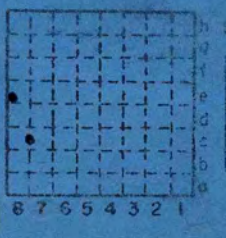
Sahara Coal Co. Mine # 20

Air Shaft 2550' from NL, 140' from WL, Sect. 10
Slope Portal 660' from WL, [redacted]' from [redacted]L, " "
1760 S

ABND - 1983

SAHARA COAL CO.
MINE # 20

ISGS-Mine Index No. 909
Coal Report No. S-56



[redacted]

SALINE COUNTY

MOORE'S MODERN METHODS

SAHARA #20

(Sheets) COAL PRODUCTION (Sheet)

Period Mo. Day Year Mo. Day Year		Tons	
	1970	212	719
	1971	508	928
	1972	561	085
	1973	640	198
	1974	563	020
	1975	453	118
	1976	506	114
	1977	501	543
SAHARA COAL CO.	1978	286	246
	1979	310	529
MINE NO. 20	1980	348	122
	1981	275	480
	1982	358	104
Final production May	1983	61	374

SUMMARIES

No. 1970 to 1971 (INC) No.	721	647

Railroad, Wagon, Strip, Idle, Abandoned

SLOPE

IDENTIFICATION

County No.

Coal No. 5

Coal Report No. S-56

Quad.

County SALINE

Sec. 10

T. 9 S.

R. 5 E.

Index No.

8 7 6 5 4 3 2 1

h g f e d c b a

COAL MINE—PRODUCTION

ILLINOIS GEOLOGICAL SURVEY, URBANA

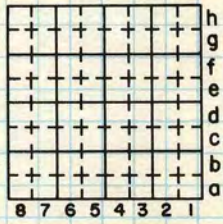
(2732—2M—7-41)

Sahara Coal Co. Mine 20. Face Channel Sample #1. FC and Column in S. workings. Harrisburg No. 5 Coal.

Dark gray shale top, normal underclay bottom.
Seam Ht. 4'9".
Top - Down

0"-2"	Coal - Normally bright banded. Few thin (<1/16") pyrite lenses.
2"-2½"	Pyrite nodule - Up to 1" thick in part of section 10" across.
2½"-1'3"	Coal - Normally bright banded. Pyrite on vertical fractures. ¼" fusain, soft at unit base.
1'3"-2'1"	Coal - Normally bright banded. Pyrite and some minor kaolinite.
2'1"-2'2½"	Fusain (up to ¼"), Pyrite (to ½") - Both menticular and discontinuous.
2'2½"-3'6"	Coal - Normally bright banded. Pyrite on cleat. Fusain (<¼") lenses at ∿3', vertical feather-like pyrite vein extends ∿2", calcite, kaolinite and pyrite on cleat. ¼" fusain at base.
3'6"-4'9"	Coal - Normally bright banded. Calcite on vertical fractures. Less pyrite observed.

*No shale partings observed in the seam.



By PL Date Sept. 21, 1972

Quadrangle

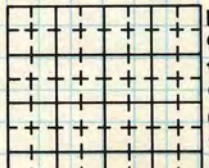
County Sec. 10 T 9S R 5E

1700'E, 2600'S, NW/cor.

Sahara Coal Co. Mine 20. Face Channel Sample #2.
At end Main E. 2-3 entry north of track entry.

Normal dark gray shale top.
Coal - Split by gray siltstone. Where observed 1 ft. thick at this locale marks bottom of coal.
Only mining top bench 4'6".
Top - Down

Coal - Normally bright banded. Thin 1/8" pyrite band at ½". Several thin, soft fusain bands. 1/8" pyrite band at 9½" and at 10". Bottom of unit at 10½".
Coal - Normally bright banded. Pyrite on vertical fractures. Down to 17".
Coal - Somewhat sheared, abundant fusain, soft, broken up. Down to 20".
Coal - Normally bright banded. Prominent joint 45°. Down to 22½".
Fusain - Soft, irregular, ¼ to ½". Down to 22 3/4'
Coal - Normally bright banded. Pyrite on vertical fracture. Same 45° fracture. Kaolinite on vitrain. ¼" soft fusain at base. Down to 38".
Coal - Harder than above, more thinly banded, calcite on cleat. Down to 49".
Siltstone - Dark gray. Coal inclusions. Sometimes split, 2 beds. Coal parting 1" thick omitted from face channel sample.
Coal - Hard, thinly banded, calcite on cleat. To bottom (54").



By JA H? Date Sept. 21, 1972

Quadrangle

County Sec. 11 T 9S R 5E

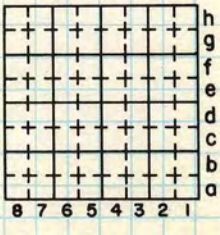
1400'E, 1300'S, NW/cor.

Sahara Coal Co. Mine 20. Face Channel Sample #3.
N. of the Main West.

Seam Ht. 4'5".
Normal gray shale roof.
Underclay bottom.

0"-10"	Normally bright banded - Abundant kaolinite and pyrite on cleat. Thin bony band at base of unit.
10"-19"	Normally bright banded - Abundant pyrite. Several thin fusain bands. ¼" mineralized fusain at bottom.
19"-43"	Coal - Normally bright banded, c ½" bony band near top. Kaolinite and pyrite on vertical fractures. ¼" fusain at base of unit.
43"-53"	Coal - Normally bright banded, calcite, kaolinite and pyrite on cleat - bottom 1'. Contains many more soft fusain layers than above (more than 12 bands).

Nothing excluded from FC sample.



By JH and PL Date Sept. 21, 1972

Quadrangle

County Sec. 9 T 9S R 5E
2100'W, 1400'S, NE/cor.

SAHARA COAL CO. MINE NO. 20 SALINE COUNTY, ILL.

Notes by John Nelson on visit with H.-F. Krausse and Bob Gullic and Terry Guest from Sahara, 5/26/77.

The purpose of this visit was to examine faulted areas in the mine and select areas for possible later detailed mapping in our study of the Cottage Grove Fault System.

Sahara # 20 is a slope mine in the Harrisburg (No. 5) Coal. There are at present two conventional faces and four with continuous miners. Coal haulage is by conveyor belt; men and materials move by rail. The coal is transported by overland belt to the cleaning plant at Sahara # 6 (strip mine). It is sold to a variety of large and small users, mostly in the Chicago area, and some is also sold to local trade.

In this mine, as at Mine No. 21, the intake air is forced into the mine and the return is via the slope. This is in contrast to most other underground mines in Illinois, which use upcast fans on exhaust. A unique feature of Sahara underground mines is the conditioning or tempering chamber for intake air. This is a worked-out panel through which the air is routed before being sent to the working faces. Not only does this make conditions more comfortable for the men but also it greatly improves roof control, as the shale in the active part of the mine is not subjected to destructive seasonal changes in temperature and humidity.

At the time of our visit working faces were as follows:

(1) A 9-CM continuous miner driving new air courses just off the bottom.

(2) A conventional unit in the first panel south off the Main West, working on retreat. Pillars are

not pulled systematically, though some notching takes place on retreat. When complete, this panel will be a new conditioning chamber.

(3) A conventional unit in the second panel south off the Main West, beyond the point where the Main West turns to the southwest. This also is on retreat. It is in low coal, with a downgrade and bad top at the face, and possible faults. (We did not visit this face.)

(4) An 8-CM continuous miner working in the northeast part of the mine, on advance. See notes for Location 6.

(5) A 12-CM continuous miner driving the mains at the far northeast. See notes for Location 1.

(6) Another 12-CM miner working a panel east off 4-6 South off the Main East.

Our tour takes us from the bottom along the Main East to the extreme northeast part of the mine. Along the entire route the roof is gray shale and siltstone of the Dykersburg Shale Member. Nowhere do we see the St. David Limestone or the underlying black shale. We are told that black shale roof is rare in this mine. Most likely it is present in the far west, farthest from the channel. The coal thins from 7-8' at the northeast to a little over 4' in the west.

The top throughout the mine is excellent. The main entry is driven 26' wide and used for both track and conveyor belt. Other entries are 20' wide, and rooms are 26' wide. The mine appears generally very clean and orderly, and large amounts of rock dust are used. This is rather unfortunate in our view, as it hinders geologic observations.

We are told about the fault that was encountered in the workings directly south of the slope bottom. The coal dipped to the south, with bad top and small

faults. A fault of full-seam (approx. 5 feet) displacement, down to the south, was encountered, and mining halted at this point. From previous experience in Sahara # 7 and Peabody # 44, more steep grades and faults were known to lie ahead.

Numbers Refer to Locations on Map
See Map in Folder 10-3-8(A)

1). Mouth of east cooling chamber. Coal seam about 4½' thick; clean bright coal with no partings. Sharp contact to roof of Dykersburg Shale; medium gray, with brownish cast, rather weak, poorly bedded, finely micaceous, contains a few carbonaceous plant impressions and occasional tree stumps in growth position ("kettlebottoms"). Poorly defined, curving joints trending roughly 090-100. About 6"to 1' of the roof has slabbed down in most places, and a few larger roof falls up to 5 feet high are present. These are the only falls seen on this visit.

One small "explosion structure" noted near mandoor to panel. It consists of stringers of coal contorted and upturned into the roof shale. Tried to take a photo, but the electronic flash failed. plant fossil ? P310

We would expect the worst roof in the mine to be here, in the conditioning chamber.

2). Extreme northeast workings of mine. Coal appears to rise gently to the north overall, but steep local hills and valleys interrupt the trend. In face area, coal is the thickest in the mine (7-8') and is cut out by large irregular rolls which appear to be erosional channels. The coal edge is jagged and no riders or stringers of coal are noted in the channels. There are slickensided fractures in the roof but no major faults are present.

Observation throughout this area is hindered by the large amounts of rock dust applied to the hard, fresh face. It is extremely difficult to clean up the ribs to examine the details of the structures.

In the 1st Entry (westernmost) the entire 8-foot coal seam is cut out within 10 feet, and the face is solid rock. The coal "fishtails" against the cut-out but no true splits or rock bands are visible in the seam outby the cut-out. The channel filling consists of hard, silty gray-brown shale with plant fragments. The trend of the channel appears to be NW-SE.

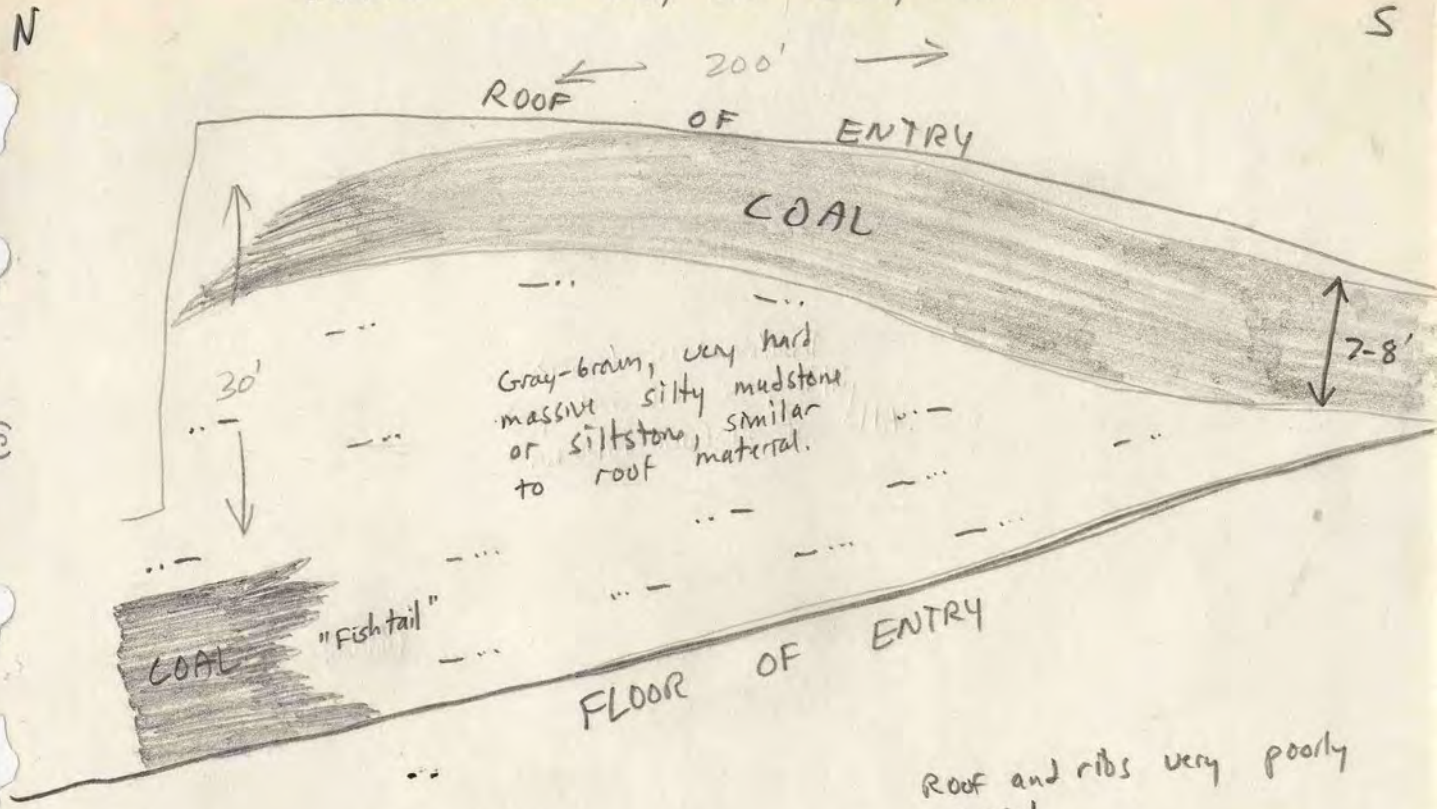
Entry 1-A, to the west of Entry 1, has just begun to mine into the channel. There is a slip at the face roughly parallel to the washout border. The channel fill is poorly laminated silty shale or siltstone, with small sandy lenses.

A couple hundred feet outby the face is a very large interruption of the coal seam. Conditions for observation are extremely poor and what must be a spectacular structure is mostly hidden by rock dust.

Mining northward, the coal rises sharply, then turns downward and abruptly ends. The nature of the pinch-out is not visible. The entry was graded downwar through the floor. The entry is 25 to 30 feet high at the north end where the coal pinches out. Below the pinch-out point the coal seam reappears. It fishtails to the south, apparently against a channel like those being encountered farther north. See sketch (over).

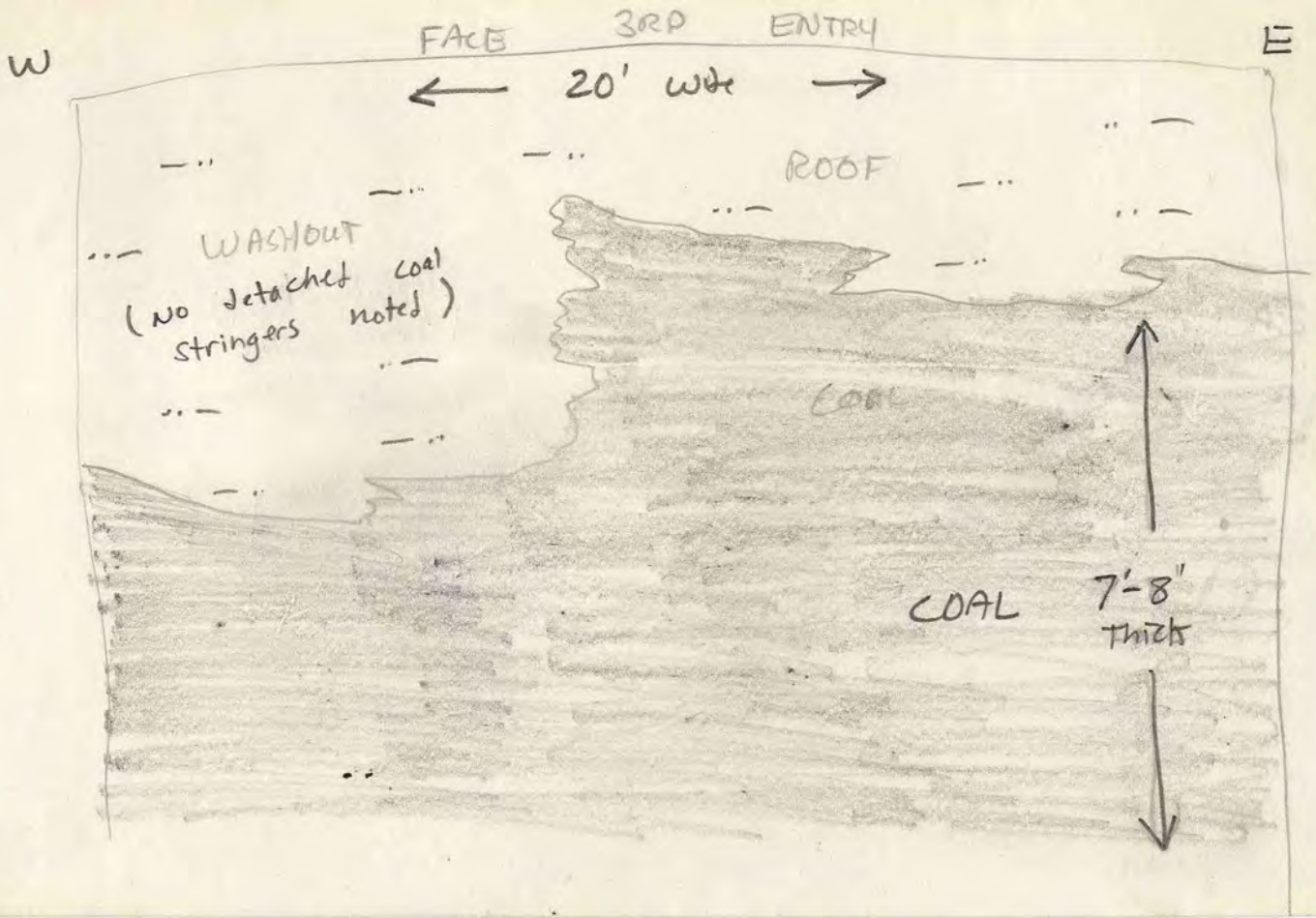
No faults are visible, though it is possible that a low-angle reverse fault has offset the coal bed. This structure is unlike any I have ever seen. Perhaps if we return in a year of so, after the ribs have had a chance to rash, the true nature of this structure will become apparent.

LOCATION: 2nd Entry 200' Outby Face.



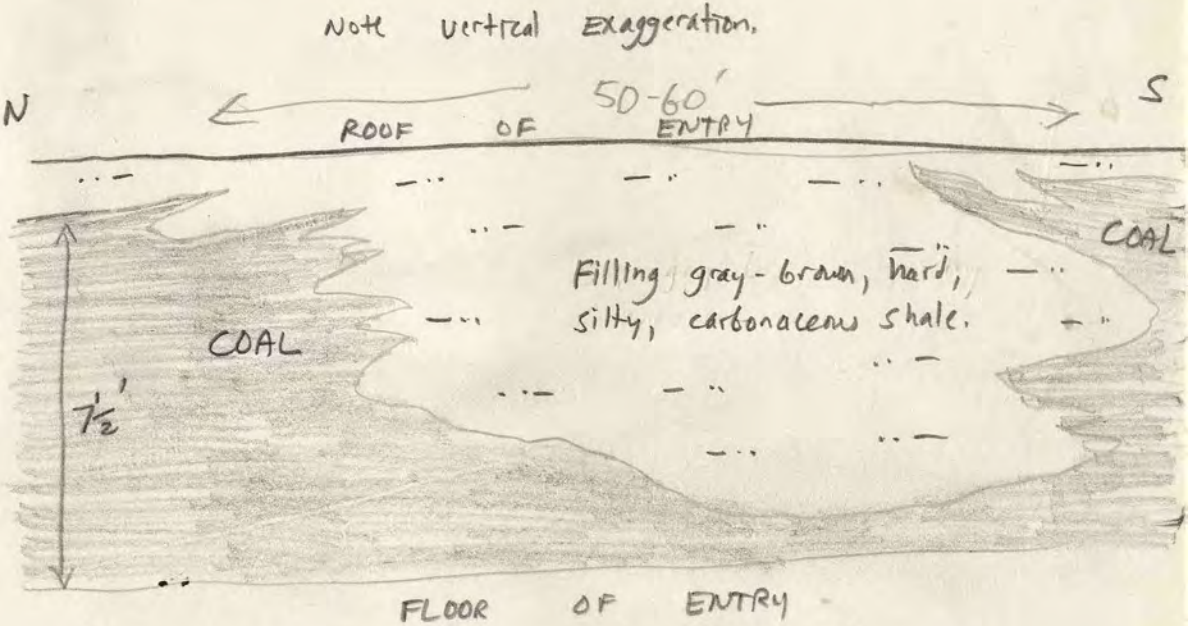
(5)

Roof and ribs very poorly exposed.


W
FACE 3RD ENTRY
E
20' wide
ROOF
WASHOUT
(No detached coal stringers noted)
COAL
COAL
7'-8' Thick

(6)

Near Face of 4th Entry.



(7)

(2)

3). Located along main entry about 180' north of the point where entries turn from NE to N heading. Sharp local hill in the coal with a roll at the crest. This roll has splayed coal riders and is much shallower than the channel-type rolls described above. The coal has moved or sheared along the bedding planes near the roof, 5 to 6 feet above the floor. In one place crushed coal is visible along the shear surface, and several subsidiary low-angle shears are present. No way to estimate the displacement (if any).

There is also a vertical fracture zone striking about 130° in the roof and coal. There appears to be a downwarp or flexure in the coal, and the coal is crushed along this zone. Several bedding-plane shears are apparent. The feature is complex and hard to decipher in the limited time available. This is the first feature we have seen that may be connected with the Cottage Grove Fault System.

4.) Located just outby the point where the Mains turn from northeast to north heading. Fault zone.

The largest fault is at Stopping 17 and has 5.0 to 5.5' of displacement. It is a normal fault trending 158/75° NE. There are numerous parallel fractures with little or no displacement. The coal seam is 7.8' thick with no significant partings, and no sign of movement parallel to bedding as at Stop 3. The floor is exposed on the upthrown side of the fault. It is a hard, greenish gray, massive, micaceous, carbonaceous siltstone, with small iron-stained nodules.

Other faults occur in the area, mostly northeast of the large fault, and their trend is roughly paralle to the large fault. Both normal and reverse faults are present, along with fractures in the roof. The largest fault has about 3 feet displacement. One fault is seen to change from normal to reverse across the track entry. Most of the fractures occur in bunches, and they intersect and branch. The total fault zone is about 200 feet wide. Though the roof is badly sheared, no slabbing or falls were noted.

Just outby the largest fault are joints in the

roof trending perpendicular to the direction of faulting.

5.) Located about 3-4 crosscuts outby previous stop, or 3 crosscuts inby the slam door at the turn, along track entry.

Local hill in coal. Disturbed zone 1-2' below top of coal, with apparent multiple bedding-plane shears. Coal between shear surfaces is slickensided, rotated in blocks, and locally crushed. No other faults or structures noted.

Possibly the hills in the coal are the result of the same stresses that produced the faulting, and the bedding-plane shearing is a response to the folding of the coal.

6.) 8-CM section. Coal 6-7' thick. Roof is sandstone, light to medium greenish-gray, very fine-grained, argillaceous, thinly and irregularly laminated, very carbonaceous with coal partings, stringers, and abundant fossil tree trunks.

In No. 1 (right hand) entry there is a fault about 20' outby the face. It is a normal fault trending 140-145/65-70°NE with about 0.6 displacement. Several closely-spaced parallel branching fractures are nearby This is the same set of faults described at Stop 4.

Another fault down to the west a few inches lies closer to the face. The roof at the face is not bolted The area is slightly damp, with no water dripping. The moisture may be only water spray from the continuous miner.

In # 2 Entry the sandstone roof is somewhat lenticular with carbonaceous partings. The bedding surfaces appear somewhat ripply; possible interference ripples. A set of small faults trending roughly parallel to those in Entry # 1 lies near the face, in unbolted roof. Another set trending 090° (east-west) is also present; these may be compactional slips. There are numerous uneven slickensided horizontal surfaces in the latter fault set.

In the remaining faces the coal seam undulates gently, but no more faults are noted. The top in this area is very good compared to that in most other mines, but is relatively poor for this mine. Roof control is with 60" resin bolts, installed by a single-boom Acme roof bolter with canopy.

7.) Located along Main East just west of point where Mains turn to NE heading.

Map given to us by Bob Gullic indicated a fault in this area. We find only one rather small normal fault trending 155/50° SW. It is difficult to tell whether it is a tectonic fault of the Cottage Grove System or a compactional slip.

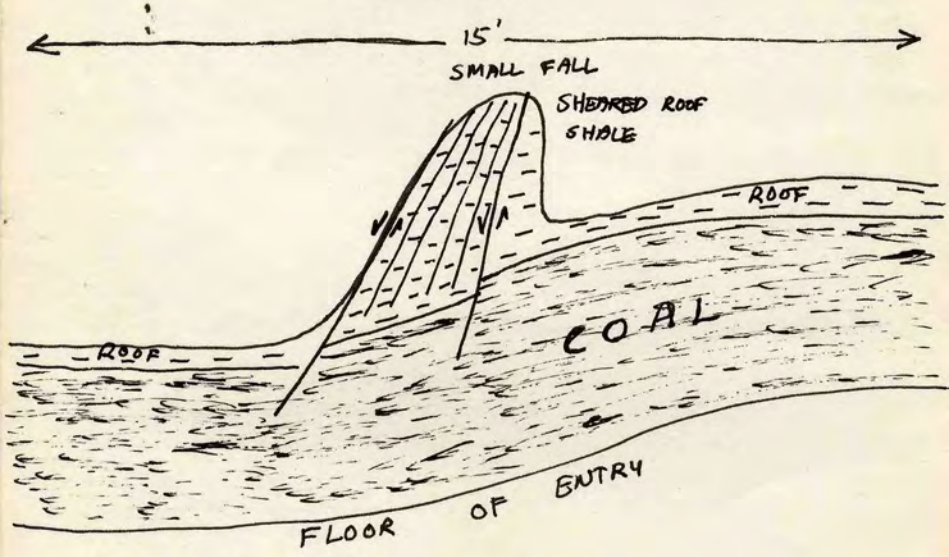
The coal seam undulates strongly in this area, and there are many rolls. The rolls are low and wide with long coal riders that in some cases may be continuous over the roll crests. Some are very large and cut out nearly all of the coal seam. The coal varies from about 2' to 7' in thickness; the normal height is about 5 feet.

The roof and roll-filling material is very silty shale or siltstone; gray-brown, poorly bedded, and highly carbonaceous with abundant plant debris. It is interlaminated with light gray siltstone and fine-grained sandstone and locally displays flaser bedding. The bedding may be distorted near rolls. The floor is dark gray, firm, silty claystone with abundant carbonaceous plant fragments and small sideritic (?) nodules.

8.) Fault on Main East just east of slope bottom. Cribbing makes it hard to study, and time is running short. On the north rib of the combination track/belt entry the structure is essentially a monocline trending 145/65-70° SW and downthrown about 3 feet to the west. The roof is sheared along the strike of the monocline. See sketch (over).

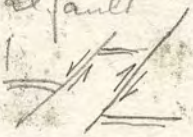
Sheared flexures of this type are fairly common in the Cottage Grove Fault Zone in other mines we have visited.

Stop 8
structure on north rib of track entry.



Sahara Coal Company
Mine # 20 N to NE Major Faults area
May 10, 1978

(1) 1st fault: 125/50 to 60° SW
t = 8' fault appears to be normal fault
limiting a reverse faulted horst



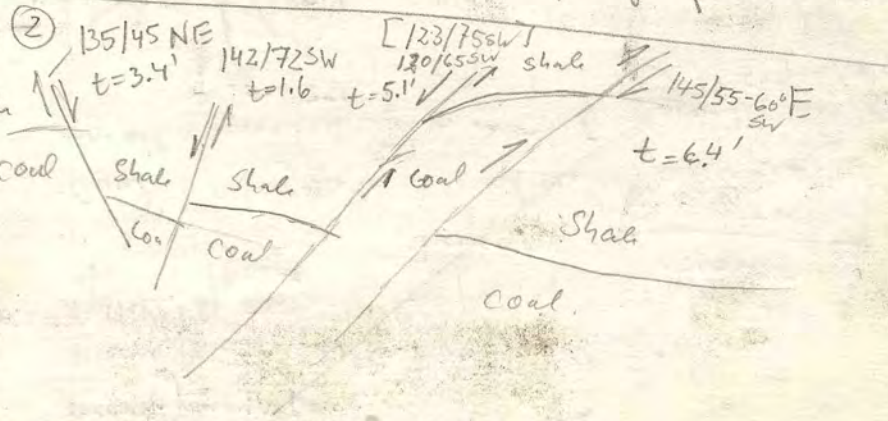
Measurments of associated small slips and faults in coal.

105/65 SW
127/67 NE
155/27 NE } very dense 20 to 30/foot
153/47 NE
150/78 SW

horizontal + dip slip striations

105/53 SW } both sparcy about 8-14/foot
142/51 SW
140/53 SW

107/72 NE ± major plunge (strike 31° E



(3)

140/42 SW direction of fault t = 0.7 SW normal

accompanying are

minor faults with horizontal striation

system of ~~three~~ sets 65/70 NW

70/80 NW

110/85 NE

10/± vertical

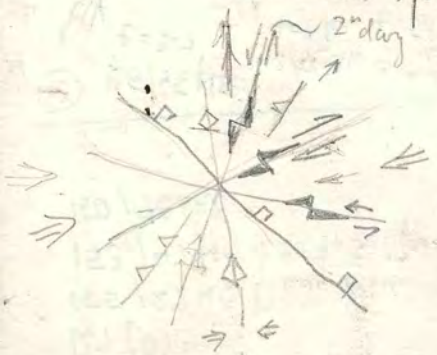
Coal is intensively sheared and pulverized

small associated folds in coal ~~160/70~~ 160 to 165/55

50 to 60/10 S

Mini-reverse faults

40 to 45°/60 SE



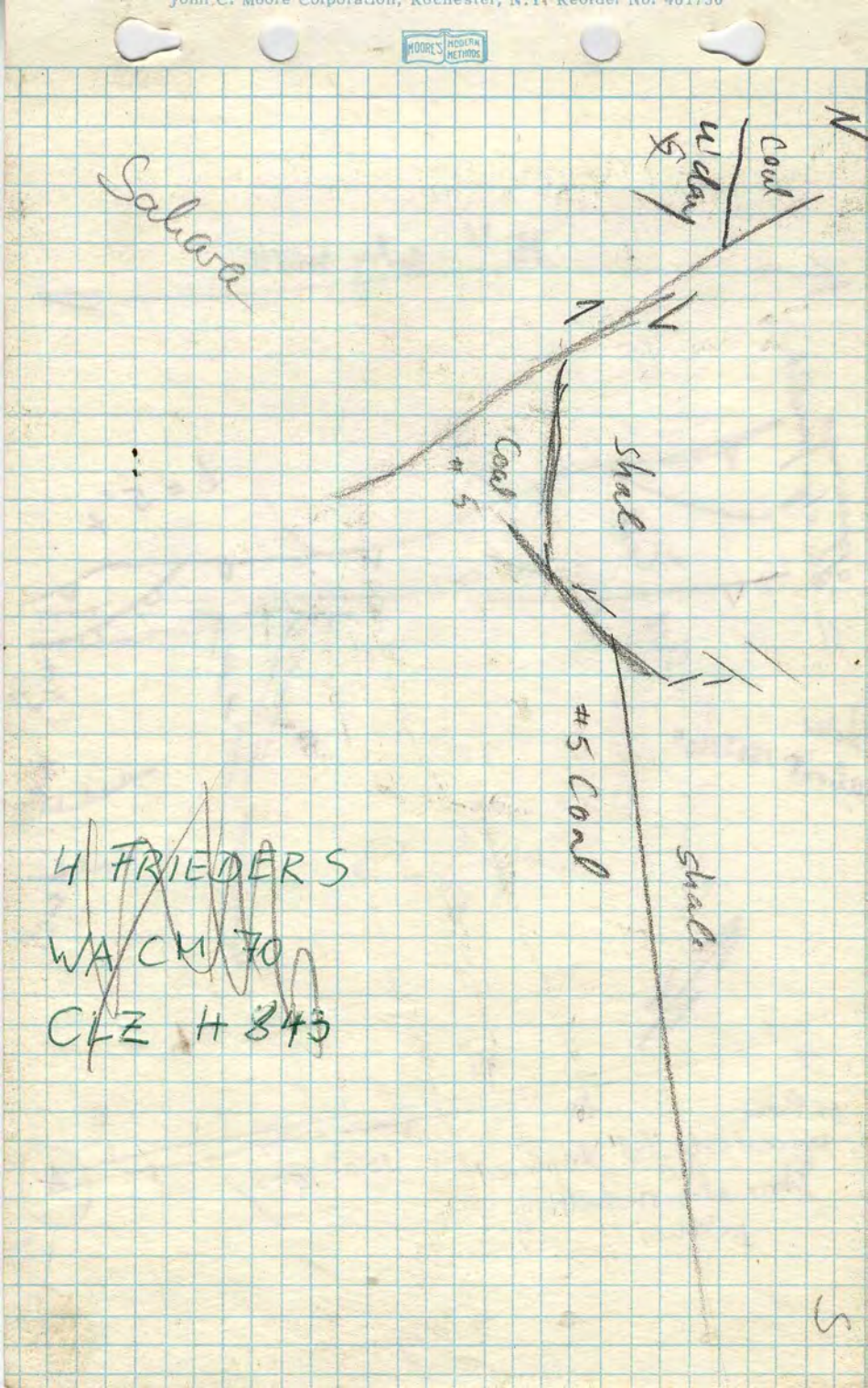
cleats: 150/88 NE

55/86 NW

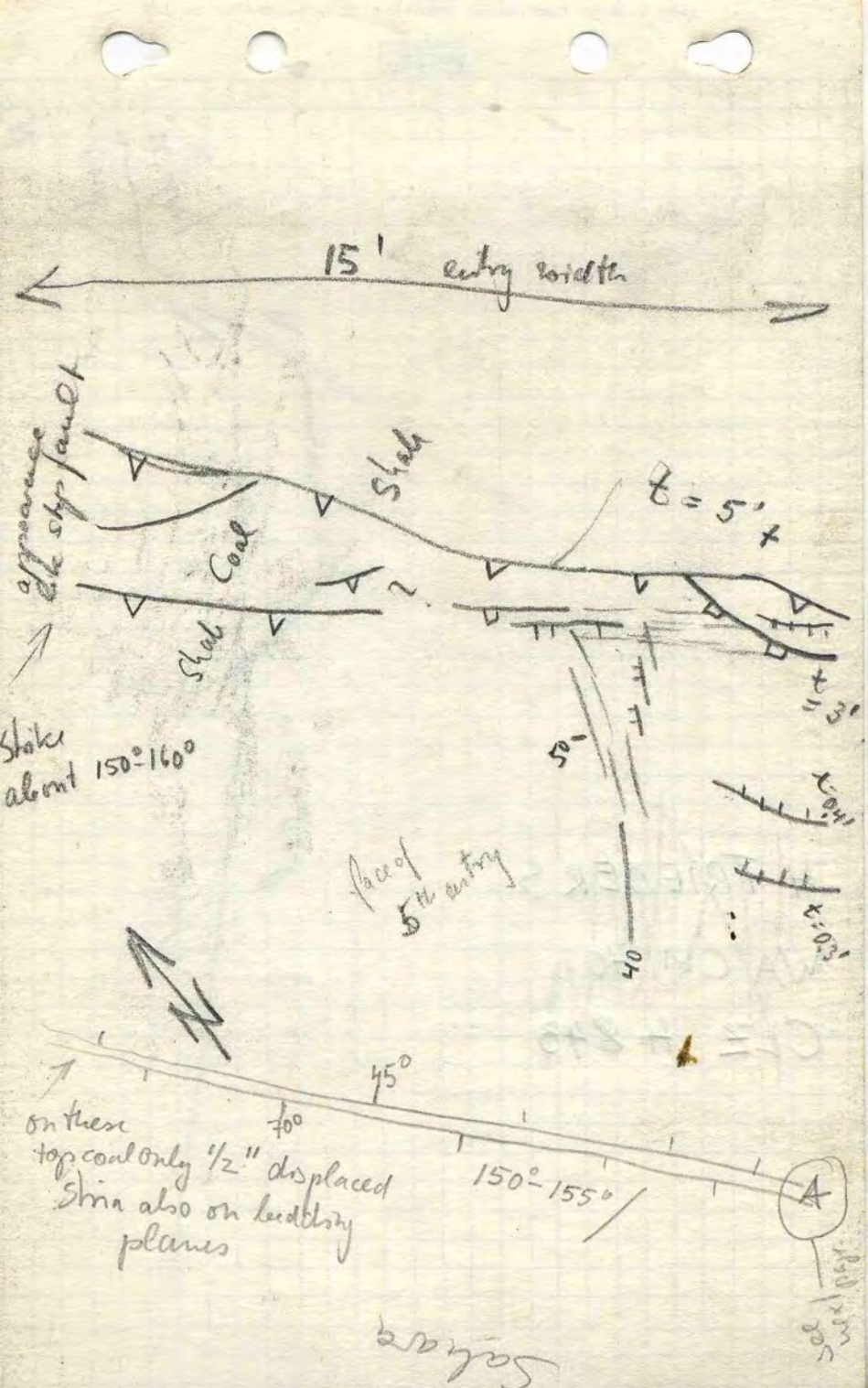
goal head: 148-155/± vertical at N. fault

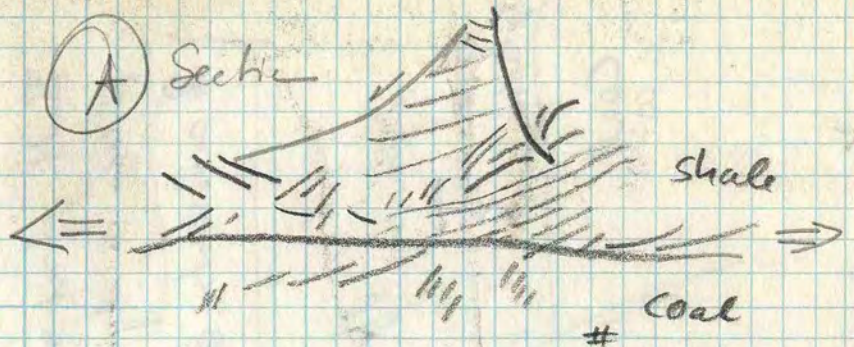
measurements of all types of slickenlines

80/76 NW striae pl	70° W	Rev 32/72 SE	t = 0.2'
78/82 NW "	8° W	Rev 43/62 SE	t = 2"
165/65 W "	17 S		
170/80 E "	0	N 155/62 SW	
175/75 W "	3 S	N 146/57 SW	
		N 138°/46 SW	
12/72 "	22 S		



4 FRIENDERS
WA CM 70
CFZ H 843


15' entry width
Slab
Coal
Slab
t = 5'+
t = 3'
Strike about 150°-160°
50'
face of 5th entry
t=0.4'
t=0.3'
45°
40°
150°-155°
A
on these top coal only 1/2" displaced
Slips also on bedding planes



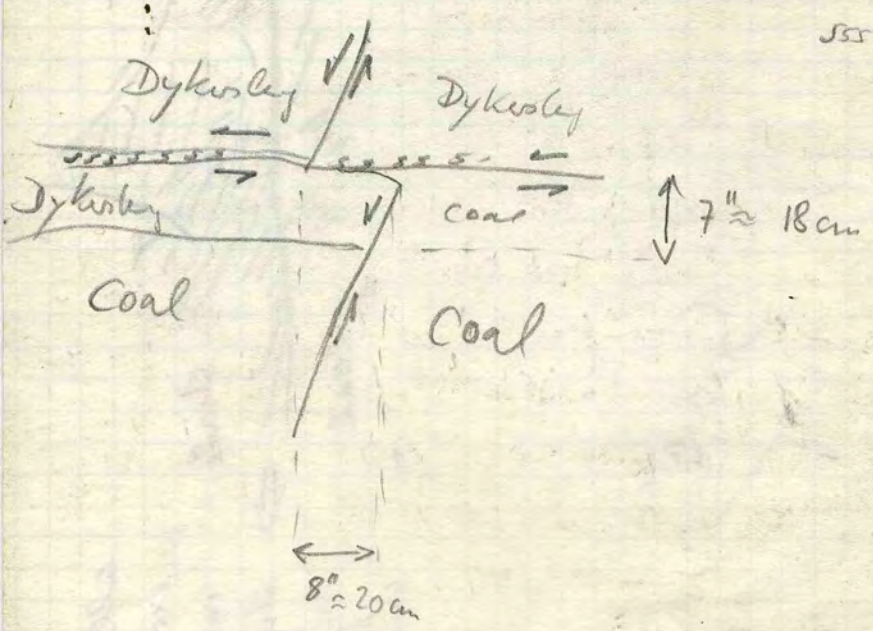
all surfaces except coal/shale interface are shear plane supporting lateral movement

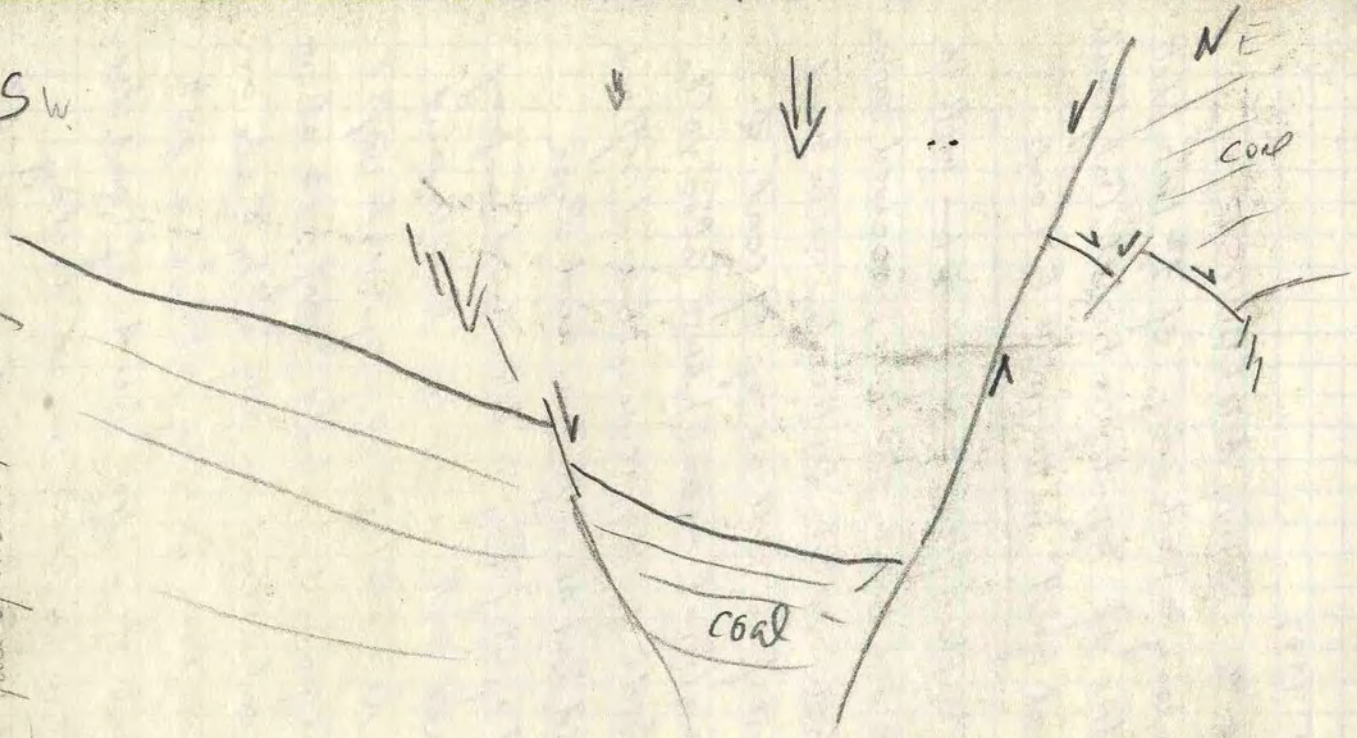
Sahara

Fault offset on bedding plane // shear plane in Dykesbury Shale

2 crosscuts on Rly (3 entry face of

555





Sahara face of NE. 57, 6 County

Sahara 21
05 | 27 | 77

Sept 01 1977

Orient # 3 Return AIR COURSE,

Escapeway = track entry of 7th Main North several hrs of Syndepositional Coal/Shale or "Coal split" in Herrin (# 6) Coal.

First walked from ~~South~~ → ~~+~~ north to South to see main structure, occured various continuous split lenticula rolls and rolling roof as well as top of coal In Coal (material = coal) were also rolls and folds partly recumbant roll and not fold, but also factures and slips. Shale of split fill is like medium gray Envy shale with siderite bands and nodules but altogether very weak soft and fine grained, while roof rock above upper coal bench is very silty shale or in places even sandy siltstone with flaser beds etc. Upper bench of coal does not seem to have an underclay. The siltstone as well as the gray shale?

Sahara Coal Co. Mine No. 20
May 10, 1978
Notes by John Nelson on visit with H.-F. Krausse and Myron Whyte, Sahara

Mapping faults and related features in Main North (Northeast part of mine). See map in folder 10-3-8 (D).

1. At face a fault trends 140/55 SW with about 2.0' normal displacement. Clay along fault plane below top of coal on hanging wall indicates either squeeze-in or extension on fault with roof shale dropped in from above. Many smaller faults and fractures parallel with main fault, and vertical fractures in roof are normal to faulting.

Just southwest of the normal fault is a plane trending 160/85E with slickensides nearly horizontal-plunge 12° SE. The plane is sinuous in dip direction. Top of coal downthrown about 0.2' to the west. Main direction of movement indicated by slickensides is left-lateral.

2. Complex major fault zone about 20 feet wide trending roughly 140° - a branch fault of the Cottage Grove system. See sketch (over).

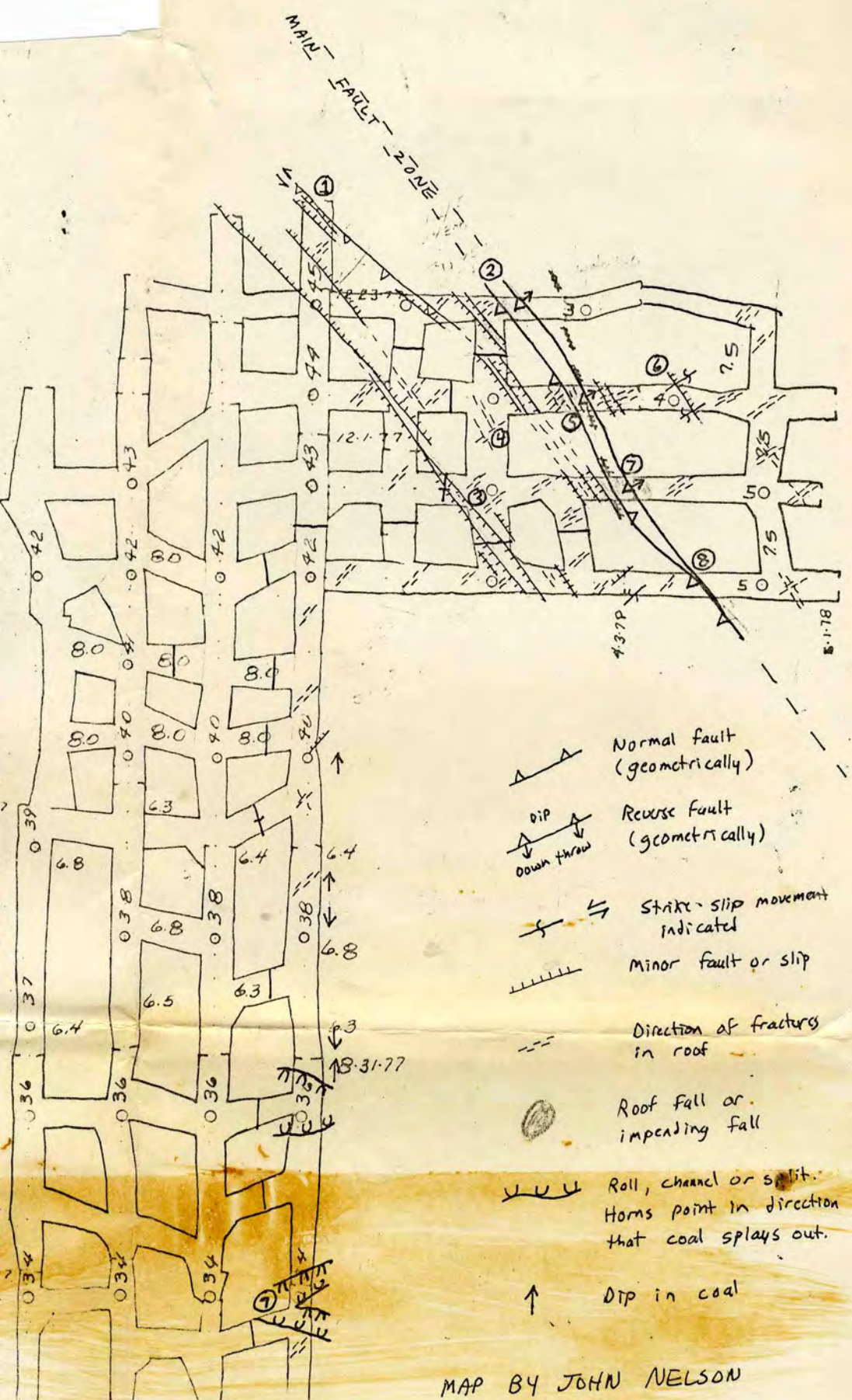
The overall pattern is of a horst bounded by low-angle normal faults on one side and low-angle reverse faults on the other. The coal is arched upward toward the horst on both sides. On the northeast side over 10 feet of vertical displacement has occured, but the coal seam is about the same elevation on opposite sides of the faulted area.

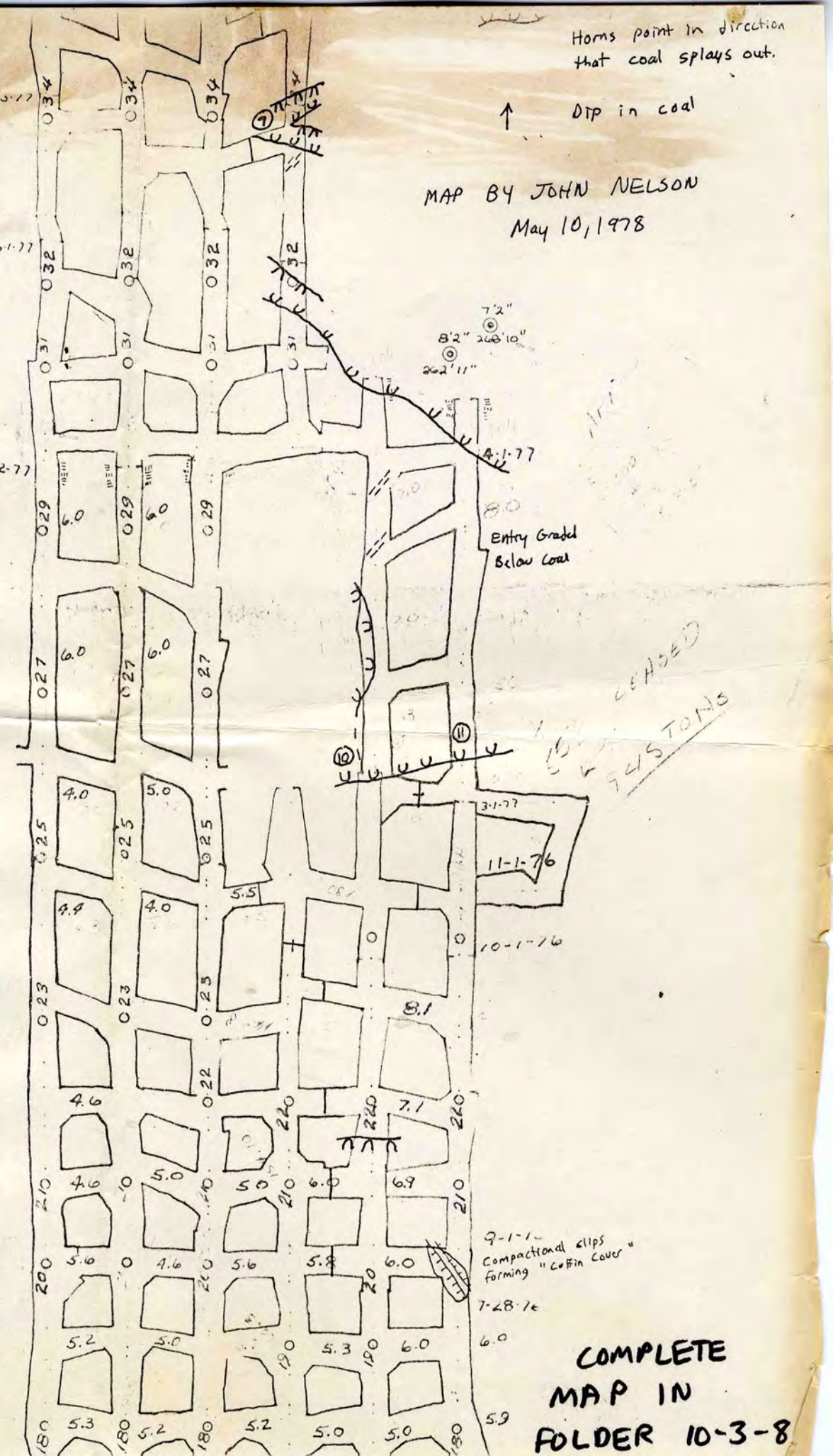
Coal and rock in the fault zone are intensely folded, fractured, and locally crushed. Slickensided surfaces are abundant. Both horizontal and vertical straitions are seen.

A component of strike-slip movement is indicated but it is impossible to estimate the magnitude.

11-3-8 (D)

ARA NO. 20




Horns point in direction that coal splays out.
DIP in coal
MAP BY JOHN NELSON
May 10, 1978
7'2"
8'2" 268'10"
262'11"
Entry Graded Below Coal
3-1-77
11-1-76
10-1-76
9-1-76
Compactional slips forming "Coffin Cover"
7-28-76
COMPLETE MAP IN FOLDER 10-3-8

Abundance of fractures and shear planes has created a large roof fall and very unstable top conditions. There is no water seepage at present.

3. Large roof fall showing faults trending 135/60-65 SW and also roughly vertical fractures tending parallel with these. A very prominent system of jointlike fractures in the roof shale trend 050-055/80 NW; roughly perpendicular to main direction of faulting. Spacing averages about one per foot, but locally they are much more closely spaced. Intensity of fracturing increases toward main fault and there is no doubt the fractures are fault related, as the Dykesburg Shale normally is not jointed.

4. Fractures here trending 042/82 NW are partially open with filling of mud. Spacing is in places several to the inch. Fractures parallel to main faults occur in bundles of very intense fracturing.

5. Major fault zone presents very peculiar-picture (sketch, over). The coal seam is more or less continuous through the fault zone, though it is fractured and pulverized. No major displacement of the main seam has taken place.

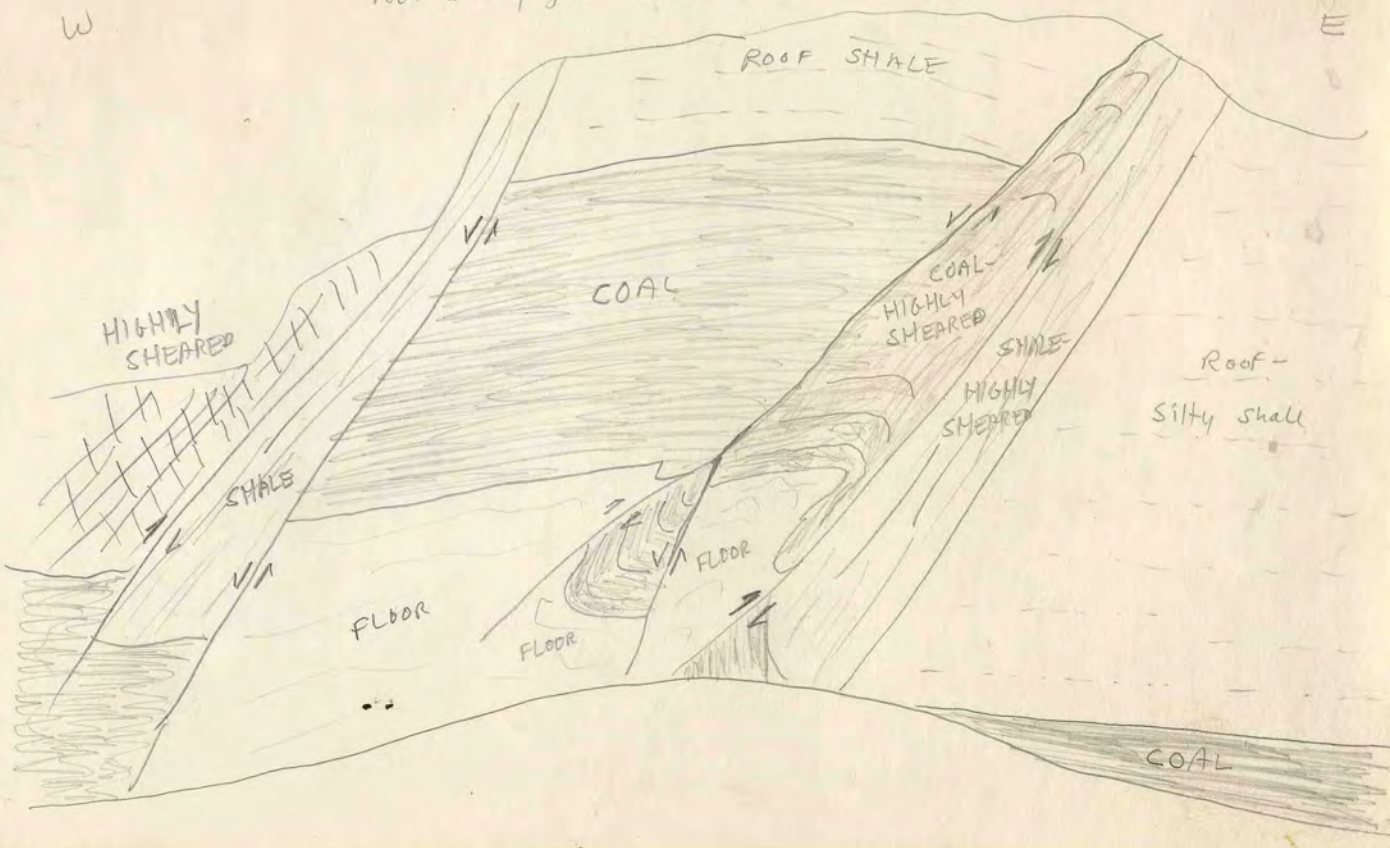
However, along a SW-dipping fault the coal is sharply dragged upward along one side, and clay is sharply dragged down along the other side. Farther up along the fault plane is a large wedge of crushed coal and there is no indication where it came from. Most likely the coal wedge was shifted laterally along the fault zone, as well as moved upward. The only other explanation would be reversed or scissored movement on the fault plane.

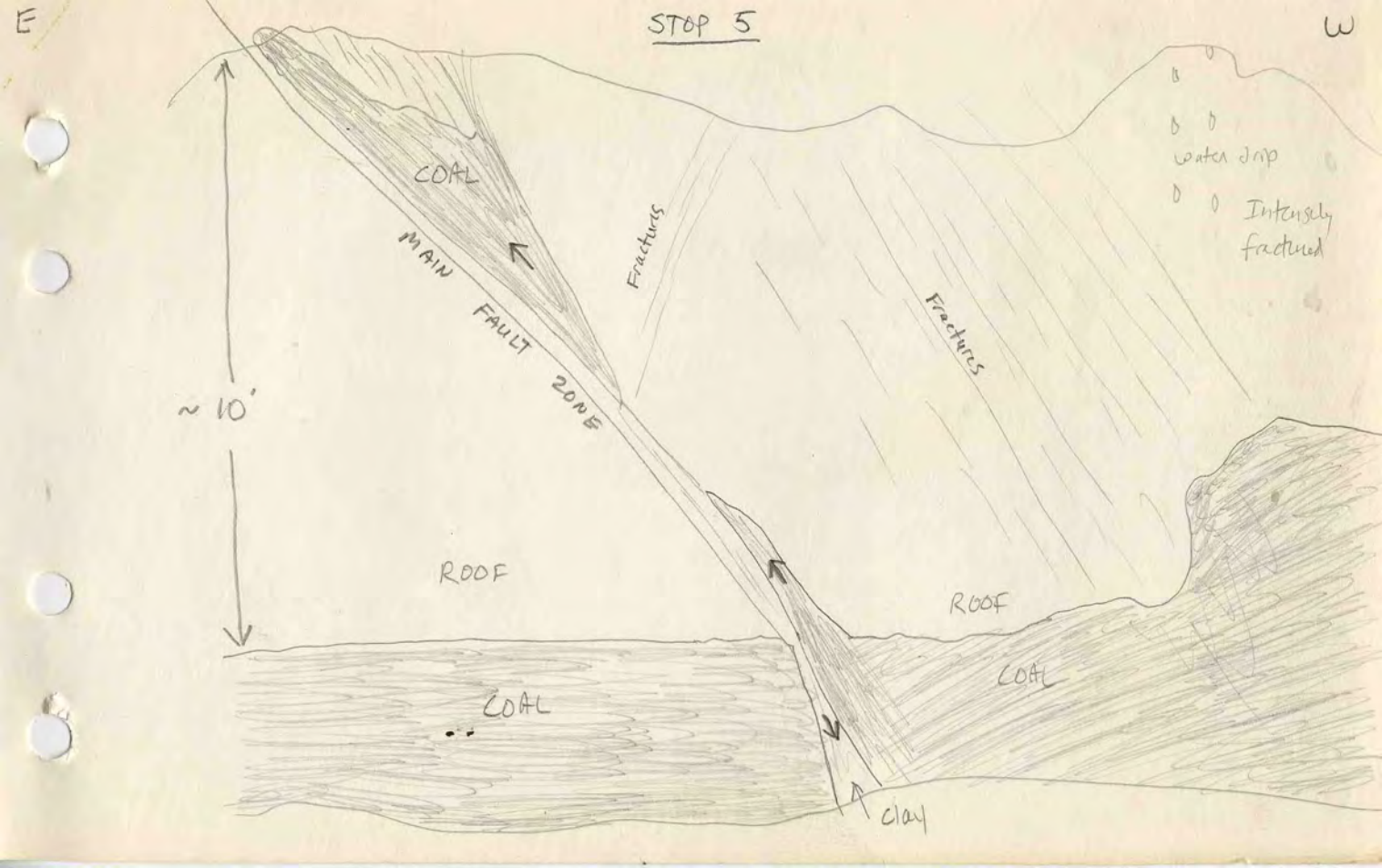
Similar structures have been observed in Zeigler No. 4 (see notes of 10/19/77)

The roof rock is intensely fractured parallel and perpendicular to the fault zone. Roof is very unstable and water is dripping.

STOP 2- VIEW OF NORTH RIB

Not a very good view due to rock dust and high ribs




E
STOP 5
W
COAL
MAIN
FAULT
ZONE
Fractures
Fractures
water drip
Intensely fractured
~ 10'
ROOF
ROOF
COAL
COAL
clay

6. Closely-spaced set of fractures in roof trending 140° cross entry. Very little vertical displacement in them. Slickensides are vertical or steeply dipping. Horizontally strated surfaces roughly normal to 140° faults occur on both north and south ribs.

On north rib strike-slip shear trends about 090° (both strike and dip vary) and plunge of straitions vary from 7°W to 7°E. On south rib there are actually several horizontally striated surfaces with similar variable trends and in addition the coal is crushed and folded. See H-F K. note 3.

7. Major fault zone seems to be turning to a more N-S heading as we follow it south, and its appearance is again greatly changed. Unfortunately the view again is poor due to rock dust and height of entry. A massive roof fall occured in the fault zone, but no water is presently dropping.

The fault zone here is bounded on the southwest by a fairly clear-cut high-angle normal fault with 3-4 feet displacement down to the east. The coal seam is bowed upward through the fault zone but less strongly than at Stops 2 and 5.

Northeast of the normal fault the pattern is very complicated but we can see that the coal and roof shale have been sharply tilted upward until bedding is nearly vertical. At the crest of the fold, the coal is about 10 feet above its normal position. This coal is completely pulverized. A great many SW-dipping fractures continue to the crest of the fall.

The fault zone looks about the same on the south rib; but view is poor.

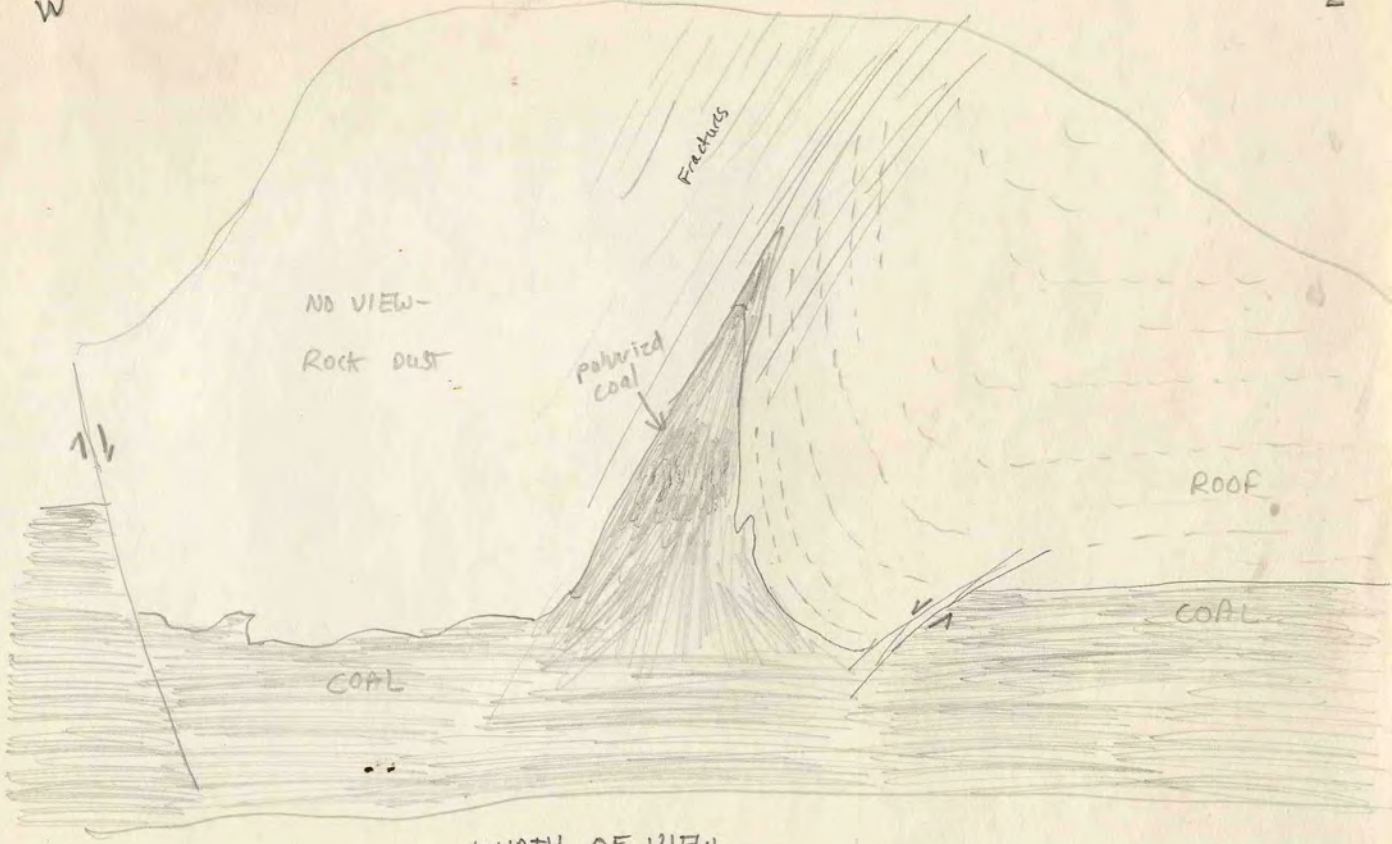
I get the impression that the amount of strike-slip compenent is increasing southward.

In the middle of the fault zone the coal "has gone every which-way". See photos by H-F K.

STOP 7 - NORTH RIB

W

E

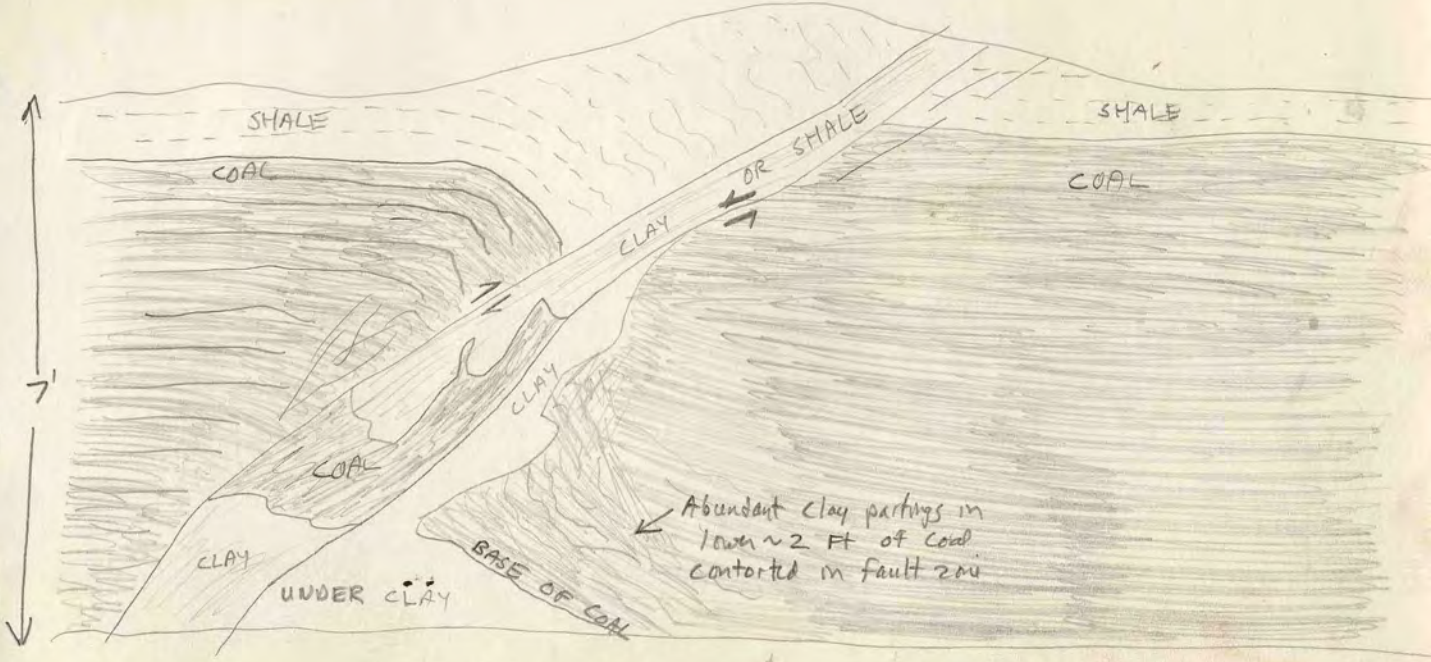


WIDTH OF VIEW
ABOUT 30 FEET

Stop 8 - View of North Rib

W

E



8. Main fault zone abruptly narrows to south, here only 1-2 ft. wide. Trend of fault is roughly 135/55 SW. Overall displacement of coal seam is only about 3 ft. down to SW, but actual deformation pattern is very complex (see sketch). Both normal and reverse faults and undoubtedly horizontal movement, have taken place. On the south rib essentially only one fault plane is present.

The coal is about 7.5' thick in this area, and contains numerous thin clay and shale partings in the lower 2 feet or so. We are not far from the main channel to the east, where the No. 5 Coal is cut out.

9. Large rolls in which the upper half or more of the coal is replaced by siltstone. Abrupt "fishtailing" of coal on either side of rolls indicates coal has been removed by erosion or was not deposited. Large compactional slips are present more or less parallel with the sides of the roll.

The filling material is same as roof - siltstone or silty shale, med-dark gray, hard, poorly bedded, finely micaceous, contains thin discontinuous light gray siltstone intrutions.

Features probably are small distributary channels contemporaneous with coal formation.

10. Large north-facing roll front. Upper part of seam splays out into siltstone, lower part dips downward to north and is continuous. Splitting is apparent on the west rib for some distance.

11. As at Stop 10 the upper part of the coal splays out into sandstone and the lower part dips northward. The coal continues to splay out northward and the entry has been graded into the floor. Near north end of entry (not directly accessible) the coal seams to pinch out entirely.

This part of mine works maybe approaching the big channel. There are no indications (other than roof fractures with no displacement) of tectonic faulting in this vicinity.

Conclusions

The following conclusions drawn after leaving the mine and examining regional maps.

1) The fault system at Stops 1-8 is nearly on a direct line with a large fault in Peabody No. 47 and probably connects with it. (See sketch map, over)

2) The fault system described at Stop 4 on May 26, 1977 probably connects with another fault in Peabody No. 47.

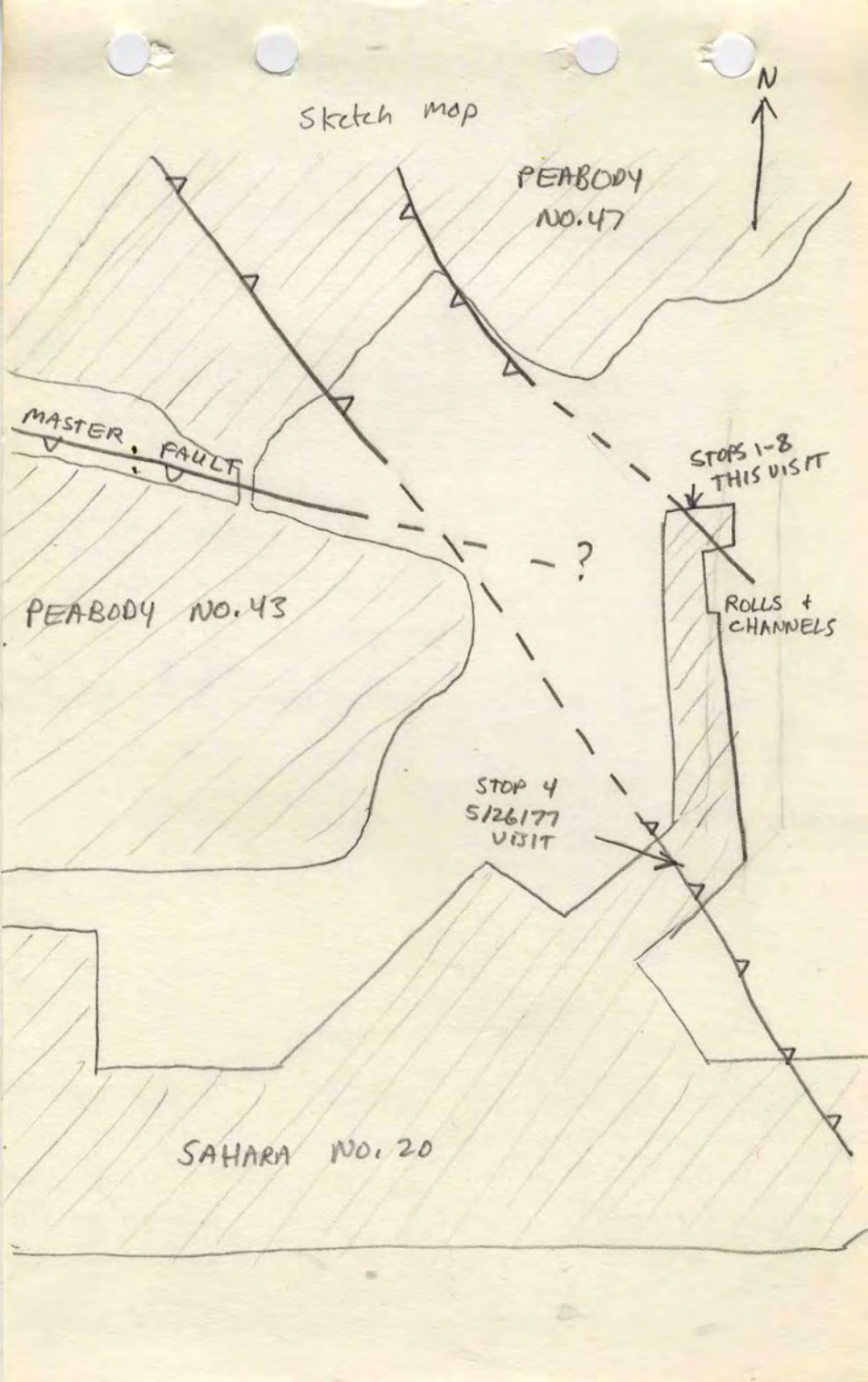
3) There are no indications of the east-west trending master fault that runs between Peabody No. 43 and Peabody No. 47. Possibly it has curved and still lies north of the present workings; however, this appears unlikely. Probably the master fault dies out and the shearing action is taken up along the NW-trending faults.

4) The failure pattern at Stops 1-8 indicate the forces involved are compression at right angles to the strike of the faults (about 050°) and extnesion parallel with the faults. There is a strong component of lateral shear, but the direction and magnitude cannot be determined.

5) The features observed at Stops 9-11 and Stops 1-2 last year are not related to tectonic activity. They are instead products of stream channel activity contemporaneous with coal formation. Some faulting has occured, due to slumping and differential compaction. The mine workings are very close to a major channel in which the No. 5 Coal is cut out. Effects of this channel should diminish rapidly to the west.

POD

6) It should be noted that among the company personnel, only Eric Egli seems to have understood that the faulting and the channeling are two separate and distinct processes. Projecting a mine can be very difficul when such different phenomena are confused and lumped together as "faults."


Sketch map
N
PEABODY NO. 47
MASTER FAULT
STOPS 1-8 THIS VISIT
?
ROLLS + CHANNELS
PEABODY NO. 43
STOP 4 5/26/77 VISIT
SAHARA NO. 20

John C. Moore Corporation, Rochester, N.Y. 14604
FORM 180 W

SAHARA COAL COMPANY MINE NO. 20 SALINE COUNTY

January 16, 1979

Notes of visit by John Nelson with John Popp, accompanied by Fred Borders, surveyor.

Sahara is driving a set of entries southward, through an east-west trending segment of the Cottage Grove Fault System, in order to reach a patch of coal left between the abandoned workings of Sahara No. 7 and Peabody No. 44. See the sketch map and detailed map.

General Description of Faulted Area

Sahara No. 20 mainly lies along the Brushy Anticline. On top of the anticline the coal is level or gently rolling. The north and south flanks are both faulted and are characterized by steep dips. Sahara is now mining down the south flank of the Brushy Anticline.

In this area the crest of the anticline is an abrupt flexure, north of which the coal is level and south of which the coal dips southward at an angle of about 10 degrees. Many fractures and faults occur along and south of the flexure, but very few fractures are seen north of it.

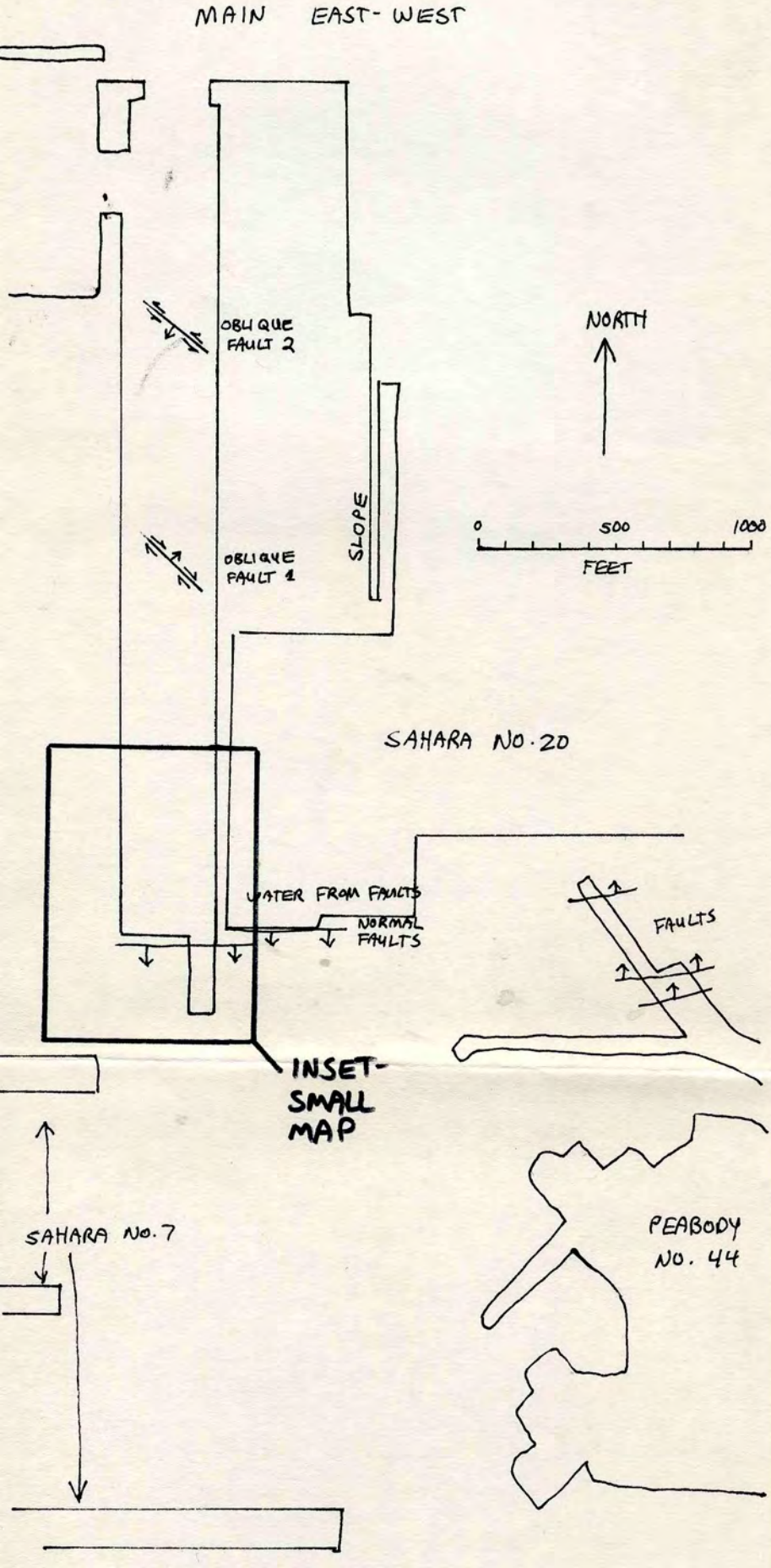
25 to 40 feet south of the flexure is a high-angle normal fault with the south block downthrown at least 6 feet. Two entries have been driven about 150 feet beyond this fault. The entries are graded mostly in the roof rock, entering the coal near the face. At the face several small east-west faults are present, with up to two feet of throw. Beyond the face the dip is known to continue, and more faults are expected.

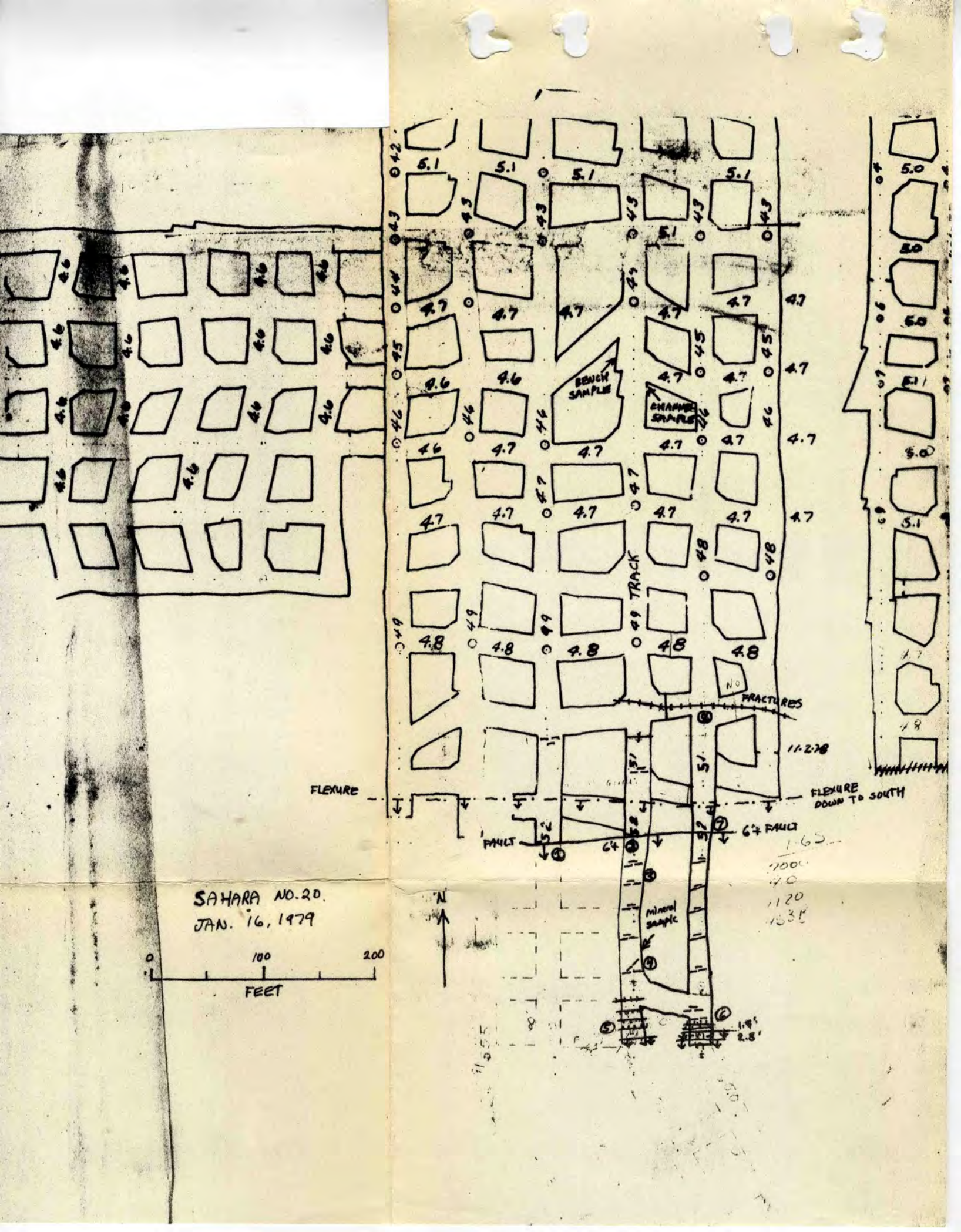
Detailed Notes

See map for locations of stops.

1.) Entry butts against E-W trending fault downthrown to south, and coal begins to pitch down to the south. Fault plane is irregular, with gouge of crushed coal. Slickensides appear to be in dip direction.

General map of faulted area and vicinity, Sahara No. 20, January 16, 1979. See also detailed map.




SAHARA NO. 20.
JAN. 16, 1979
0
100
200
FEET
N
FLEXURE
FAULT
FRACTURES
FLEXURE DOWN TO SOUTH
6'± FAULT
TRACK
BENCH SAMPLE
CHANNEL SAMPLE
mineral sample
11.2.78

North of fault are numerous E-W fractures with little or no displacement.

Coal is fresh and hard and ribs are dusty; rather difficult for study.

2.) Same fault as at Stop 1 has been penetrated here. It trends 085/77 S and has at least 6 feet of throw down to the south. The coal on the east rib is 4.5 feet thick. The coal and rock are locally crushed within one foot of the fault, but the plane is very sharply defined and, in most places, is planar. Near the top of the coal seam the fault plane is locally irregular. The fault lies near the center of a 5-foot wide zone of parallel fractures.

Slickensides are visible but are not very prominent. There are poorly-defined low-angle striations and mullion plunging eastward, and better-defined fine vertical slickensides. The latter appear to be more recent. The striations indicate at least two stages of movement here.

The fault is geometrically a normal (gravity) fault but the first set of slickensides and mullion suggest left-lateral movement.

The fault lies about 20 feet south of the sharp flexure in the coal. South of the fault the entry is graded through the roof (Dykersburg shale).

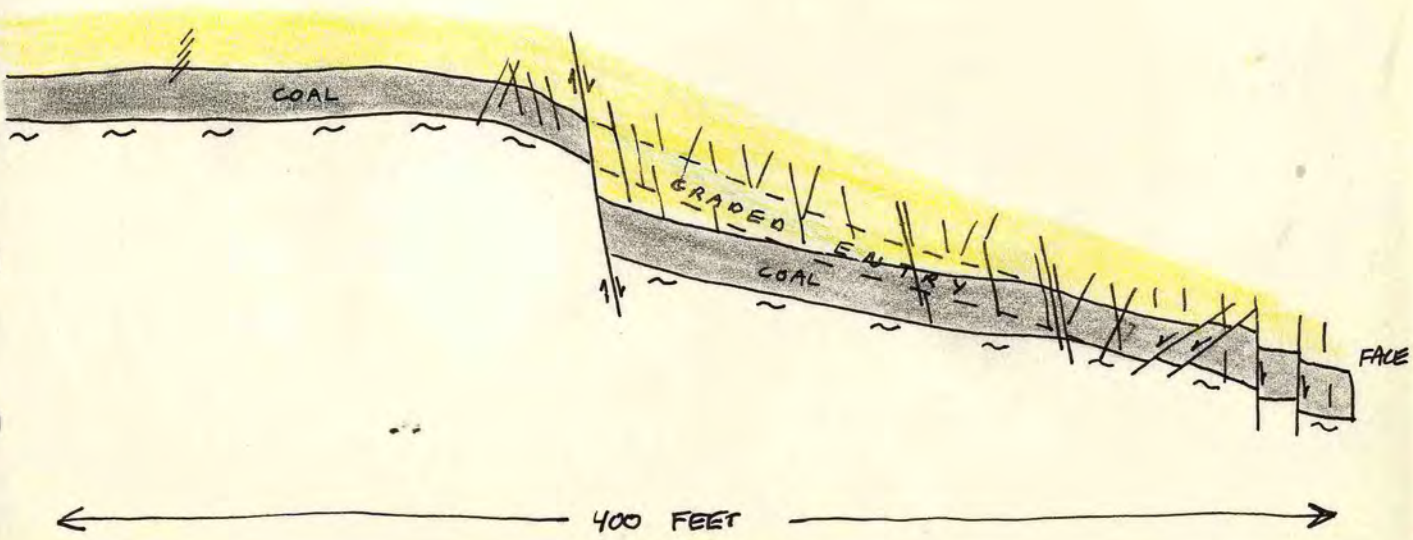
3.) Entry here is graded in roof south of fault. The roof is shale, medium-dark gray, hard, indistinctly laminated, silty, and finely micaceous. The shale dips southward at less than 10 degrees, but the entry is graded at a higher angle in order to re-enter the coal.

Numerous steeply-dipping fractures or small faults in the rock trend 080-100. They have very straight planes and no visible slickensides. It is impossible to tell if any movement has occured because the shale is so uniform, but they look like simple tension fractures. Collected a sample of white mineral, probably calcite, filling one of the fractures which trends 085/75 S.

NORTH

SCHEMATIC CROSS-SECTION OF
FAULT ZONE IN SAHARA NO. 20
JAN. 16, 1979

SOUTH



4.) Entry still graded in roof, with about 2 feet of the upper part of the coal exposed at the base. Two sets of fractures seen; the more prominent trends 083 and has filling of a white mineral (probably calcite), and the other set runs 043 and has no mineralization. Neither set shows slickensides or measureable displacement. The 083 set occurs is tightly-spaced bundles. The 043 set consists of widely-spaced individual fractures resembling ordinary joints. All fractures are generally straight and planar, but in places they may branch or curve slightly. One big calcite-filled fracture trends 072 and, like the others, shows no measureable displacement.

5.) Face of entry. A large number of small faults offset the coal and roof rock. The trends of faults vary but most are nearly east-west. Dips range from about 40 degrees to nearly vertical. Some are downthrown to the north, some down to the south; the coal still is dipping southward at 10 degrees or slightly less. Throws on faults range up to about one foot. Slickensides are hard to see, but where present, run in dip direction.

Fred Borders tells us that Sahara has mined against this system of faults in several places, but this is the only spot where no water was encountered. At all other places much water flowed out along the faults and the company did not try to mine through.

Along the west rib very near the face are several fractures trending 025 and filled with a white mineral, which was sampled.

6.) The same zone of faulting in the next entry to the east. Some of the faults are larger here; measured one with 1.9 feet of throw and another with 2.3 feet, both down to the south. All are normal faults. Most of the south-dipping faults are high-angle, and the smaller north-dipping faults are more gently inclined and seem to trend a little more north of east than the south-

dipping fractures. With the faults are closely-spaced bundles of fractures, along which coal and rock are broken or finely pulverized. Most fault planes are straight and planar.

In spite of the fractures the roof is very solid, and almost no slabbing has occured.

7.) The large fault of Stops 1 and 2 here appears much the same; a high-angle normal fault down at least 6 feet to the south. Small slices of pulverized coal are seen along the fault. No slickensides observed; coal is pulverized and shale reduced to a sticky clay along the fault.

Just north of the fault the coal dips southward at 11 degrees. The flexure is about 20 feet north of the fault. North of the flexure the coal is nearly horizontal and has very few fractures.

8.) This line of fractures is the only significant structural feature north of the flexure. It is a narrow zone of subparallel fractures trending about 102. The fractures are closely-spaced, generally have shallow dip angles, and show slickensides in dip direction.

Bench Samples

See map for location. Eight equal benches were taken, each about 7 inches thick. The samples are numbered 1 through 8 from top to bottom.

Description of Strata

Roof- Shale (Dykersburg), medium-dark gray, hard, poorly bedded, faintly laminated, very silty, finely micaceous, finely carbonaceous, with no identifiable plant remains. A few small oxidized pyritic nodules and occasional thin stringers of coal are present.

4.6' Coal (Harrisburg No. 5), N.B.B., very hard, not blocky, a fresh face. No significant bands or partings; nothing excluded from samples. Occasional thin, discontinuous lenses of fusain. Cleat poorly developed; main direction is 045, with fillings of white calcite occasionally bordered by pyrite. Calcite also on other irregular vertical surfaces (butt cleat ?). Finely crystalline pyrite is fairly common, especially along a small slip in Bench 4 and a nodule in Bench 5. Coal is slightly softer near base.

Floor- Claystone, olive gray, moderately hard, silty, finely carbonaceous, some plant debris, minor oxidized pyrite, many slips.

Channel Sample

Channel sample was taken about 50 feet away from bench samples (see map). Coal 4.7 feet thick, appears same as at bench sample locality, except that lower 0.5 feet is rather shaly and thinly bedded. Stringers of coal extend into underclay. No exclusions from sample.

Northwest-trending Faults

A northwest-trending fault, with parallel fractures crosses the track entry about 1000 feet north of the place where the channel and bench samples were taken.

The fault trends 132/55 NE and the northeast block is downthrown about 0.9 feet. Geometrically it is a normal fault. Rather indefinite slickensides and mullion plunging about 20° to the southeast indicate a component of right-lateral movement considerably larger than the vertical movement.

The striations and mullion are found all along the fault in both the coal and the roof. The angle of plunge varies but the direction of dip is consistent. Locally faint slickensides trending in other directions are seen.

In the belt entry the fault splits into several smaller faults, all of which are downthrown to the northeast. The grooves and striations are quite prominent and range from horizontal to a shallow plunge to the southeast, as above.

Another 900 feet farther north (just south of crosscut 14) a second set of northwest-trending faults crosses the track entry. The largest fault strikes 135 and the southwest block is downthrown 0.9 feet. In the roof the plane is very straight but in the coal the fault splits into many fractures, some of which turn horizontal and merge with bedding planes while others cut obliquely through the coal at various angles. It is not possible to show any vertical displacement below the top few inches of the seam.

Several sets of slickensides, locally superimposed, are seen along the fault plane in the roof. The most common and prominent direction plunges southeast at a fairly high angle. These striations indicate roughly equal components of normal and left-lateral movement.

Towards the southeast, in the crosscut, the fault curves to a more southerly heading and splits into several branches. The largest branch again has mullion and slickensides plunging southeastward, indicating oblique left-lateral movement. The faults are seen only in the roof; they divide into many branches downward.

Definite drag-folding is visible in places along the main fault, and it confirms a combination of normal and left-lateral movements.

In the crosscut northwest of the track entry the fault trends 141 and again the grooves plunges toward the southeast. The amount of vertical offset at the top of the coal is very persistent, slightly under one foot. As before, the fault splits in the coal.

In the belt entry (west of the track entry) the fault branches along strike but maintains the same overall vertical displacement. Several sets of slickensides are seen, locally superimposed.

Northeast of the main fault are several smaller faults striking parallel with it. One of these faults is apparently a simple normal (gravity) fault, with the northeast side down and slickensides running in dip direction. This fracture extends through the coal seam in a fairly straight line; it does not branch like the larger fault. Most of the smaller faults seem to be simple normal faults, but there is no time for a detailed study.

Summary and Conclusions

Movement on the east-west trending faults in the south part of the mine was predominantly vertical. Strike-slip movements, if they occured, were only minor and incidental. The only indication for horizontal movement is indefinite slickensides at Stop 2. The east-west faults are all normal faults, signifying extension. Quite likely they are secondary to the folding that produced the Brushy Anticline.

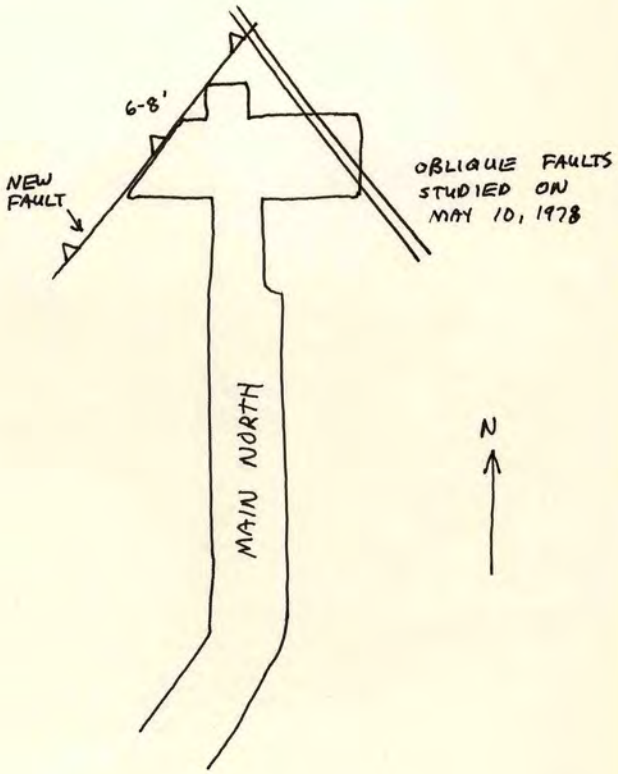
The northwest-trending faults, on the other hand, show strong evidence for horizontal or low-angle oblique displacements. As such, they are typical of the northwest-trending subsidiary faults in the Cottage Grove Fault System. Some of the smaller northwest-trending fractures may be secondary to the primary oblique-slip faults.

Location of Bench & Channel Samples

Approx. 800' north of the southeast corner of Section 9, T.9S-R.5E, Saline County.

ADDITIONAL NOTE

In the office Eric Eggli, chief engineer for Sahara told us that in entries driven west off the Main North they encountered a fault trending NE-SW with 6-8 feet of throw down to the northwest. This fault intersects the NW-SE trending oblique faults studied by us last year (see sketch below). Because of these faults and the large rolls encountered in the same area, Sahara has abandoned the heading.



SAHARA COAL COMPANY, NO. 20 MINE, SALINE COUNTY
January 16, 1979
Notes by John Popp on a visit with W. J. Nelson and Fred Borders, surveyor for Sahara.

Purpose of the visit is to examine faults in the southeast mains off the slope bottom and to collect bench and channel samples. The mains have crossed the faults in two entries. See Nelson's notes for a reference map. My notes are numbered according to Nelson's stops.

2. Fault face
The fault is trending 085°/77°S and is a normal fault (down to the south). Slickensides are present along the fault plane and are both horizontal and vertical. Offset along the fault is indeterminable. The entry has been graded downwards as well as through the overlying Dykersburg Shale.

Fractures and joints are present outby to the north, and their trend is similar to the fault. Fractures, joints, and the faults do not have a severe affect on roof stability, and no falls are present. Neither is there much water other than a drip or two.

A gouge zone is present at the fault, and the gouge extends about 2.5-3.0' into the coal with the coal being pulverized at the fault and becoming increasingly hard away from the fault. The silty shale is likewise pulverized up to about 1.6' from the fault. A second small fault (displacement is not measureable) is 1.6' away from the main fault, and beyond the second fault the shale is unaffected. The shale is gouged to a sticky clay in the fault, and little, if any, mineralization is present. The actual fault plane cuts the rock very sharply - there is little mixing of shale and coal.

4. Fracture zone

A series of fractures is present in the roof, two directions being more or less prominent at 072° and 083°. These two directions are distinct. A third direction is less well defined at about 088°. Mineralization is present in some of the fractures in the form of calcite.? The fractures are not definitely correlated with any fractures in the coal.

Fred reports that total displacement along the fault zone in this area is about 40-41 ft.

5. Face Area

This area is now idle while mining is working to the west to nick the fault. At this location several small displacement faults are present with displacements as much as one foot. Most of the faults are dipping to the south; however, a few are low-angle (35°) and dip to the north raising the coal to the north.

Nelson reports additional fractures at 025°, and they too are filled with the white mineral (calcite).

It is noteworthy that the roof in this area is stable in spite of the high density of fracturing and faulting. The area is not wet even though in going through the faults the entries were graded downward. No additional gas was encountered in this area. Because the top is good and because the area is dry Sahara will continue south to get to a remaining block of coal. At other places where they mined up against this fault they were forced to stop by excessive water and bad top. In going to the south Sahara is approaching their old No. 7 mine.

6. Next entry to the east

This entry also grades through the fault to the down-faulted coal. Several faults are again present as to the west, however, these faults appear to have somewhat greater displacement. The north dipping low-angle fault (35^{o}) is present, displacment is 0.65', and is trending at 100^{o}. Two south-dipping faults are trending closer to east-west (095^{o} and 087^{o}), and they have displacements of about 2'.

The gray silty shale appears to be pretty uniform in composition although one can't get a good look at it because of the rock dust. It is medium gray to dark gray, has a white or light gray streak, and is firm and pretty well bedded. It contains occasional plant fragments.

On the ride out we stopped to examine several small displacement faults. Nelson took detailed notes and plotted their locations. Both faults show a greater tendency to strike-slip movement than did the master fault seen at the previous stops. Horizontal to oblique slickensides and moullion grooves dip to the southeast, which corresponds to the trend of the faults ($\sim 138^{o}$)

SAHARA COAL COMPANY - NO. 20 MINE
SALINE COUNTY
JANUARY 16, 1979

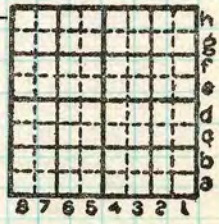
Shale, Dykersburg, up to 40'+. we saw at least 8-10' in the immediate roof, medium gray to dark gray, firm, silty, very slightly carbonaceous (w/ plant fragments) and micaceous.

Coal, Harrisburg (No. 5), 4.8', n.b.b. apparently free of much parting or mineral matter.

Underclay, 1.5'+, dark gray to greenish gray, slickensided.

Sahara Coal Co. Mine #20
Description of bench samples taken
in the mine by J. Nelson.

Bench 1	(Top of No. 5 seam)
CP2088 C20500	Clarain, dull, rare fusain partings. Pyrite (brassy) on cleat. Encrusted verticle joint with fine grained cc and Fe-stained. Occasional shale parting; 2 mm thick. One 3/8+ shale parting (excluded specimen) that was very fine grained pyritic.
B2 CP2089 C20501	Clarain, moderately thin layered vitrain layer 1 cm with cleats: a) unmineralized = dull b) mineralized with kaolinite and rosettes of pyrite = specimen in pyrite, random pieces = minor to trace amounts.
B3 CP2090 C20502	Clarain, dull, dusty coal, blocky, typical attrital coal fracture, sparry calcite on cleat. fusain, ≤4 mm trace of kaolinite and pyrite rosettes on cleat.
B4 CP2091 C20503	Clarain, with fine laminations. Fusain layer: 2 mm and on several other partings. Sparry calcite on cleats, pyrite (less abundant than calcite) on cleat; and pyrite and fusain layer ≤3 mm. One rough verticle surface with calcite (fine granular) with pyrite(?). Specimen taken to check this. Also bottle of calcite from cleat surface.
B5 CP2092 C20504	Clarain, with numerous vitrain layers ≤1 mm. Fusain as ≤1 mm layers and partings. Calcite (sparry) on cleat pyrite, minor amount of cleat.
B6 CP2093 C20505	Clarain. Shale, black parting (one, possibly 2). Fusain partings = minor pyritized shale(?) as layer or lense ≤15 cm. Possibly a lenticular nodule (not excluded). Calcite spar and lesser amount of pyrite on cleat.



By F. Fiene and R. Harvey Date 2/7/79

Quadrangle

County Saline Sec. 10 T 9S R 5E

B7 CP2094 C20506 Clarain (one 1 mm vitrain layer). Fusain on fine parting. Calcite patches of 4-6 mm, $\leq$1 mm thick. On few bedding surfaces no pyrite observed.

B8 CP2095 C20507 Clarain, fusain partings abundant, calcite on cleat and on some bedding planes with fusain. Pyrite-trace (cleats) and with fusain on parting. = trace too.

SAHARA COAL COMPANY MINE NO. 20 SALINE COUNTY
February 29, 1980
Notes by John Nelson on visit with Steve Danner. Accompanied by Thurmond "Pink" Gulley, superintendent of the mine, and Terry Guest, surveyor.

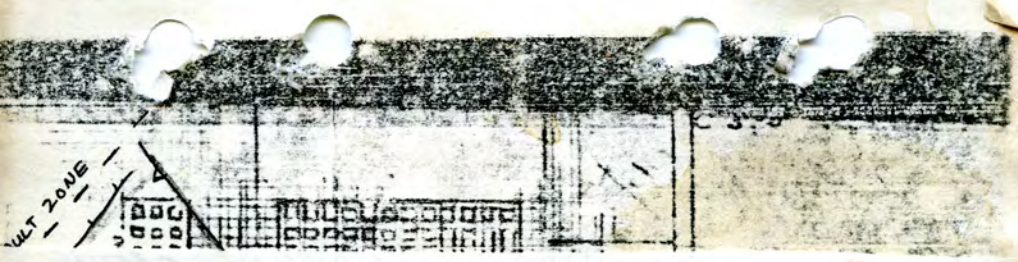
Purpose of visit was to examine faults exposed in far north workings since our previous visit. See map (attached). There are two sets of faults which intersect just north of the mined area. One set, which was seen earlier, trends NW-SE. The other set, which has not been crossed, trends NE-SW.

1.) Face of southernmost entry butted into NE-trendin faults. Clearly visible outby the face is a normal fault striking NE, dipping about 45 degrees to NW and downthrown about 8 feet, a little more than the thickness of the coal. The dip of the fault varies quite a bit. No drag is apparent and the coal is cut cleanly. There is a zone of pulverized gouge 1-2" thick. The hanging wall is all Dykersburg Shale intensely fractured and locally brecciated. The bedding is widely destroyed in the shale, which is olive gray, silty, micaceous.

The fault here has very indefinite slickensides with a hint of horizontal (strike-slip) movement.

West of the fault the roof has fallen about 30 feet up and 30 feet ahead (see sketch). Near the top of the fall is a layer of coal, several feet thick, dipping steeply to the west and overlain by dark gray or black shale, with more olive shale above that. The coal is thoroughly pulverized. Mr. Gulley climbed up and obtained a sample for us. There is obviously one or more large faults west of the 8-foot normal fault. The coal seen in the roof fall most likely is No. 5 Coal. In any case there have been large displacements, probably with a component of reverse and/or strike-slip movement.

2.) Face of 2nd entry inaccessible due to deep water.

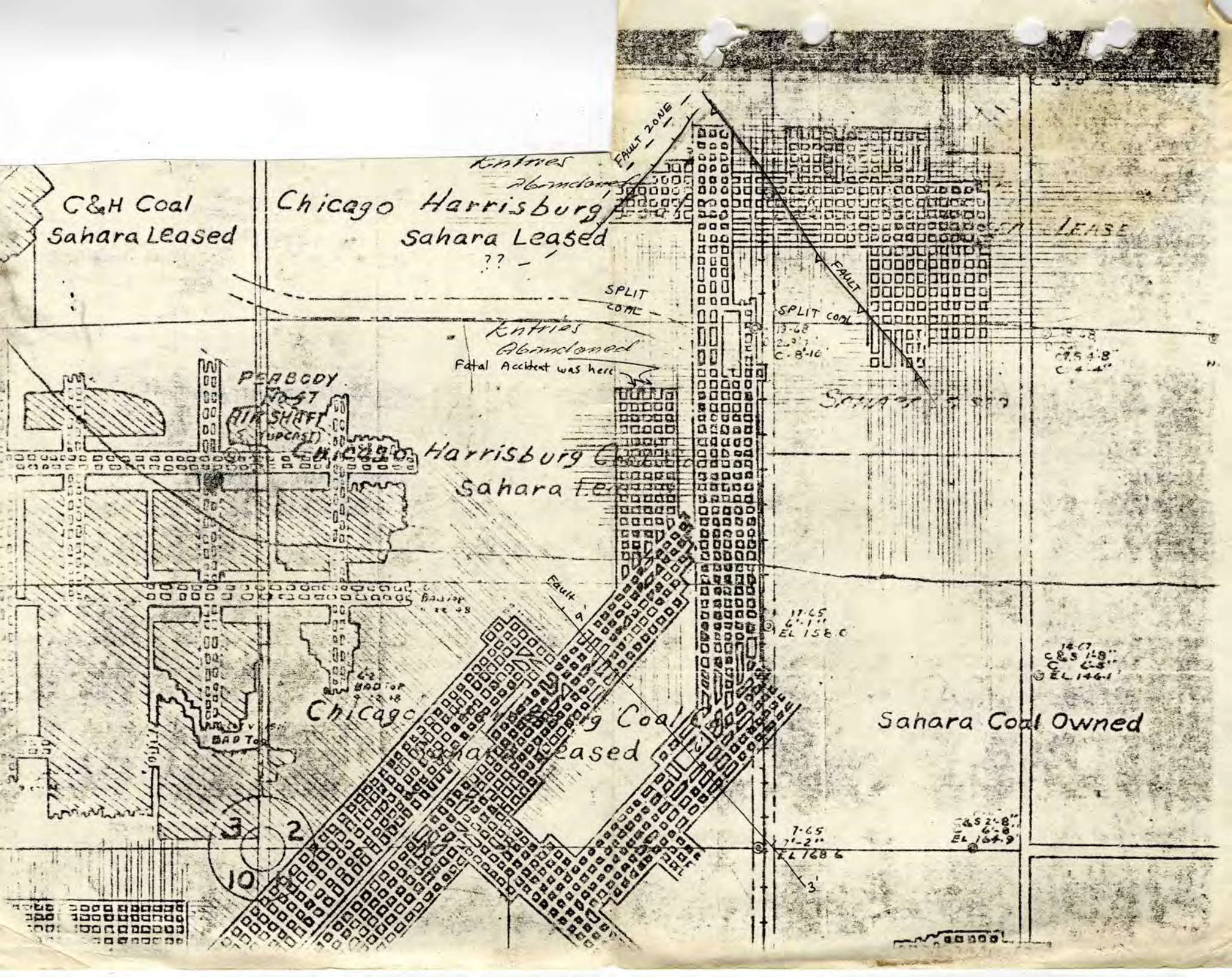


GENERALIZED MAP

1" - 400'

NORTHEAST WORKINGS

SAHARA NO. 20

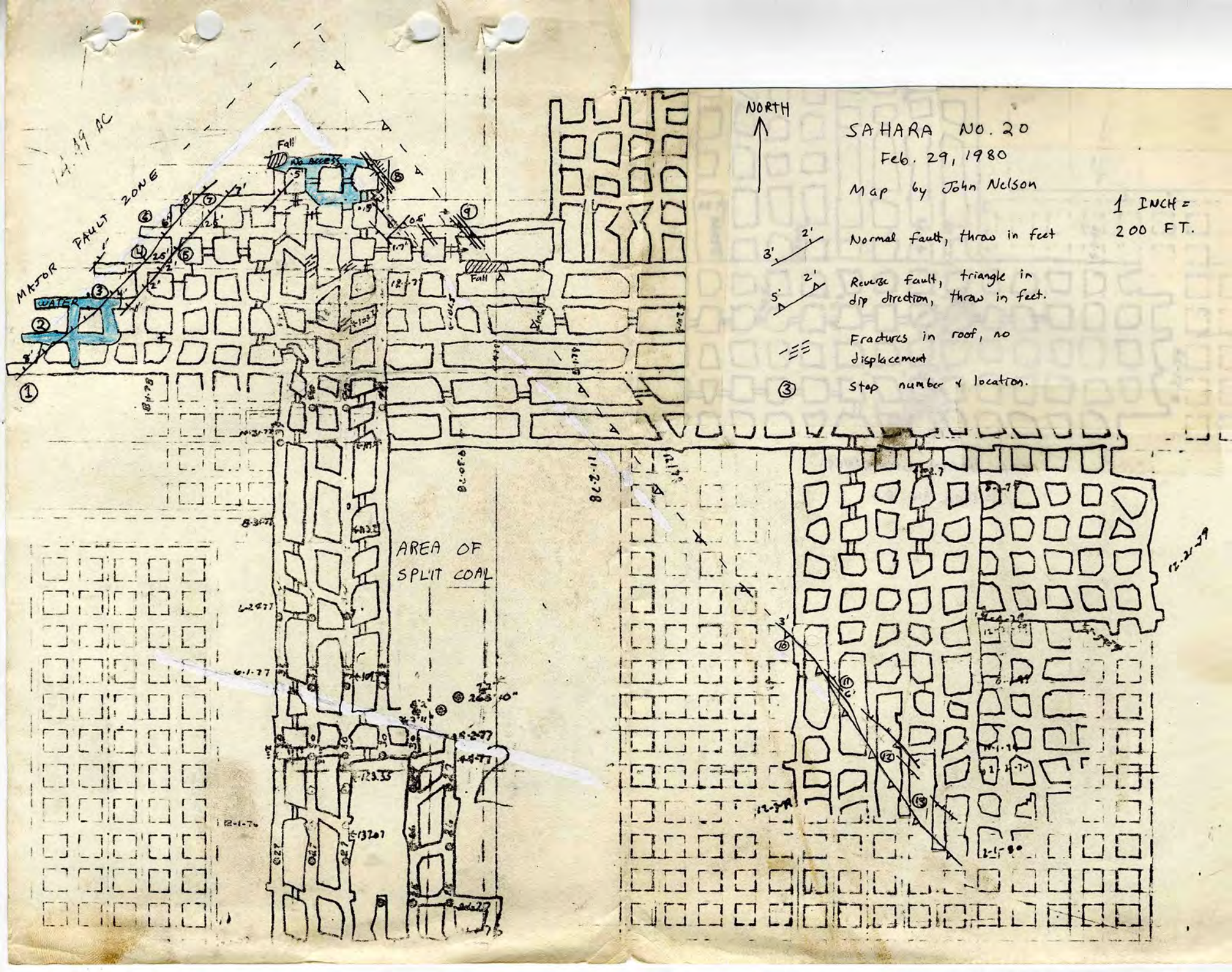

C&H Coal
Sahara Leased
Chicago Harrisburg
Sahara Leased
??
Entries Abandoned
FAULT ZONE
SPLIT COAL
Entries Abandoned
Fatal Accident was here
FAULT
SPLIT COAL
PEABODY
AIR SHAFT (UPCAST)
Chicago Harrisburg
Sahara Fe
Fault
Chicago
Sahara Coal Owned
3
2
10

FIELD MAP

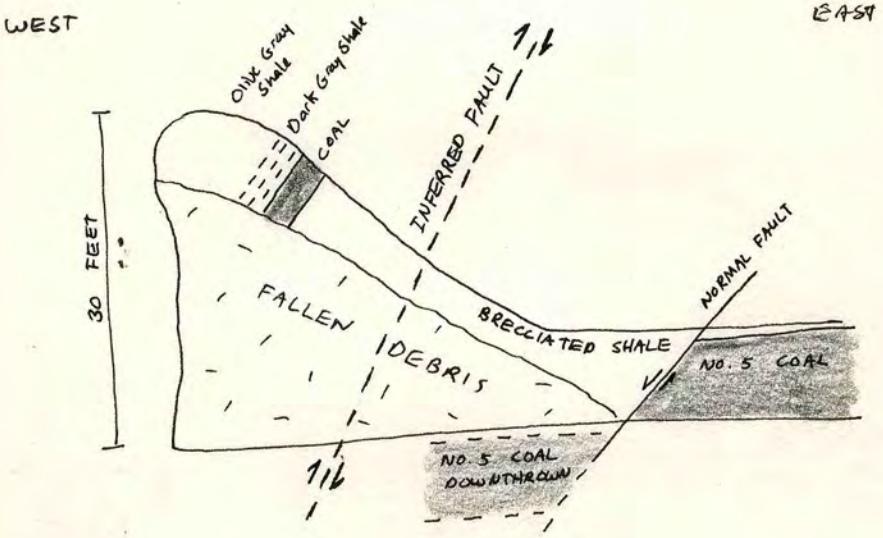
1" - 200'

FAR NORTH WORKINGS

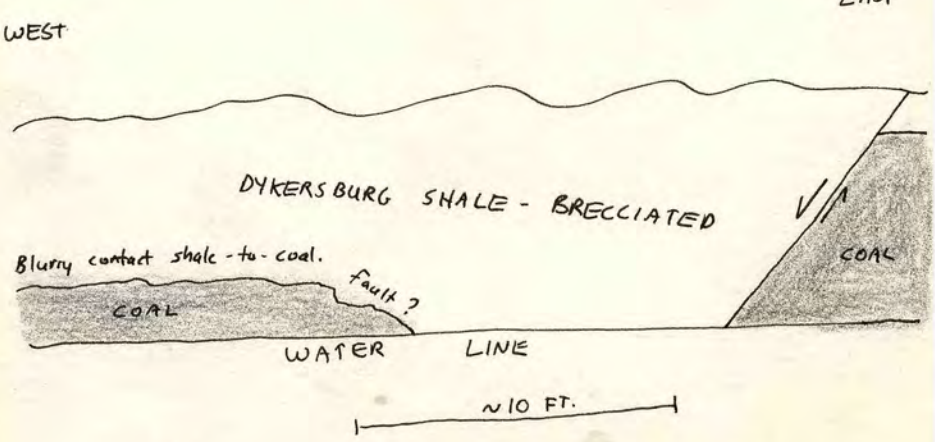
SAHARA NO. 20


NORTH
SAHARA NO. 20
Feb. 29, 1980
Map by John Nelson
1 INCH = 200 FT.
Normal fault, throw in feet
Reverse fault, triangle in dip direction, throw in feet.
Fractures in roof, no displacement
Step number & location.
MAJOR FAULT ZONE
WATER
Fall
No Access
AREA OF SPLIT COAL

STOP 1
CROSS-SECTION



STOP 2
VIEW OF NORTH RIB



The normal fault from Stop 1 is diminishing in displacement toward the northeast; here we can see the top of the coal on the downthrown side. Again the shale on the hanging wall is fractured to brecciated, with most bedding obliterated. The coal visible on the north rib, above the water line, is cut by a fault with very blurry plane-see sketch (over).

3.) Third entry also blocked by deep water. The normal fault here has 4-5 feet of throw and the rocks on the downthrown side are not as thoroughly sheared and brecciated as before. No view much beyond the normal fault.

I believe the brecciation of rock west of the normal fault must be the result of movement on other, larger faults ahead of the face.

4.) Continuation of normal fault northeastward. On the south rib it has less than a foot of total offset and multiple fractures are dipping 45 degrees to vertical, some with the southeast side downthrown. The fault traces across the roof as a wide zone of steeply dipping fractures. On the north rib the fault again increases to 2.5 feet throw and intersects a SE-dipping fault with 0.6' throw, forming a small graben. A number of lesser faults are also present. West of the zone the shale is fractured but not totally brecciated. The coal is also intensely fractured to the point that the coal-shale contact, and minor faults offsetting the coal, are quite blurry. Near the face the coal is crushed but is solid, probably due to mineralization. Calcite-filled "goat beards" are seen. Some bedding surfaces in the roof have slickensides. Certain layers in the coal show crushed and rotated fragments probably signifying slippage along the bedding planes.

5.) A second normal fault parallel and en echelon with the first one. Its structure is similar to that of the first fault; moderate dip angle on main fault

accompanied by numerous high-angle fractures with little or no displacement. The fault increases in throw toward the northeast. Definite dip-slip striations are present along the fault surface on the east rib of the cross-cut. Details are hidden by rock dust.

6.) The first normal fault is increasing in throw to the northeast; it has 5 to 6 feet of offset on the north rib. View at the face of the entry is blocked by a large fall. In the crosscut north off the 5th entry the fault has at least 8 feet of throw; the entire thickness of the coal is offset and only shale is seen on the downthrown block. Several sets of striations are present on the fault surface. All plunge steeply (nearly in dip-slip direction).

7.) Face of 6th Entry blocked by large roof fall. The first fault is visible but cannot determine its throw. The second fault has increased to 7 feet of throw and maintains a dip of about 45°, with prominent dip-slip striations.

Conclusions on Northeast-Trending Faults

These northeast-trending faults do not fit the expected pattern of faults in the Cottage Grove Fault System, but I believe we have seen only the edge of a zone of faults; and if we could see the whole zone it might make better sense.

The visible faults are moderate-angle normal faults with the northwest side downthrown. In some respects these faults resemble compactional faults more than tectonic structures. However, the presence of intense high-angle fracturing, and brecciation of coal and shale, indicates tectonic movement. It is remotely possible that the normal faults were initially formed through differential compaction, and later re-activated by tectonic movement. Yet there is no indication here

of any sedimentary discontinuity which could produce compactional faults of this magnitude.

Simple horizontal extension should produce normal faults dipping 60 degrees or higher. Since these faults dip about 45 degrees, the extensional forces responsible for them evidently were not horizontal.

There is clearly a large fault or faults ahead of the face. Part of this could be seen at Stop 1. The larger fault is not a normal fault, but may be reverse (or more likely I think) oblique-slip. It may even be a segment of the "master fault", which was believed to be discontinuous in this area. However, it would be difficult to explain why the master fault has assumed a heading of northeast in this area. Nowhere else in the fault system does the master fault trend northeast.

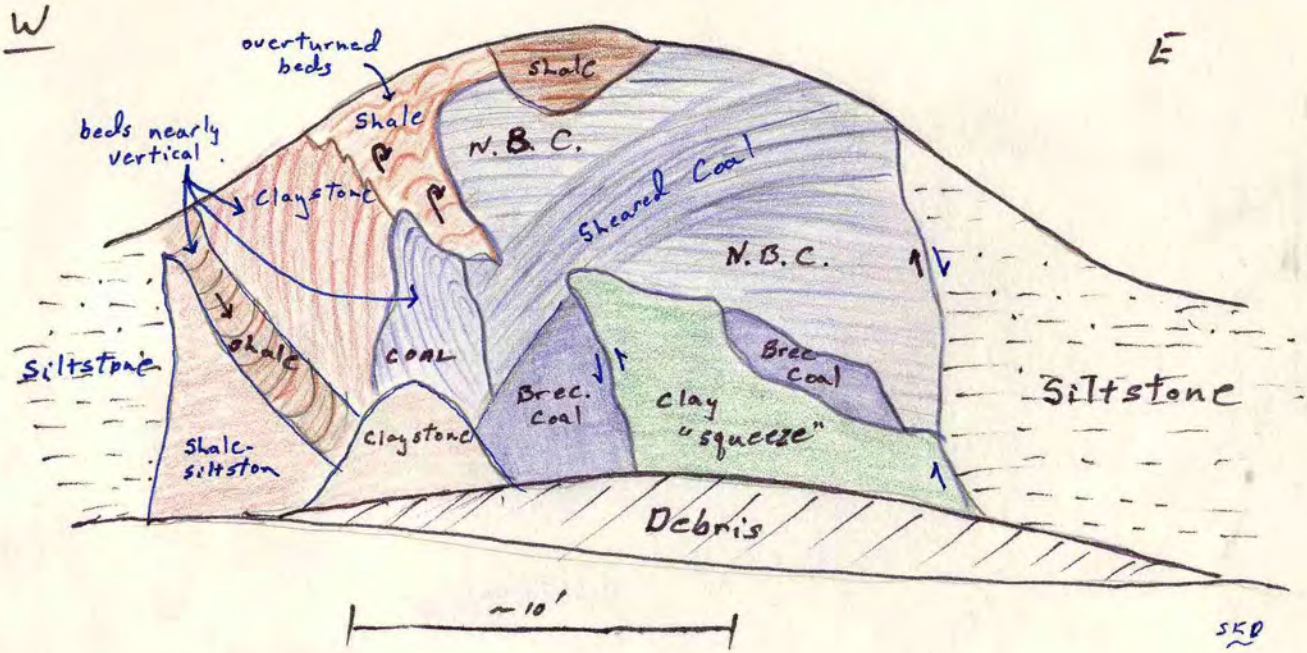
The fault zone either dies out rapidly to the northeast and southwest, or it curves strongly at both ends. No faults were seen with this trend in Peabody No. 47 or in the part of Sahara No. 20 that lies on line with the fault to the southwest.

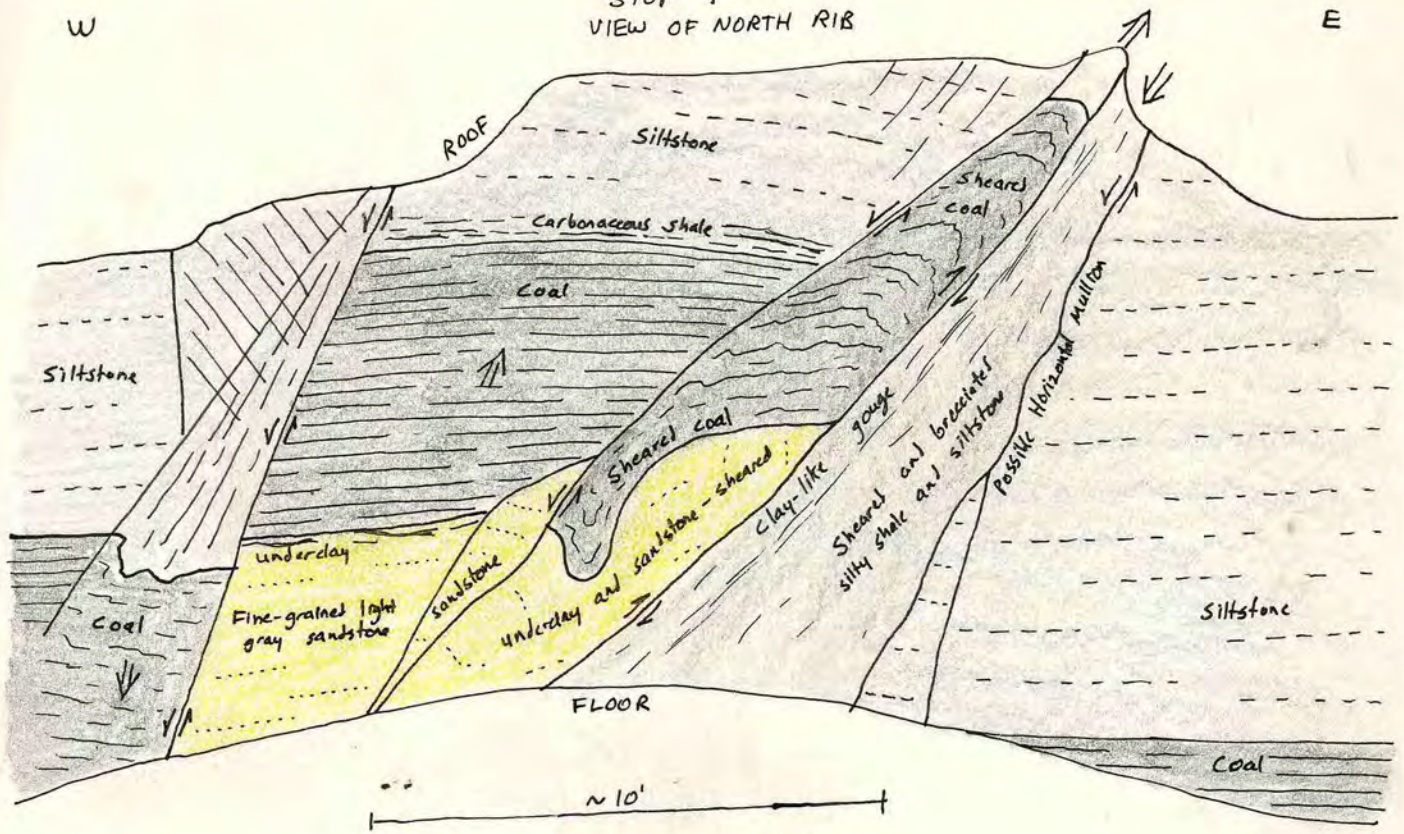
8.) Two sets of fractures- northeast and northwest. We are just south of the point of intersection of the two fault zones. The stronger set of fractures here are high-angle northwest-trending fractures with dip-slip striations but little apparent offset. Several of these have formed a "coffin cover" roof fall at the intersection. The northeast-trending fractures have no slickensides or visible offset, but several of them in the roof are filled with calcite up to 0.02' thick.

9.) Sketch of main northwest-trending fault zone on north rib. This is same exposure sketched at Stop 2, May 10, 1978. (I didn't realize that at the time I was sketching). Difference in structure between two drawings is due to material that has sloughed off the rib since 1978.

Steve sketched the faults on the south rib; the structure there is even more complicated.

Stop 9 ... view of south rib




STOP 9
VIEW OF NORTH RIB
W
E
ROOF
Siltstone
Carbonaceous shale
Coal
Sheared coal
Siltstone
Sheared coal
Clay-like gouge
Sheared and brecciated silty shale and siltstone
Possible Horizontal Mullion
underclay
Fine-grained light gray sandstone
coal
sandstone
underclay and sandstone - sheared
FLOOR
Siltstone
Coal
~ 10'

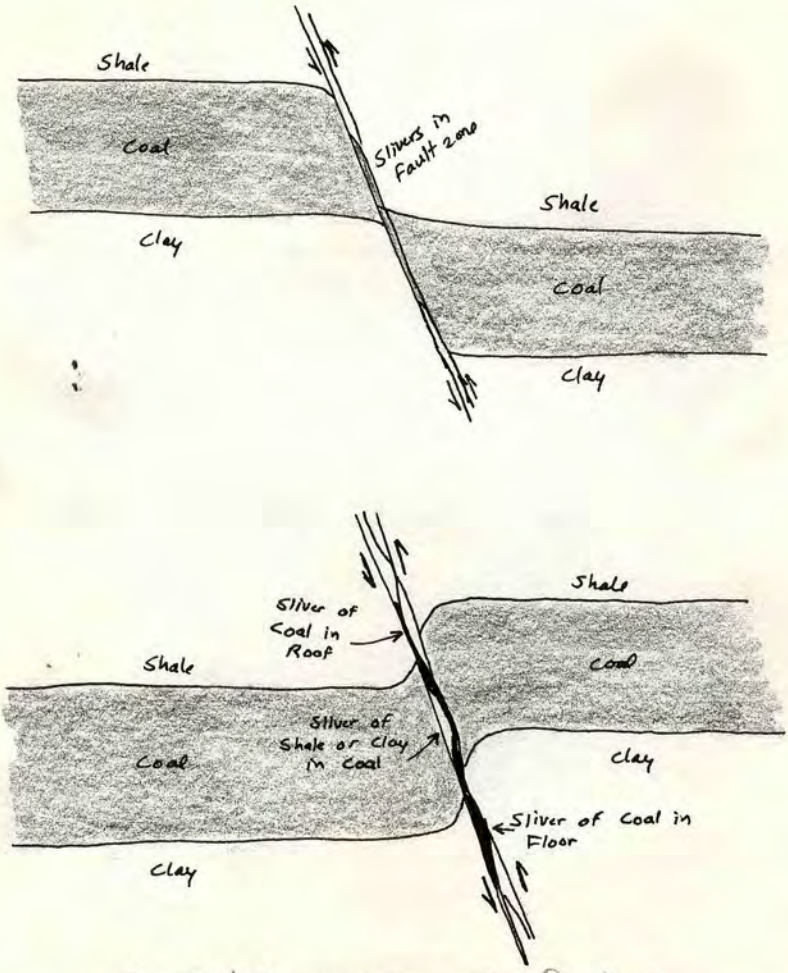
10.) Same fault as at Stop 9, here seen in the westernmost entry of the new south headings. The fault zone is narrow; only a few feet wide, and the main faults dip 50-60° southwest. The southwest side is upthrown 2-3 feet, making it a reverse fault, and the coal is sharply folded in drag consistent with reverse faulting. But a large sliver or slice of soft light gray clay is present along the main fault, with coal on either side. Also pulverized coal is present along the fault plane in the roof, with shale on both sides. This is especially well seen on the east rib. Thus at least two stages of movement must have occured on this fault. First the southwest side moved down, making a normal fault, and later the southwest side moved back up, making a reverse fault. Drag from the first stage of movement, if any had been present, was obliterated by later movement. See sketch (over).

11.) Same fault zone seen in 2nd entry from the west. Poor view due to rock dust, but can see that at least two faults, diverging toward the southeast, are here. Both are high-angle reverse faults with the southwest side upthrown. The northern one has about 6 feet of throw and the southern one has almost no offset but a sharp flexure indicating a final stage of reverse movement. Intersecting the northern fault is a small normal fault dipping 45° to the southwest.

The coal is about 8 feet thick in this area but has a high content of clay partings, especially in the upper two feet or so. The coal also has closely-spaced fractures. There is certainly a possibility that more splits will be encountered as they work southward.

12.) Fault zone in 3rd entry from west; good exposure on east rib (sketch). The west rib is so heavily dusted that little can be seen.

The zone as a whole has almost no offset in the coal. The larger fault has very strong drag on both footwall and hanging wall; beds are overturned in

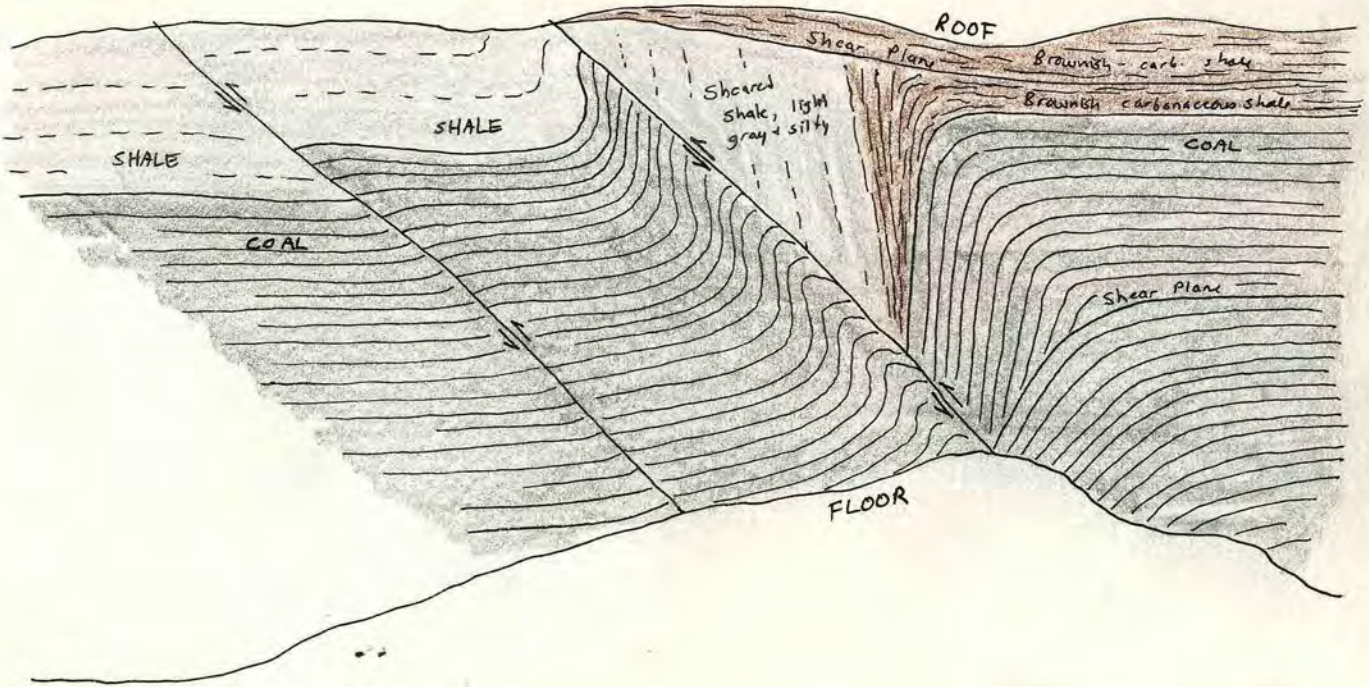


Hypothetical sequence of faulting:
Two-stage faulting results in slivers of coal being left in the roof and floor, while slivers of shale or clay are left within the coal. First slippage was normal, second slippage was reverse along the same fault.

STOP 12
VIEW OF EAST RIB

N

S



places. The drag indicates that many feet of dip-slip movement occured. Again the first movement must have been normal and the second movement reverse, both movements with approximately the same dip-slip restoring the coal bed to its original position on opposite sides of the fault. Note that on the footwall there is a small "kink" in the drag-fold close to the fault plane, suggesting that a third stage of minor normal movement took place.

An additional feature to note is the horizontal shear plane above the right-hand side of the fault. It truncates the drag fold and brings horizontal layers above in contact with vertically-dipping layers below. Cannot tell whether this horizontal fault offsets the main reverse fault or not.

13.) Fault in 4th entry from west has similar appearance to fault at previous stops. It has strong drag indicating reverse movement, but large slivers of clay or shale on the fault within the coal signify an earlier episode of normal movement.

They have just mined into the fault at the corner of the 5th entry. The miners have halted advancement and are setting props all along the face. Sahara is doing a good job of projecting this fault. Long pillars are left through the fault zone and the entries are narrowed to 16 feet from the usual 20 feet. As here, they make sure to place additional roof support at the fault immediately. Sahara's policy undoubtedly reflects their broad experience with faults and how to allow for them. Many other companies would not know how to project these structures, and would get many large roof falls as a result.

We are told of a disasterous roof fall in the headings parallel with the Main North. A miner operator's helper was killed and the continuous miner and shuttle car buried under fallen rock. The miner operator and buggy runner were saved by the canopies on their machines. The fall was blamed on a large hidden

slip in the roof. The slip was running parallel with the heading and was not visible in the coal. I would assume it was a compactional-type fault and not related to the Cottage Grove System. The face where the fall occured was butting into the same area of split coal that was crossed in the Main North. After cleaning the fall, Sahara decided to abandon the headings.

SAHARA COAL COMPANY MINE NO. 20 SALINE COUNTY
February 24, 1981
Notes by John Nelson on visit with Steve Danner, accompanied by Tom Fox from Sahara.

Main purpose of visit was to collect face-channel samples of coal.

SAMPLE 1

Unit 02 - Main West Entries off Main South (southwest of slope bottom). Face mined by continuous miner about 2 years ago. Coal is not too badly oxidized; we removed surface oxidation with a pick before taking the sample. No exclusions (we would have excluded any non-coal material thicker than about 0.03')

Roof- Shale (Dykersburg), medium to medium-dark gray, weathers golden brown, moderately hard, poorly bedded, slightly silty, platy fracture, locally contains small slickensides, contains a few small carbonized plant fragments, but otherwise uniform. Sharp even contact with coal. About 0.3' of shale exposed. Shale was sampled.

0.50' Coal, N.B.B., moderately hard, cleat poorly to moderately developed, coal breaks in small blocks. Vitrain in moderate concentrations, thinly banded, max. 0.02', average less than 0.01'. Attrital coal also in moderate concentration, thickest bands about 0.06', average about 0.03'. Fusain finely disseminated and in thin lenses and laminae. Overall lustre in coal is resinous. Little calcite on cleat; a few thin laminae of pyrite and pyritc shale, and a little pyrite on cleat.

0.03' Bone coal, dull, hard, fairly continuous band. Contains finely disseminated pyrite.

1.61' Coal, N.B.B., similar to first unit but has less vitrain; the thickest band about 0.01'. Attrital coal 60-70% of total, banding variable

in thickness; less pyrite than above, calcite on long vertical fractures.

0.03' Fusain, soft, little or no mineralization, fairly continuous.

1.80' Coal, N.B.B., sim. to above, with more calcite-filled vertical fractures than above. Cleat development more noticeable than in above. Little or no visible pyrite. Grades into:

0.61' Coal, sim. to above but contains more fusain; fusain is in thin bands, laminae and lenses. Coal noticeably less brittle to cut with pick. Calcite on banding planes as well as on cleat. Even, fairly abrupt contact:

Floor- Claystone, medium gray, moderately hard, silty, slickensided, contains some carbonaceous debris but no identifiable fossils. Good solid floor. About 1 foot exposed.

4.58' Total Seam.

Tom Fox says no problems have been experienced with floor heaving at this mine.

The coal at this sampling locality is horizontal to gently undulating and contains no significant partings, lenses, faults, or other anomolies. The roof is excellent and does not slab or spall to any extent. The only irregularity is an occasional "kettlebottom"- fossil tree stumps in growth position with coalified bark.

We are just a short distance north of the faulted area examined on my visit of January 16, 1979 with John Popp. The area south of the fault zone has been mined out and many pillars pulled, but the travelway and belt through the fault zone are still accessible. The intake and return entries are inaccessible due to pulling of pillars. The track entry, unfortunately, is heavily dusted so that little detail is visible.

As noted on the visit in 1979, the coal abruptly pitches downward to the south, in a monocline, and a number of high-angle normal faults mostly with the south side downthrown lie along the flank of the monocline. The coal levels out near the point where the entries turn from a southerly heading to a south-southeasterly heading. Then the coal again drops sharply, and more faults and fractures are seen. The largest fault observed on the track entry has about 3 feet of throw down to the south. Still farther south the southward dip of the strata becomes more gradual and no more significant faults were seen.

On the western side of the mine, in general, the coal undulates less and irregularities such as "rolls" or split coal are rarer than on the east side of the mine near the Galatia channel.

SAMPLE 2

Unit 03- 1st room SE off 6th SW entry in panel off Main NW, off Main East. No exclusions.

Roof-Siltst. (Dykersburg), medium gray, hard, poorly bedded, slabby, contains coal streaks as high as 0.6' above the coal (and higher still away from the immediate sampling locality). Many plant fossils, abundant mica. Contact with coal undulates and upper layers of coal splay into roof. Roof was sampled.

1.53' Coal, N.B.B., hard, resinous lustre, good cleat development in two directions. Vitrain in moderate concentrations, thickest band 0.025', average less than 0.01'. Attrital coal 50% of total, thinly banded; thickest about 0.02'. Occasional bands of very dull coal; some kaolinite and calcite on cleat; little or no visible pyrite.

0.04' Fusain, soft, a lens ranging up to 0.10' thick laterally.

0.70' Coal, N.B.B., sim. to above, somewhat less vitrain, lustre less resinous, generally thin banding.

0.08' Fusain, soft, not mineralized, discontinuous, varies in thickness.

3.48' Coal, N.B.B., sim. to above, thinly banded overall, less resinous than above. Calcite and kaolinite prevalent on cleat, very little pyrite. Increased concentration of fusain in thin bands, laminae, and disseminated. One discontinuous shaly band 0.02' thick 0.20' above floor; shale is moderately soft and gray. Moderately sharp contact.

Floor- Claystone, medium gray, rather silty, upper part contains much carbonaceous debris (none identifiable); few slickensides, very competent floor.

5.83' total thickness of seam.

This face is advancing toward a narrow zone of bad workings indicated on the map from previous mining. The zone trends NE-SW and much of it was left unmined; no other exposures of it are accessible. It is probably not a fault, but more likely an area of split coal or severe rolls.

The coal near the place where we took our sample undulates strongly and there are numerous rolls in the roof; the upper layers of the seam splay into the siltstone above. Numerous slips are present. Large quantities of rock must be mined with the coal, and roof support is difficult.

SAMPLE 3

Main North off Main East, just south of split coal area. No exclusions.

Roof- Siltstone (Dykersburg), medium gray to grayish-

brown, hard, thinly and irregularly laminated, poorly bedded, carbonaceous, contains thin stringers and splays of coal from top of seam. Coal thins abruptly toward face with some splaying into the roof; looks like erosion. One thick stringer of coal at sample site. Sharp contact:

0.68' Coal, N.B.B., hard, resinous, poorly-developed cleat. Vitrain in moderate concentration, thinly banded, thickest band 0.02', average 0.01' or less. Attrital coal about 60% of total and has thin to moderate banding. Fusain finely disseminated. Little visible calcite; pyrite in lenses up to 0.02' thick along upper contact (none in sample); one large lens of fusain 0.05' thick and 0.6' long at roof line.

0.05' Fusain, soft, not mineralized, discontinuous.

0.30' Coal, consists of alternating bands of bright coal, dull coal, and shale; rather fissile with an earthy lustre; shale up to 50% of total. Included in sample.

1.80' Coal, N.B.B., similar to first unit, less vitrain. more attrital coal, thickest vitrain 0.02' thick, increased fusain in thin laminae, also finely disseminated fusain. Little pyrite on cleat. Overall lustre less resinous than top coal. Main feature of unit is a horizontally slickensided surface trending parallel with the rib (north-south). This is not a true fault as far as I can tell.

2.60' Coal, similar to above, not slickensided. Calcite and kaolinite on cleats, little visible pyrite. Fusain in thin bands and occasional lenses up to 0.10' thick. Much fusain in some layers. Vitrain up to 0.025' thick.

1.12' Coal, N.B.B., similar to above but contains numerous discontinuous bands of shale up to 0.02' thick, most about 0.01' thick. Coal very thinly banded and has moderate concentration of vitrain. Much calcite on cleat and in

vertical fractures. Also much finely disseminated fusain and many laminae of fusain.

Floor- Claystone, medium gray, silty, hard, micaceous, little carbonaceous debris; almost a siltstone.

6.65' total thickness.

Coal seam undulates strongly and varies greatly in thickness, from less than 4 feet to more than 10 feet and locally even more. In places much of the upper part of the seam appears to be eroded and replaced by siltstone. The upper layers split away from the seam and splay into the roof. The roof is siltstone or silty shale, medium gray, with regular laminae of light gray siltstone or fine-grained sandstone. Irregular shear fractures are common in the roof, and several roof failures have occured.

The coal on fresh faces is nearly dry and emits less gas than normal for my experience in Illinois.

Major split of coal is north of sampling site. The coal is split in the lower half by a lens of slitstone or silty mudstone at least 10 feet thick and more than 100 feet across. The upper bench of coal, which was mined, arches upward across the lens and thins, with splaying of the upper layers into the roof. Several discontinuous splits or layers of shale and siltstone up to several inches thick occur in the upper bench of coal. This upper bench varies from about $3\frac{1}{2}$ to $6\frac{1}{2}$ feet thick. Cannot tell whether the lower bench continues under the lens; it dips very sharply under the margins of the lens and is lost in the floor. The margins of the lens are very abrupt and blunt, with not much splaying of the coal. See sketch (over).

I believe this lens is either a small channel or crevasse-splay deposit laid down contemporaneously with the lower part of the peat. The arching of the coal above and below the lens is the result of differential compaction.

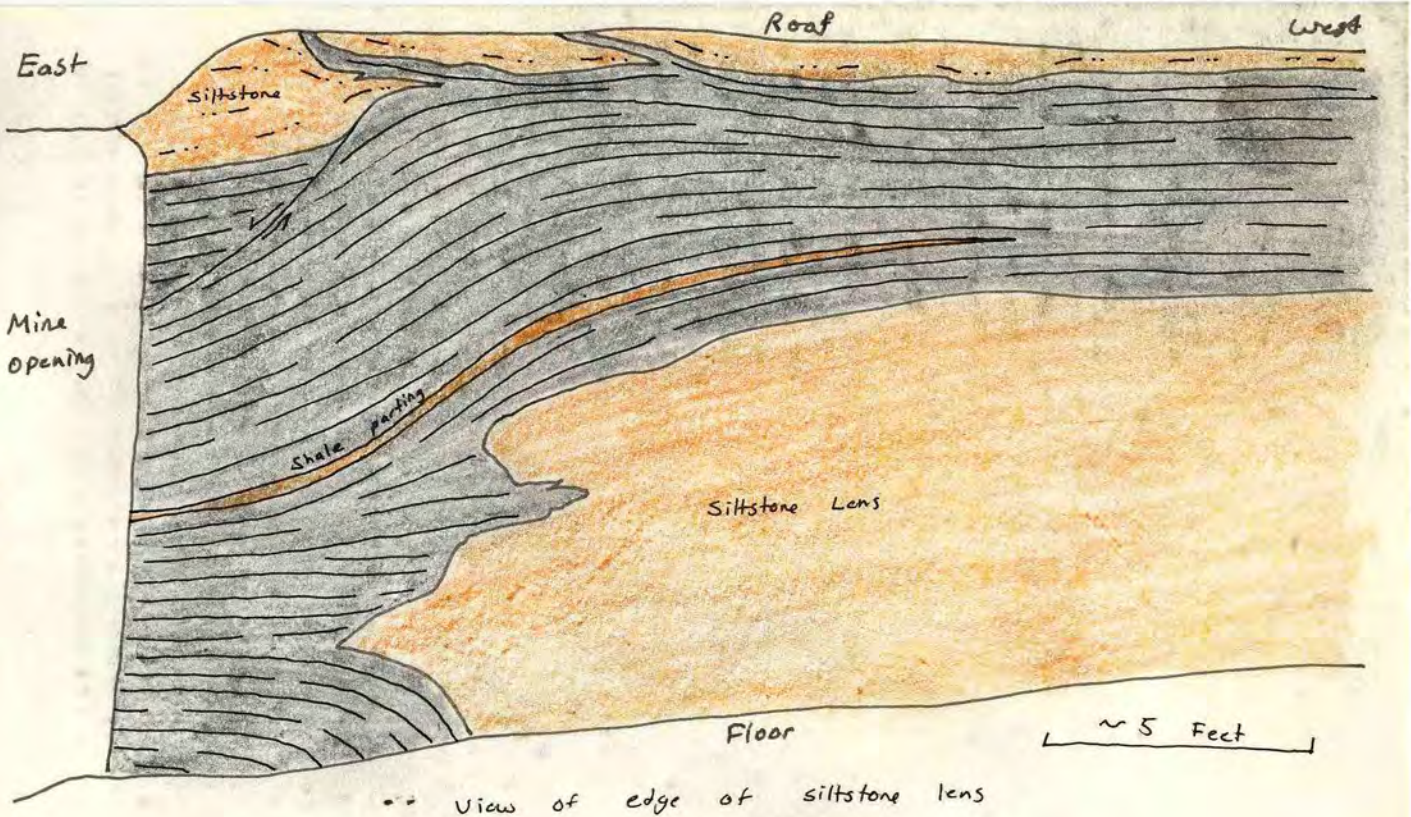
A short distance away from the lens is seen an excellent example of splitting in the upper layers of the coal. Lenses of siltstone up to 2 feet thick occur within the upper coal also. The roof, and the material in the lenses, is siltstone or silty mudstone with thin laminae of light gray sandstone or siltstone. Near the contacts of coal and siltstone, small recumbent folds occur both in coal and in laminated siltstone. This siltstone is rather massive in spite of the laminations; it does not split readily into layers. A layer of shale usually 1 to 2 inches thick and locally reaching 1 foot thick occurs quite persistently near the middle of the coal in this area. Some coal has been left in the floor during mining.

Occasional vertical fractures trending N 50-55 E occur in the roof. Some are straight and continuous for the width of a heading, others are offset en echelon. The rock along the fractures is stained brown as if water had flowed along them.

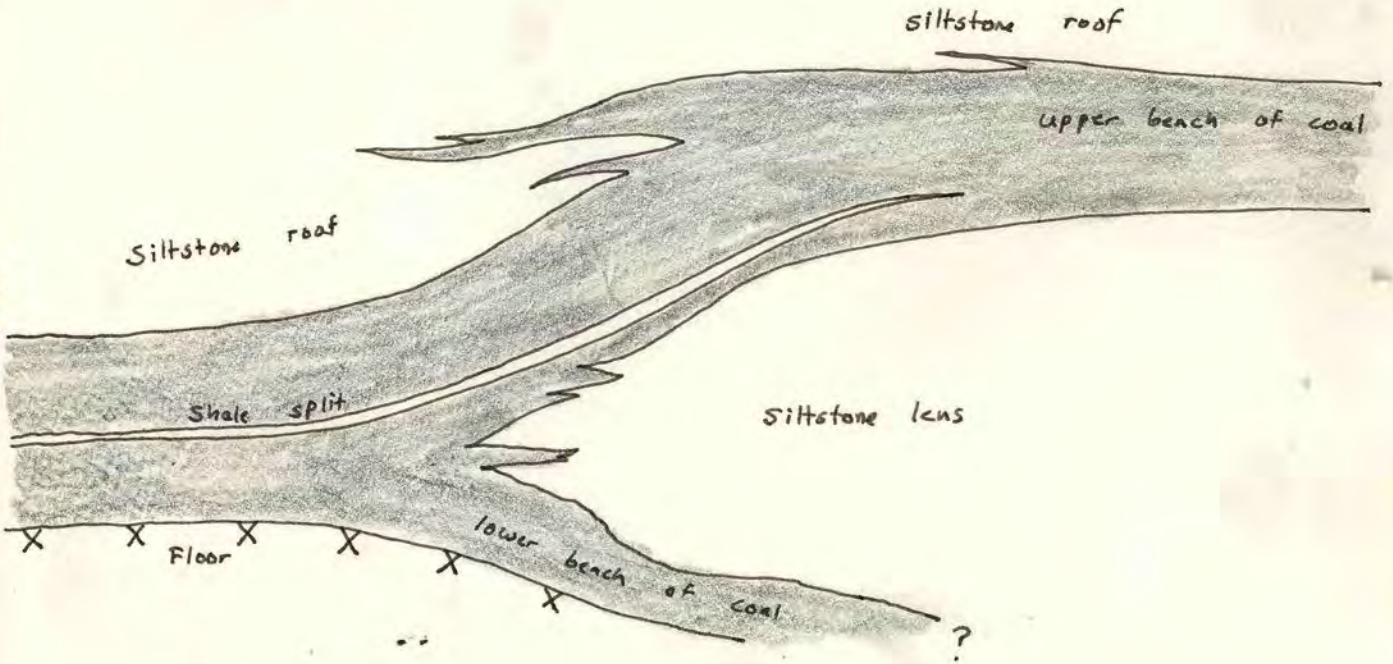
The roof is quite stable except along slips and under splits of coal. Very well-preserved large plant fossils, including leaves, stems, and bark, are seen in the immediate roof. Occasional fossil stumps in growth position "kettlebottoms" also occur.

Locations of Samples

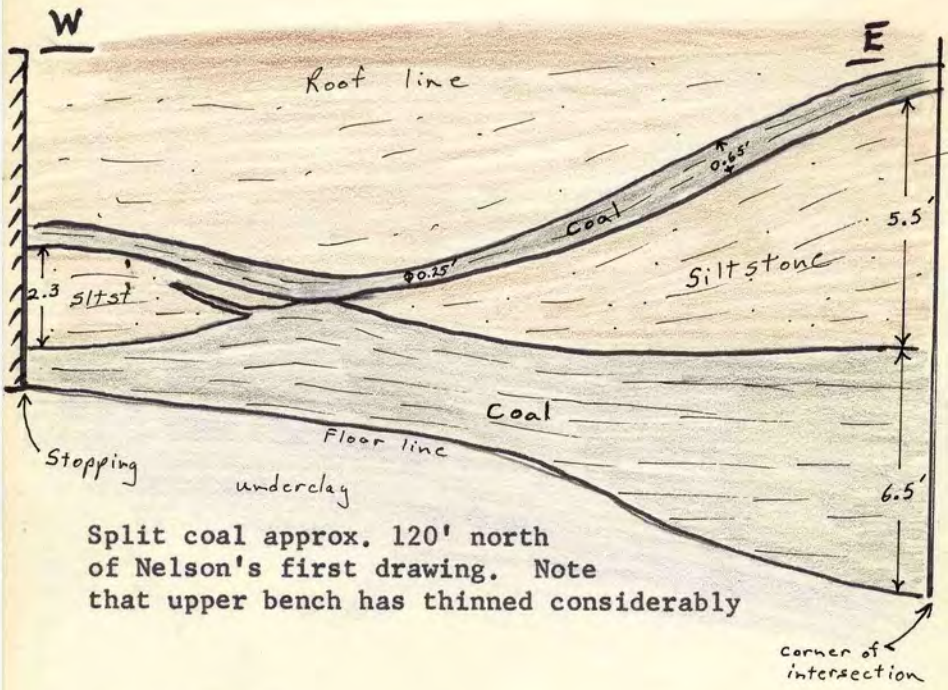
1). 720' from south line, 660' from east line, Section 9, T. 9S- R. 5E. Saline County
2). 710' from north line, 1710' from west line, Section 11, T. 9S- R. 5E.
3). 1940' from south line, 2660' from west line, Section 2, T. 9S- R. 5E.



Idealized cross-section of coal where split by lens of siltstone Saham No. 20.



Addendum to Nelson's notes: Sahara 20 Mine



Split coal approx. 120' north of Nelson's first drawing. Note that upper bench has thinned considerably

General notes:

The top in this mine is fairly stable. The only trouble areas are where faults cross the entries.

The underclay appears to be rather competent. No squeezes have been reported to date. Where sampled, the underclay varied from smooth to silty claystone. It was usually hard and greater than 1.0' thick.

S.K.Danner