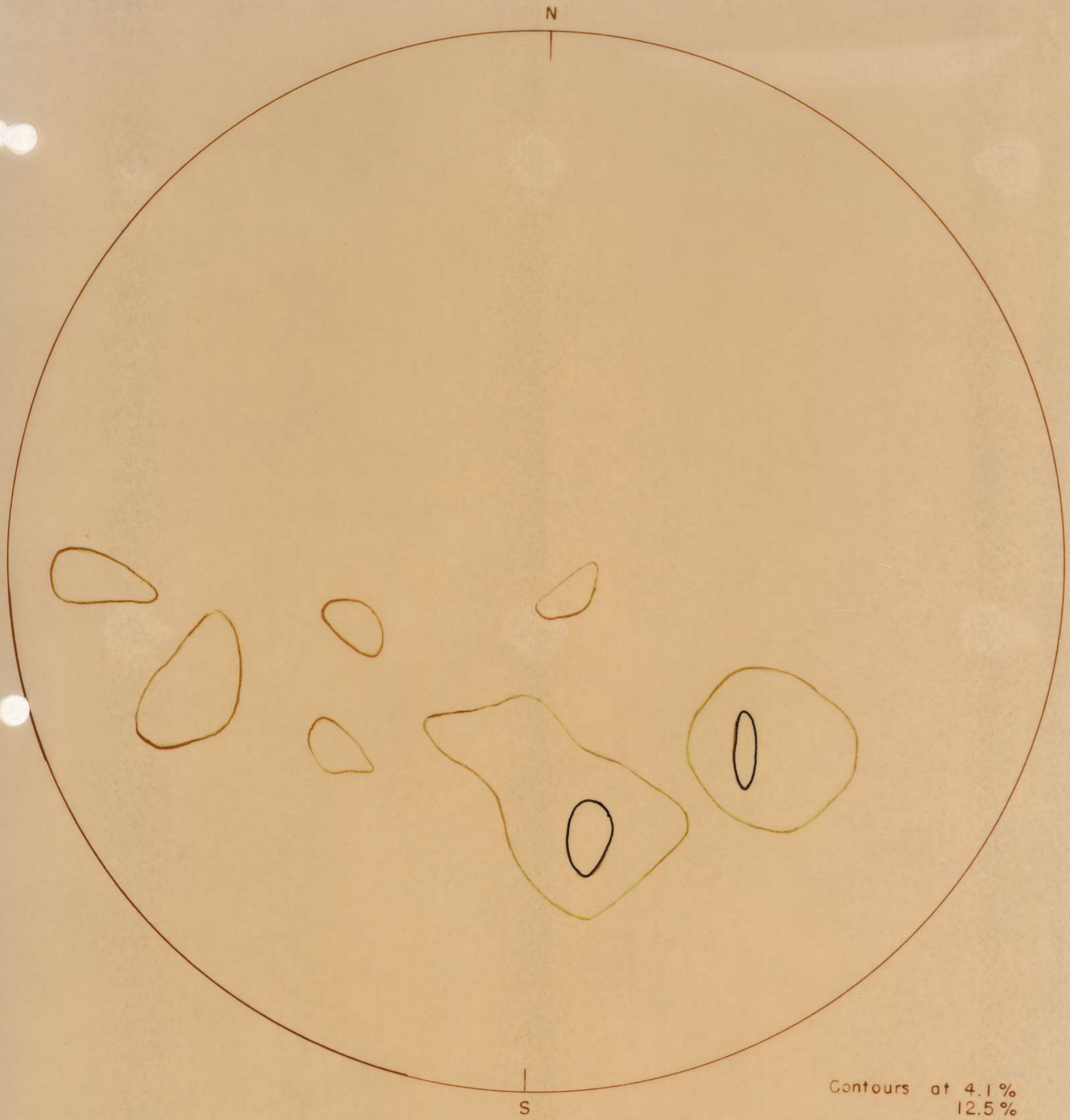


Fig 5a

Contours of Idaho Marble

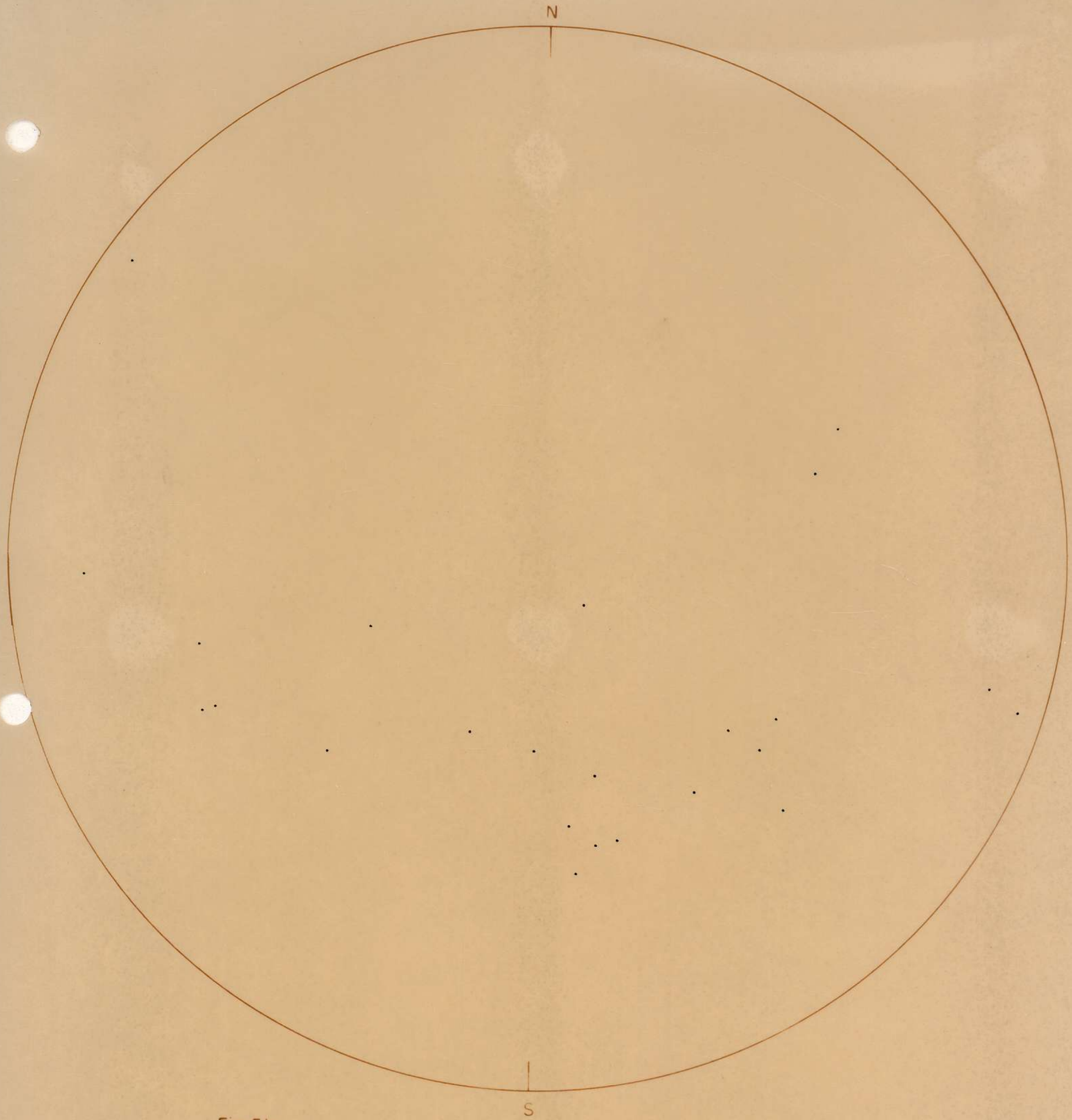


Fig 5b

24 Poles of Idaho Marble

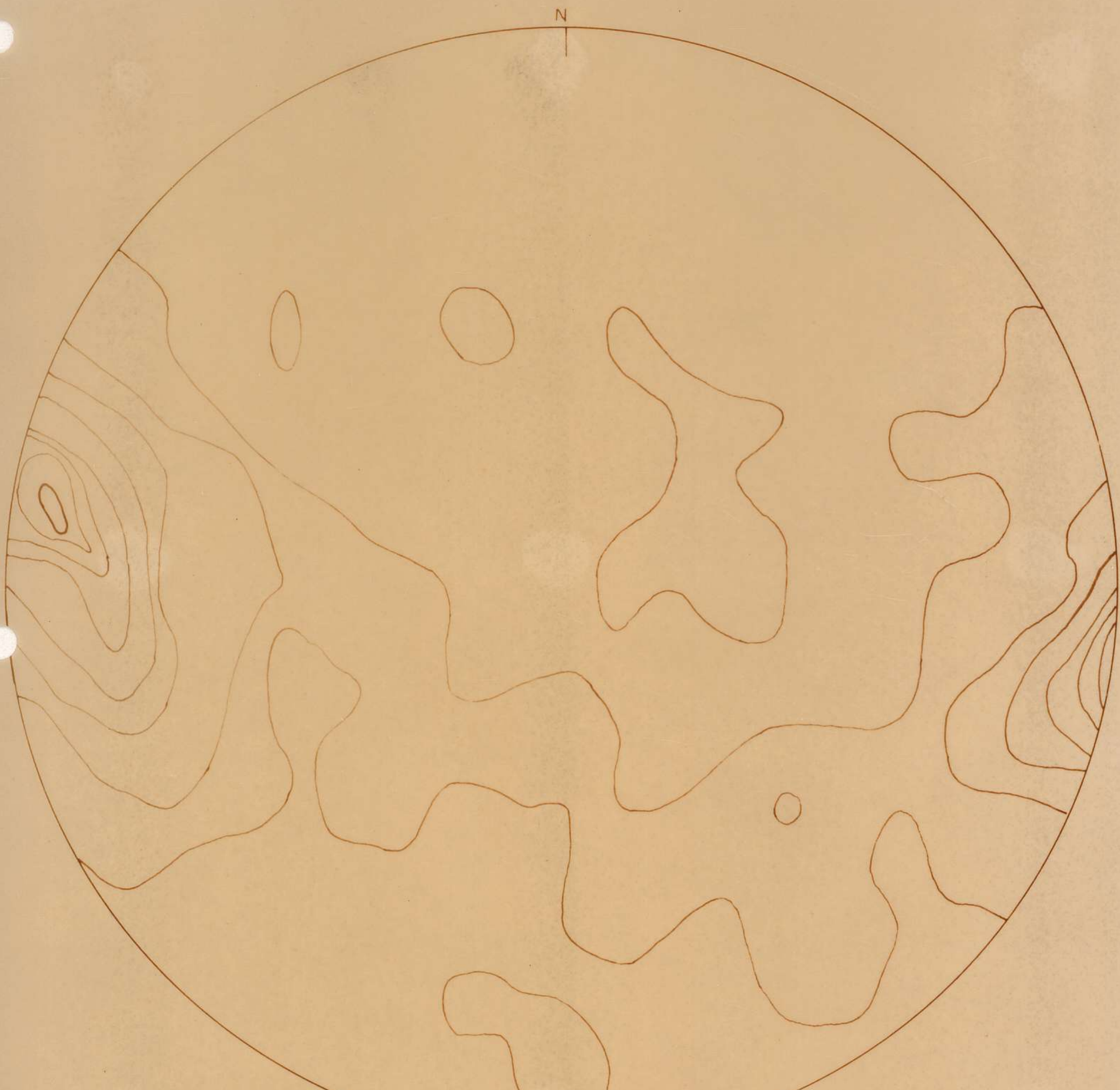


Fig 6a

Limestone Composite

Marshall Lake
Brooklyn
Idaho
Stemwinder
Idaho Ore

Contours at 0.4 %
2.1 %
4.1 %
6.2 %
8.3 %
10.4 %
12,4 %

Fig 6b

Limestone Composite 241 Poles

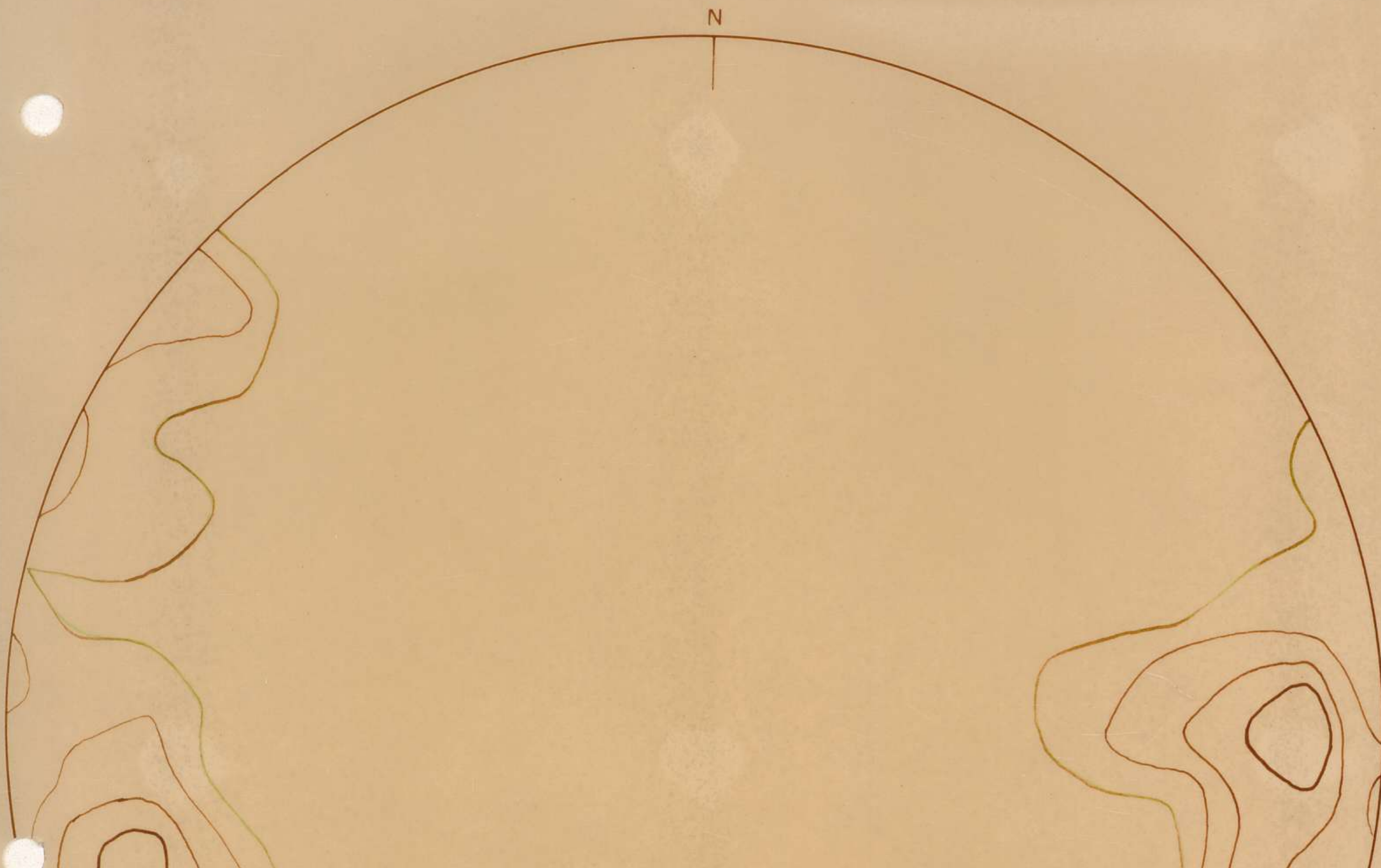


Fig 7a

Contours of 1st R.R. Grade Limestones

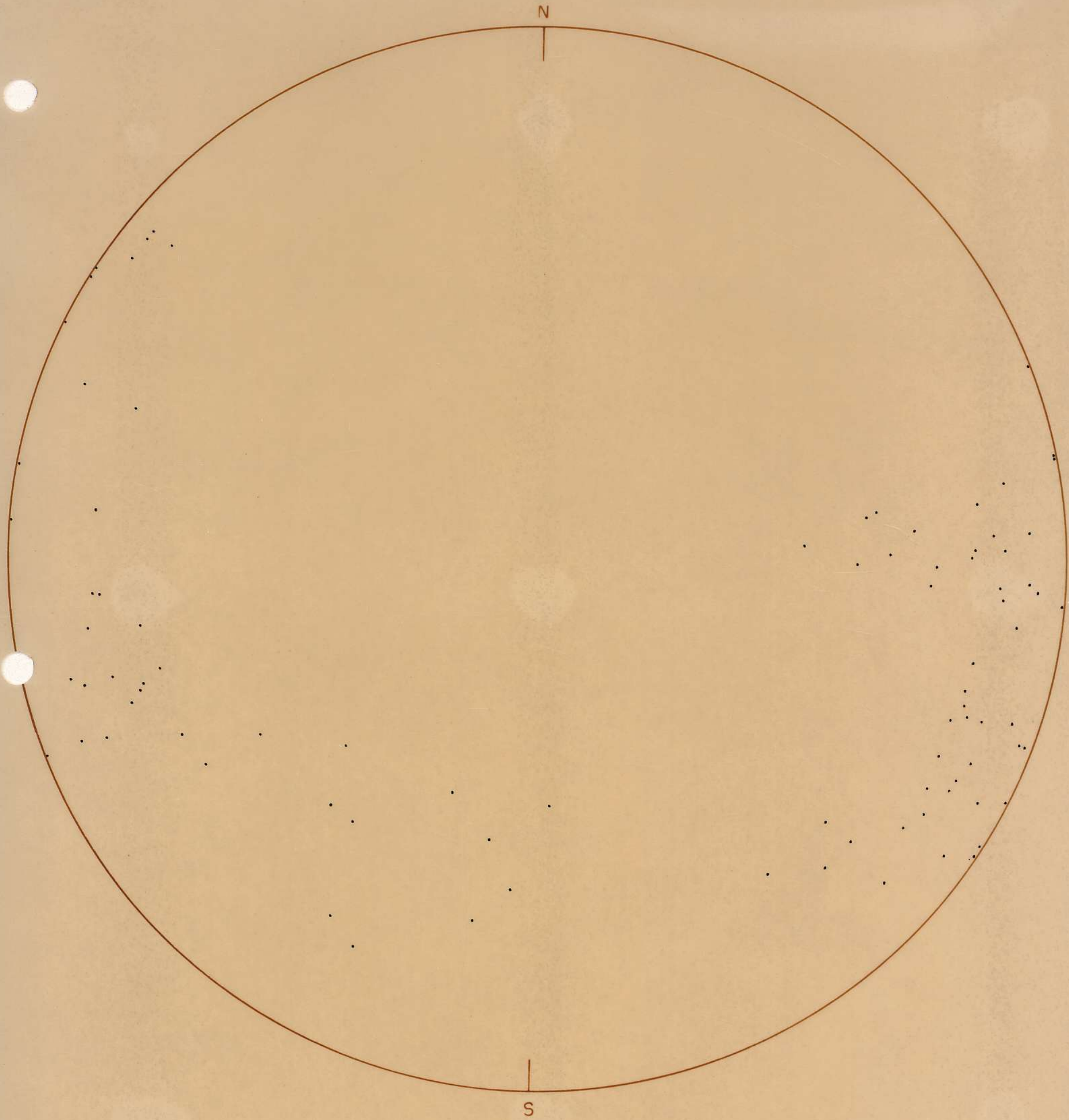
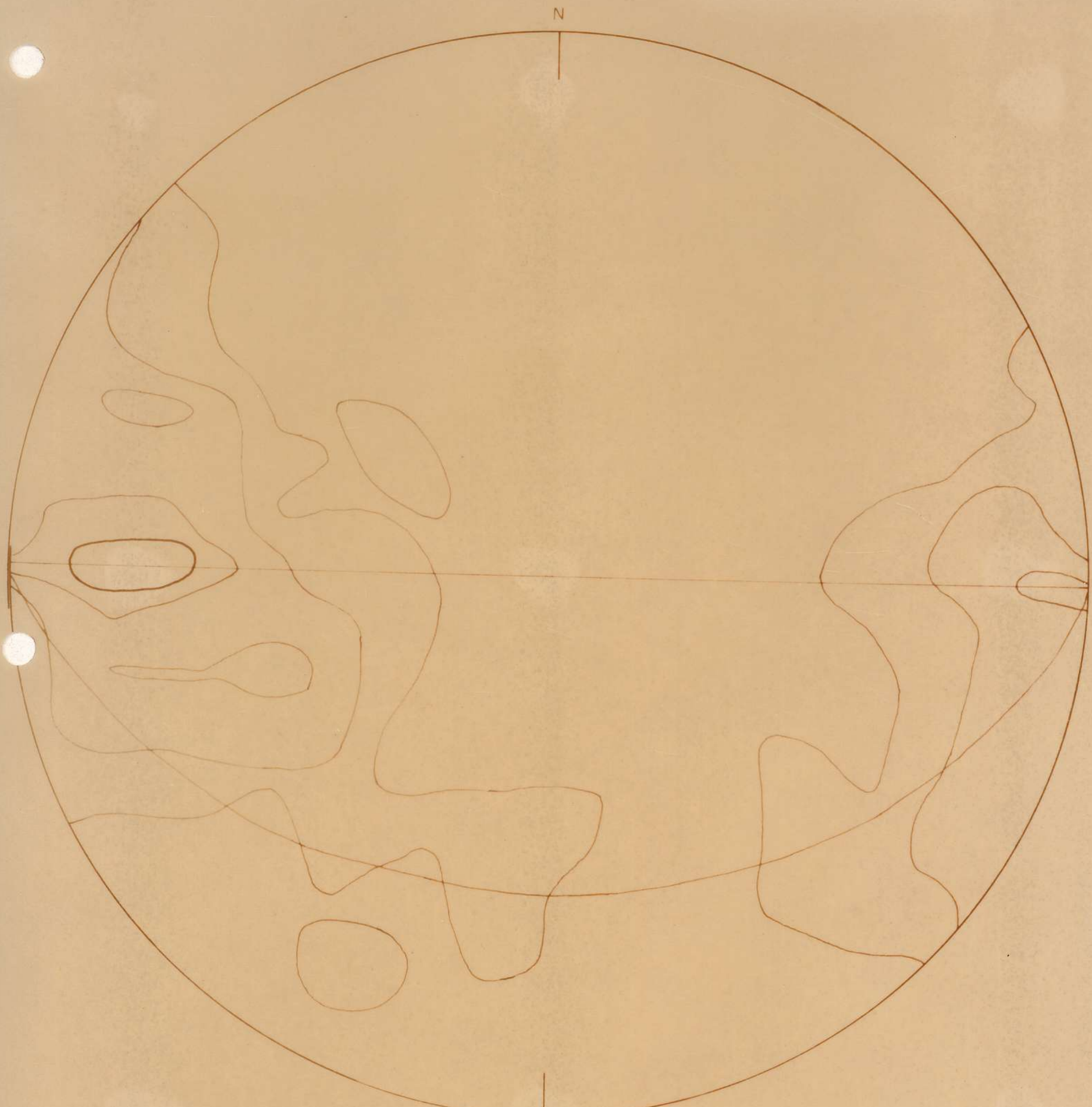


Fig 7b

92 Poles for Ist RR Grade Limestones



Contours at 0.5 %
2.6 %
5.0 %
8.0 %

Fig 8a

Contours of Ora Denoro RR Grade Limestones

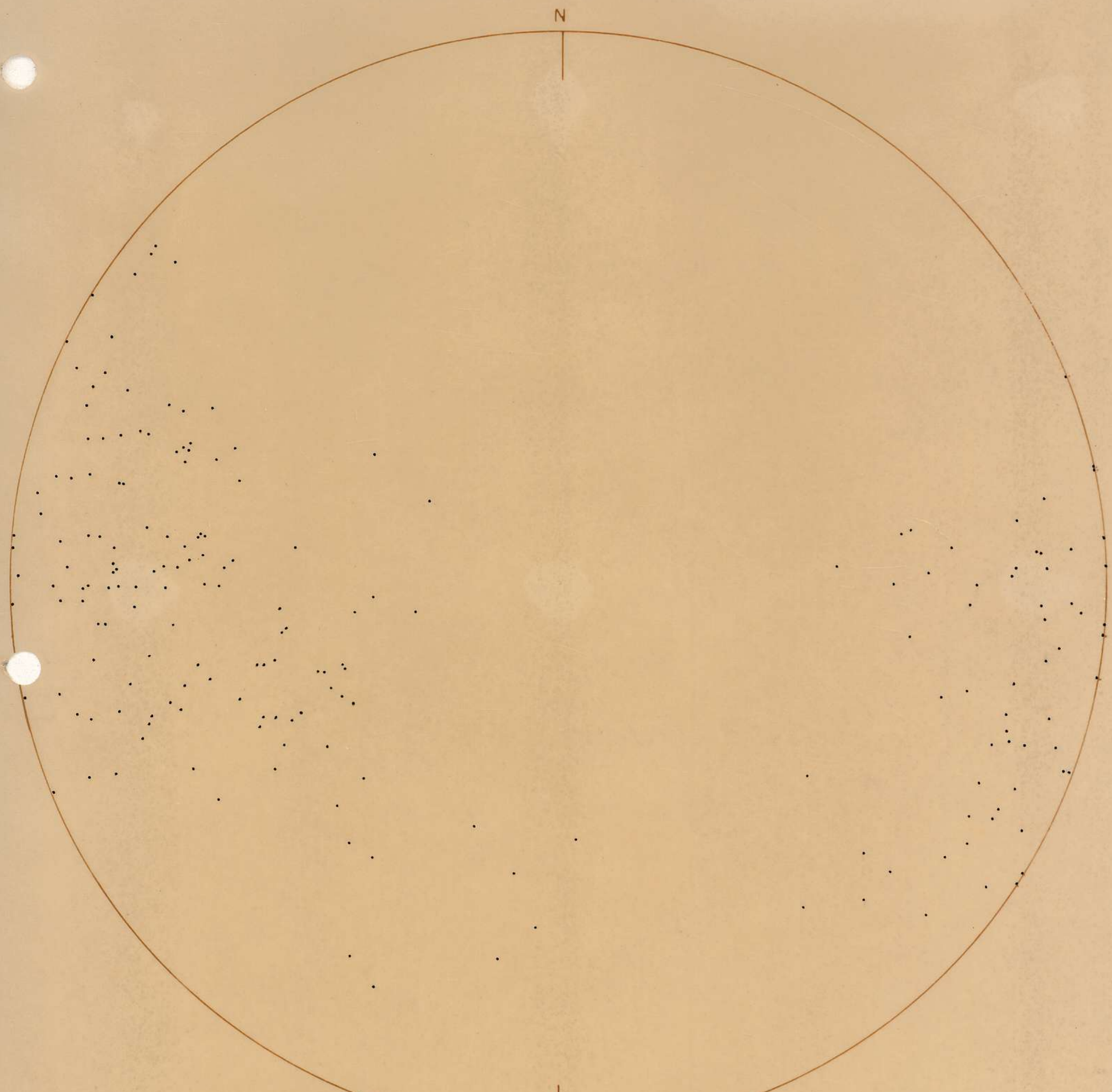


Fig 8b

190 Poles of Ora Denoro RR Grade Limestones

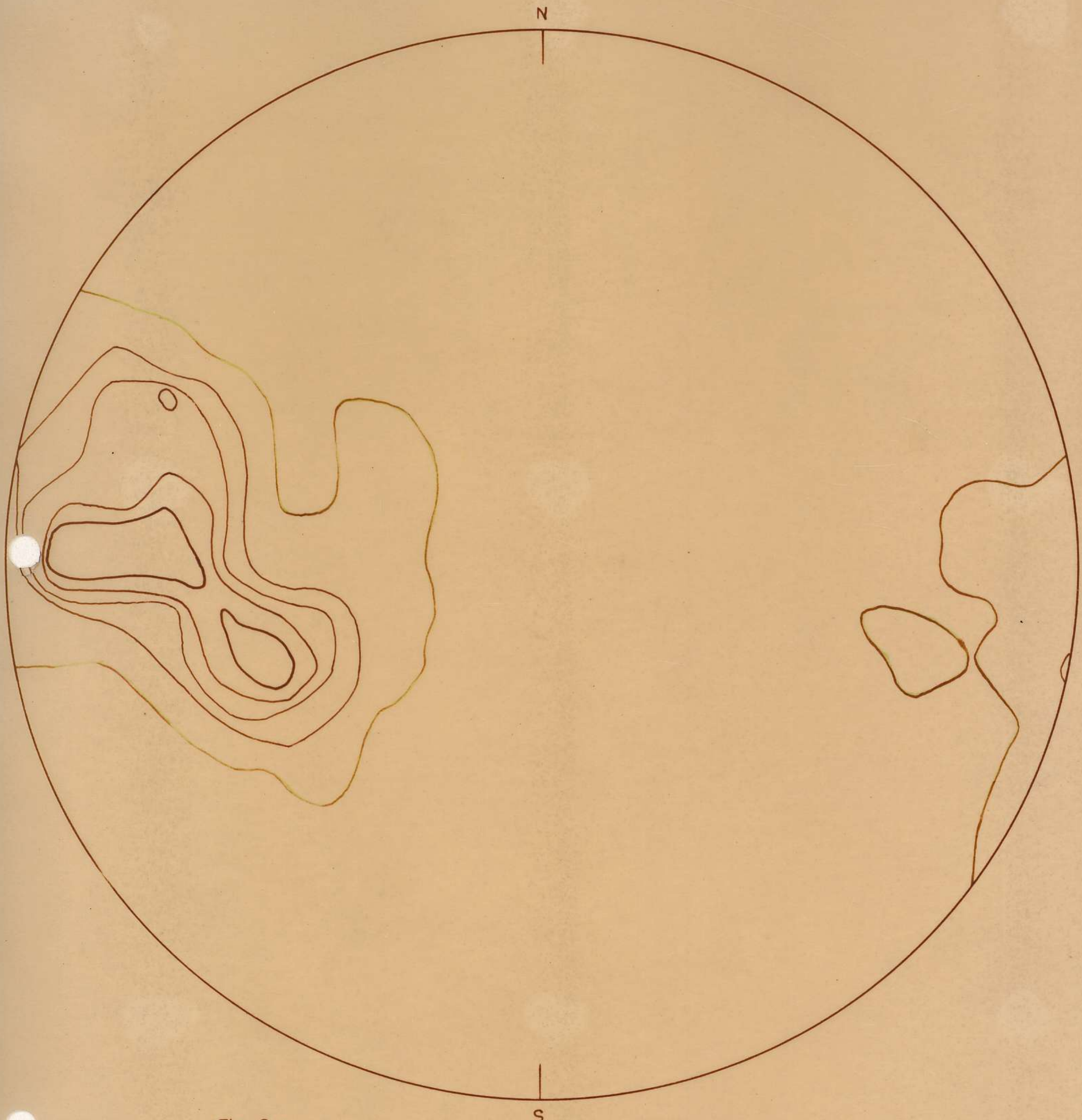


Fig 8c

Contours of 2nd RR Grade Limestones

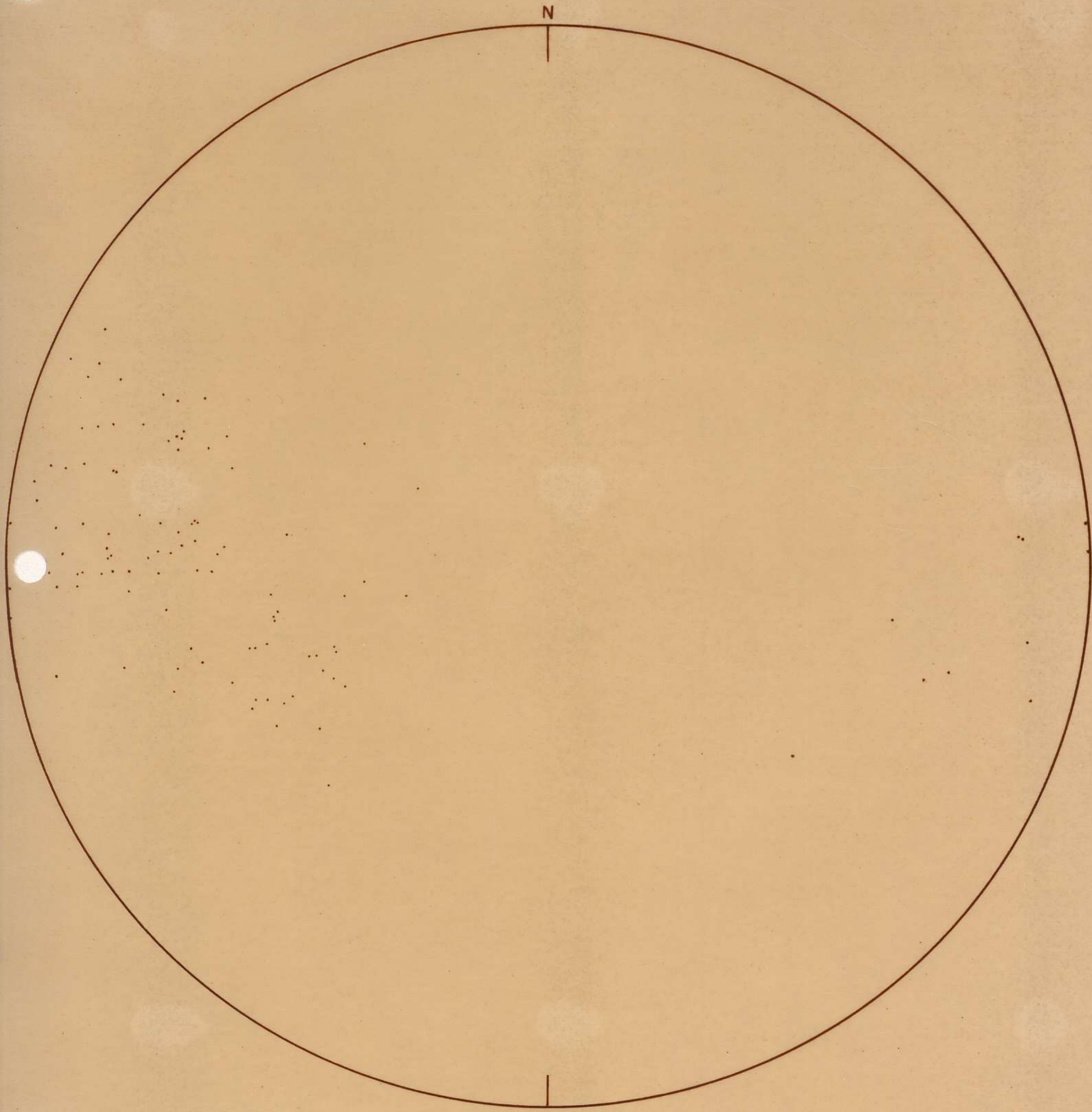


Fig 8d

98 Poles from 2nd R.R. Grade Limestones

Fig 9a

Contours of Brooklyn Composite and R.R. Grade Limestones

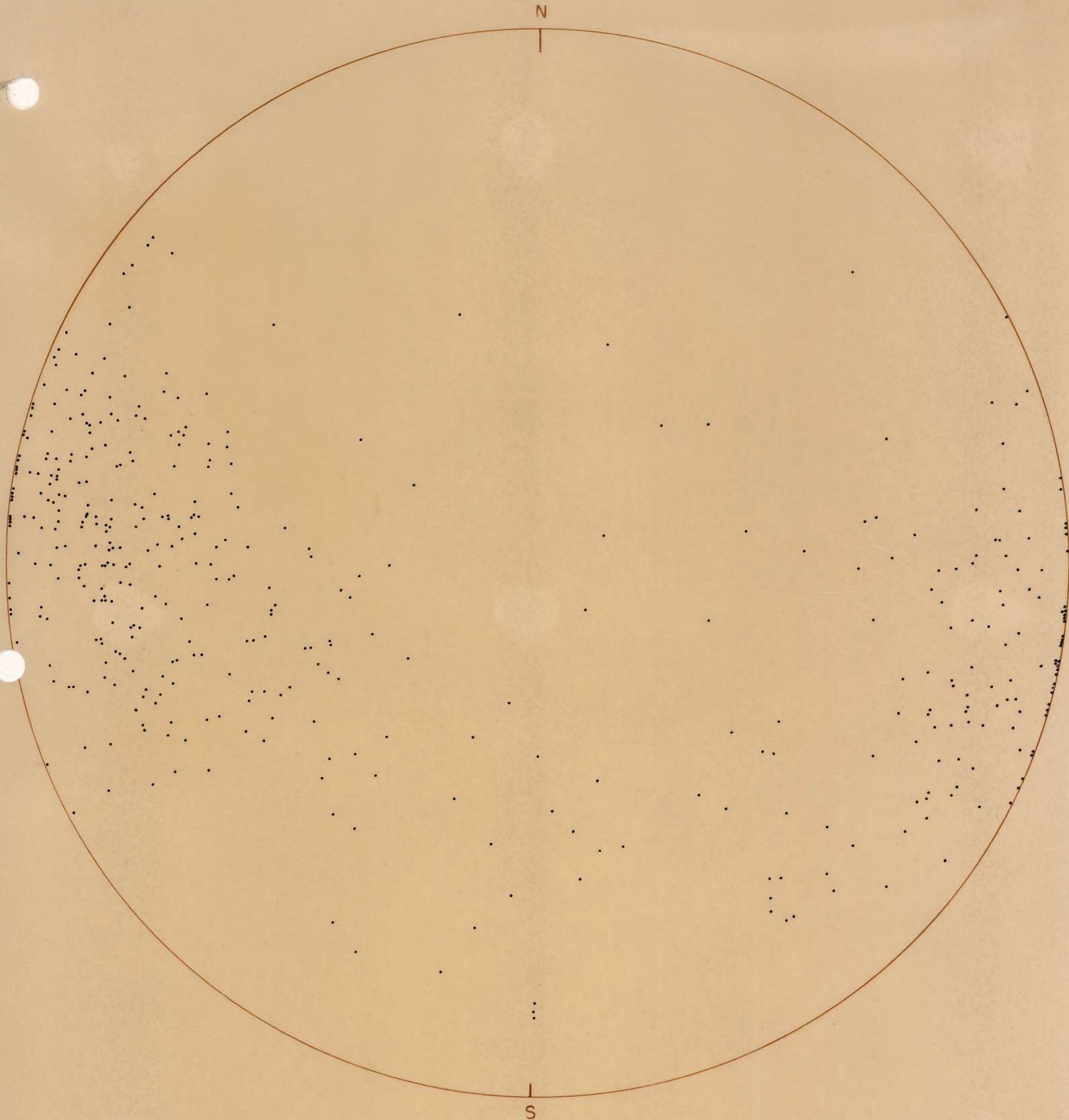


Fig 9b

431 Poles from Brooklyn Composite and R.R. Grade Limestones

Fig 10 a

Contours of all limestones including Ironsides

Contours at 0.1 %
0.6%
1.0%
2.5%
3.7%
5.0%
6.2%
7.5%

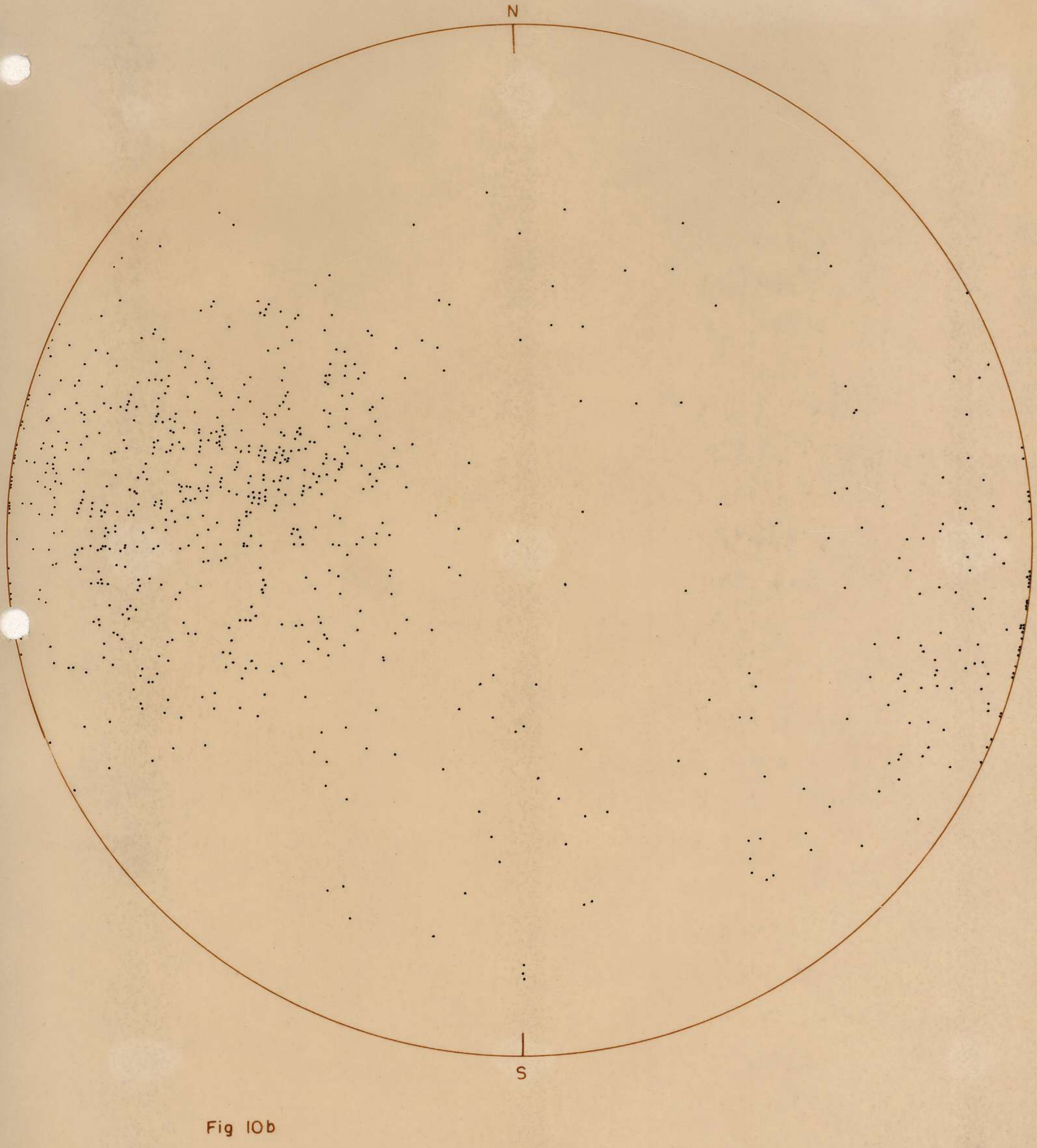


Fig 10b

802 Poles of all Limestones including Ironsides

APPENDIX I

MARSHALL LAKE TECTONIC ANALYSIS

N25°E-77°W

N32°E-74°W

N13°E-Vert.

N52°E-64°W

N56°E-68°W

N55°E-71°W

N54°E-71°W

N52°E-59°W

N17°E-86°E

N16°E-Vert.

N31°E-75°W

N55°E-66°W

N13°E-Vert.

N 8°E-68°W

N22°E-63°W

N22°E-70°E

N20°E-68°W

N13°W-83°E

N18°E-75°W

N16°E-71°W

N10°E-Vert.

N16°E-78°E

N 7°E-72°W

N20°E-76°E

N26°E-68°

N16°E--Vert.

N10°E-Vert.

N 5°E-64°E

N 8°E-83°E

N11°E-87°W

N16°E-82°E

N 1°E-68°E

N31°E-80°E

N 4°E-65°E

N13°E-76°E

N 2°W-71°E

N 2°E-56°E -mud cracks rt. side up

N 2°W-67°E

N 4°W-48°E

N10°W-58°E

N10°W-65°E

N48°W-41°E

N13°W-70°E

N 4°W-68°E

N 8°W-64°E

N 9°W-53°E

N-S- 68°W

N15°E-Vert.

N 5°E-66°W

N-S- 65°E -mud cracks rt. side up

N17°E-70°E

N10°E-66°E) Overturned

(anticlines

N43°E-70°W) Axis N80°W-35°W

N20°W-60°W

APPENDIX II

BROOKLYN TECTONIC ANALYSIS

N 7°-83°E

N 7°E-60°E

N 2°E-73°E

N 8°E-66°E

N20°E-53°E

N 1°W-76°E

N 8°E-80°E

N19°E-75°E

N 6°E-81°E ore contact striations 50°S

N18°E-61°E ore

N14°E-68°E

N21°E-70°E

N15°E-69°E

N 8°E-81°E ore contact

N11°E-82°E LS

N15°-74°E

N10°E-76°E

N 7°E-60°E

N 6°E-80°E

N 7°E-82°E

N 6°E-73°E

N 5°E-76°E

N 6°E-84°E

N 6°E-75°E

N 8°E-80°E

N 9°E-83°E

N 3°W-72°E

N 6°W-83°E

N 5°W-84°E

N 5°E-76°E

N10°E-78°E

N15°E-61°E

N13°E-50°E

N12°E-80°E

N 2°E-81°E

N11°E-49°E

N23°W-65°E

N15°W-74°E

N10°W-73°E

N13°W-73°E

N22°W-70°E

N10°W-74°E -fossils

N10°W-73°E

N19°W-63°E thin beds of green sandy argillite&LS

N 5°W-70°E " " " " 25' wide

N 7°E-75°W) (syncline

N5°E -88°E)

N10°E-88°E

Top of pit N20°E-85°E

APPENDIX III

STEMWINDER TECTONIC ANALYSIS

N28°W-Vert.

N23°W-70°E

N10°W-88°W -fossils

N20°W-80°W

N12°W-70°E

N22°E-68°W SS congl.

N 5°E-Vert.

N 4°E-Vert.

N 4°W-Vert.

N 5°W-Vert.

N 2°W-Vert.

N 6°E-85°E Vert.

N 5°E-86°E SS congl.

N20°E-82°E SS congl.

N10°E-82°E SS congl.

N 4°E-81°E SS Congl.

N12°E-77°E " "

N10°E-82°E " "

N-S - 85°E " "

N22°E-89°E " "

N 5°E-Vert. LS

N20°E-81°W drag fold

N 8°W-70°E " "

N10°E-84°E LS

N12°-85°E LS fossils

N 9°W-Vert. Ls Breccia (near basalt contact)

N 5°E-Vert Fossils

N10°W-30°E

N15°E -83°W SS Congl.

N10°W-Vert. LS

N16°E-78°E LS

N15°E-86°E LS

N18°E-80°E

N10°E-Vert.

N13°E-80°E

N 7°E-Vert.

N 7°E-Vert.

N 8°E-Vert.

N13°E-Vert.

N 5°W-Vert.

N20°E-Vert.

N 8°E-80°E

N23°E-Vert.

N26°E-Vert.

N24°E-Vert.

N20°E-85°E

N12°E-85°E

N13°E-81°W red argillite with & green)pebbles

N10°E-Vert.

N15°E-70°W

N 8°E-Vert.

N12°E-85°E

MARBLES

N54°E-44°N

N81°E-42°NW

N72°E-46°NW

N32°E-45°NW

N29°E-62°NW

N42°E-10°NW

N35°E-85°SE

N22°W-28°E

N44°E-56°NW

N40°E-40°NW

N39°E-46°NW

N73°E-35°NW

N76°E-46°NW

N16°E-85°W

N25°W-57°E

N15°W-56°E

N25°W-59°E

N69°W-29°E

N30°W-73°NE - Ore

N15°W-57°NE "

N15°W-81°NE "

N 5°E-73°E "

N-S-70°E "

N 5°E-80°E "

N15°E-85°E "

N19°W-85°W "

N 7°W-81°W - Ore

N15°W-80°W "

N-S - 85°W "

N10°E-63°E "

N30°W-54°E "

N28°W-81°E "

N30°W-68°E "

N 4°E-36°E "

N14°W-84°E "

N25°W-66°E "

N 4°E-Vert. "

N-S - 80°W "

N36°W-25°E "

N-S - 23°E "

N10°W-67°E "

N 9°W-67°E "

N 5°W-71°E "

N47°E-72°W "

N43°W-45°E Marbles

N14°E-78°W "

N25°W-52°W "

E-W - 30°N "

N81°E-50°NW "

N 3°W -75°E "

N 5°W-72°E

N40°E-66°E

N37°E-72°E

N 4°E-60°E

N21°E-60°E

N35°W-50°E

N17°E-55°E

N23°E-78°E

N10°W- 74°E

N49°W-36°NE

N78°W-22°NE

N77°W-68°NE

N10°E-56°E

N 3°W-49°E

N 7°E-75°E

N73°W-36°S

N73°E-41°N

N13°E-70°E

N20°E-68°W

N15°W-68°E

N42°W-57°E

N 5°W-62°E

N 3°W-51°E

N16°E-80°W

N 9°W-Vert.

N22°W-82°E

N 5°W-71°E

N53°W-42°NE

N-S -74°E

N15°W-61°E

N16°E-55°E

N-S- 72°E

N-S -75°E

N 5°E-71°E

N13°E-77°E

N17°E-28°W

N25°W-11°W

N10°W-33°W

N40°W-34°W

N49°W-29°W

N20°W-66°E

N17°E-55°E

N 5°E-88°E

N11°E-Vert.

N 4°E-71°E

APPENDIX VI

1st RAILWAY GRADE TO THE ORA DENORA

N32°E-77°W
N28°E-79°W
N26°E-Vert.
N33°E-Vert.
N25°E-84°W
N19°E-86°W
N29°E-85°W
N20°E-88°W
N19°E-79°W
N24°E-80°W
N86°W-53°N
N80°W-59°N
N85°E-72°N
N85°W-39°N
N 5°W-73°E
N 4°E-Vert.
N 6°E-73°E
N2°E -89°W
N 4°W-76°W
N16°W-78°E
N 9°W-75°E
N 5°W-72°E
N 2°W-78°W
N10°W-65°E
N17°W-63°E
N18°W-67°E
N19°W-68°E
N20°W-70°E
N23°W-77°E
N15°W-80°E
N22°W-82°E
N16°W-72°E
N55°W-51°E
N27°W-64°E
N50°W-51°E
N70°W-39°N

N45°W-42°N
N33°W-52°N
N80°W-45°N
N32°W-63°NE
N80°W-45°N overturned syncl. to W.
N32°W-63°NE
N60°W-67°N
N16°E-74°W
N 7°E-81°W
N10°W-79°W
N12°W-Vert.
N 3°E-77°W
N 4°W-83°W
N 3°E-85°W
N 2°E-57°W
N10°E-Vert.
N 2°E-83°W
N 9°W-55°W
N 2°W-72°W
N40°E-85°E
N40°E-80°E
N36°E-85°E) Syncline
N 3°E-64°W)
N12°E-74°W
N52°E-63°W
N20°E-73°W
N 5°W-61°W
N 1°W-71°W
N 8°W-73°W
N12°E-Vert.
N - S-65°W
N27°E-89°W
N21°E-81°E
N18°E-85°W
N 4°W-42°W
N 4°E-78°W
N 8°W-53°W
N65°E-70°N
N20°E-70°E top of pit

APPENDIX VI

N. TAILINGS DAM ARGILLITE:LS TECTONIC ANALYSIS

	N28°E-85°W	Argillite
	N39°E-85°E	"
	N35°E-85°E	"
	N45°E-69°W	Very sandy LS
Cherts	N-S -51°W	Unconformity with LS.
	N-S -67°W	LS
	N40°E-69°W	LS
	N35°E-75°W	
	N41°E-63°W	
	N32°E-Vert	Argillite
SS	N42°E-79°W	

APPENDIX VI

2nd RAILWAY GRADE EAST

LS TECTONIC ANALYSIS

N33°E-23°E SS congl./argillite & LS

N35°E-34°E " " " " fossils

N 7°W-31°E " " " " "

N 4°W-28°E 1' LS bed in SS congl.

N-S-55°E Red argillite, some SS congl. also Limestone cobbles

N10°W-43°E Red argillite

N20°W-38°E Red argillite with pebbles

N15°W-45°E " " " "

N21°W-33°E " " " "

N15°W-48°E SS congl.

N24°W-50°E SS congl.

N 9°W-42°E Argillite in SS congl.

N20°W-35°E " " " "

N15°W-47°E " " " "

N 2°E-70°E " " " "

N18°W-62°E " " " "

N49°W-48°E argillite in SS congl.

N15°E-56°E " " " "

N10°W-43°E argillite

N20°W-39°E "

N25°W-51°E "

N25°W-48°E "

N26°W-44°E "

N27°W-37°E "

N30°W-36°E green argillite

N30°W-49°E-red "

N27°W-46°E " "

N24°W-38°E argillite

N 5°W-43°E LS with sand.

N20°E-52°E SS congl.

N10°E-22°E argillite in SS congl.

APPENDIX VII

2nd RAILWAY GRADE LS: TECTONIC ANALYSIS

N25°E-64°E		N21°E-61°W
N 7°E-61°E		N37°E-48°W
N20°E-56°E		N18°E-51°W
N27°E-60°E		N23°E-54°W
N 8°E-50°E		N 8°E-55°W
N20°E-62°E		N 4°W-77°W
N19°E-63°E		N 1°E-89°E
N20°E-61°E		N 5°E-70°E
N18°E-61°E		N12°E-80°E
N 2°W-Vert.		N 5°E-80°E
N 3°W-66°E		N25°E-80°E
N 5°E-Vert.		N-S -81°E
N 3°E-51°E		N 4°W-77°W
N 9°E-79°W	Argillite	N 8°E-85°E
N14°E-66°W	"	N 6°E-75°E
N16°E-62°W	"	N 2°W-80°E
N17°E-89°E	"	N23°E-81°E
N15°E-82°W	"	N 5°E-Vert.
N29°E-82°E	LS	N-S -69°E
N20°E-68°E		N13°E-77°E
N25°E-67°E		N13°E-71°E
N 3°E-61°E	overturned syncline -axis N30°E-41°	N 2°W-76°E
N35°W-43°N		N 6°E-58°E
N12°E-82°E		N13°W-69°E
N 2°W-79°E		N-S -76°E
N24°E-86°E		N 2°E-70°E
N10°E-86°E		N-S -61°E
N12°E-83°E		N15°W-60°E
N18°E-76°E		N 3°E-59°E
N24°E-75°E		N 8°E-55°E
N19°E-73°E		N5°E -45°E
N13°E-70°E		N 3°E-70°E
N4°E -57°E	overturned anticline axis S20°W-37°	N-S -75°E

2nd RAILWAY GRADE LS: TECTONIC ANALYSIS

cont'd

N12°W-57°E

N 2°E-63°E

N - S-66°E

N - S-52°E

N 6°W-60°E

N 8°E-56°E

N 4°E-50°E

N 8°E-65°E

N - S-71°E

SUMMARY OF THE RAWHIDE SECTIONS

1. The ore beds have been folded into anticlines and synclines, as well as having been faulted.
2. Generally, in the syncline areas, two ore beds are present.
3. Although these two ore beds are indicated by the drillholes, only the bottom ore bed seems to have been mined.
4. The volcanics seem to be thin, sometimes in the order of 25'-60' thick.
5. All drill holes except the "G" holes are relative and their exact positions are not known.
6. No core holes have been drilled along the Rawhide percussion hole line as a check on assay values. One hole, No. 315 (see sec. 47,30(shows 41' of ore while a percussion hole within 20' of it shows no ore.

8

7. Inferred ore occurs in at least five areas:

					Drilling to Prove
1.	1,414,375 T	of 15.6'	@ 0.77%	12.012	1760'
2.	260,400 T	of 6'	@ 1.00%	6.000	1670'
3.	275,280 T	of 9.3'	@ 0.91%	8.463	2090'
4.	359,058 T	of 25.6'	@ 1.66%	42.496	890'
5.	496,000 T	of 12.6	@ 1.56%	19.656	3190'
	2,805,113 T	of 13.8'	@ 1.20%	88.627	9600'

8. It can be readily seen that area No. 1 gives the greater tons per foot in the proposed diamond drilling. Area No. 2 is completely new. Area No. 3 and Area No. 4 are partly known. Area No. 5 may be nearly mined out. Underground surveys are needed to confirm this.

RECOMMENDATIONS FOR RAWHIDE SECTIONS

1. Complete underground surveys; adjust sections to new survey.
2. Do detailed surface mapping over inferred ore zones. Section lines would have to be put on the ground.
3. Drill two core diamond drill holes on Rawhide section lines.
4. Drill core diamond drill holes at 50' intervals in the North Snowshoe inferred ore sections.
5. Drill remaining inferred ore sections.
6. Mine new ore zones by rim blasting from surface and pulling through reconditioned draw points underground.