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DEMPSTER HIGHWAY

AIRPHOTO MATERIALS SEARCH

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Sept. 71

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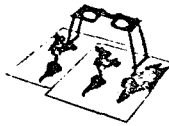
DEMPSTER HIGHWAY
AIRPHOTO MATERIALS SEARCH
MILE 166 TO 275

Sept. 71

J D MOLLARD AND ASSOCIATES LIMITED

CONSULTING CIVIL ENGINEERS AND ENGINEERING GEOLOGISTS

Telephones 523-8811 523-8855
Area Code 306



616 McCallum-Hill Building
Regina · Saskatchewan · Canada

September 8, 1971

Mr. R. K. Coates
District Director
Department of Public Works
Box 2706
Whitehorse, Y.T.

Attn: Mr. J. Quong, P. Eng.
Supervisor of Technical Services

Dear Sir:

Re: Dempster Highway Airphoto Materials Search
Mile 166 to 275

INTRODUCTION

The aerial photographs arrived from Ottawa late last week and, when they arrived, we immediately put them together in strip mosaics and transferred your proposed highway route to them. Following this we began our office airphoto examination.

We have marked approximate route mileages on the strip mosaics, so that you can readily follow the route and the location of borrow-material prospects.

George Mollard made the first reconnaissance examination of airphotos covering the route and made some annotations, which he left for me to review and to write up in to this summary report. George will be out of the office today and tomorrow and may have some further ideas that he may want to add to this letter when he returns.

We note that, initially and most urgently, you wanted us to mark embankment-material prospects for you to field check in September. This we have done. I will indicate our more important findings below.

REGIONAL GEOLOGY

We saw no evidence of glaciation or glacial deposits along the route segment extending from Mile 166 to Mile 275. The gently rounded slopes and ridge crests appear to have evolved over a very long period of time -- possibly many tens of millions of years under the influence of subarctic weathering and erosion.

airphoto interpretation and reconnaissance field checking dealing with aggregate and borrow searches • terrain analysis
• route selection and appraisal • dam sites and reservoirs • river basin studies • slope stability and erosion
• pre-bid tender information • surficial geologic mapping • resource inventories • maps and reports

ground-water consulting • well and aquifer location and evaluation • specifications • field supervision
• aquifer and well tests • well design and rehabilitation • quality problems • reports • recommendations

Mr.R. K. Coates

From Mile 166 to about 205 the sedimentary bedrock strata consist mainly of Cretaceous interbedded shales and sandstones that vary in attitude (dip and strike) from essentially flat-lying to steeply tilted locally. There is local evidence of folding and faulting of these bedrock strata, but these rocks seem only slightly deformed for the most part. From Mile 205 to Mile 270, the rocks consist mainly of shales with lesser sandstone and minor amounts of limestone and conglomerate. These are older (Devonian, Carboniferous, Permian) and thus harder sedimentary rocks than those south of Mile 205 approximately. From about Mile 245 to 275, the route lies west of the Richardson Mountains consisting of steeply dipping interbedded dark shales and graywacke sandstones.

It seems to us that a very substantial part of the surficial weathering and erosion that we see in the aerial photographs is periglacial (circumglacier) in origin. These severe weathering conditions are usually at an optimum in places where the mean annual precipitation ranges from about 10 to 30 inches and the mean annual temperature ranges from about 15°F to 30°F. This climate is also one that fosters optimum mechanical (versus chemical) weathering and erosion conditions -- especially freeze-thaw, wetting-and-drying, sheetwash and solifluction activity.

The sandstone is more resistant to weathering and erosion, so tends to be a "ridge-former" or an "escarpment-former." The shales are weaker and tend to form smoother, more softly rounded and gentler slopes and smooth drainage divides. Because the sandstone is harder and more resistant to erosion, it usually occurs in greater amounts along the crests of ridges and divides where you have, we think wisely, located your proposed highway route.

Locally the sandstone and shale strata will tend to intergrade in mineral composition and in hardness. But the shales can range from clayey to sandy and the sandstones can range from clayey (dirty, argillaceous) to almost pure quartz and be either hard or friable.

We have marked places for you to field check which we feel are localities where the residual soil mantle and colluvial soil cover (sheetwash and solifluction debris) is thinnest.

RELATION OF ROUTE LOCATION TO CONSTRUCTION-MATERIAL PROSPECTS

As we have noted above, as much as practical you appear to have wisely followed the drainage divides, corresponding generally to places where the underlying rock tends to be stronger and more sandy than it is below the flatter and lower slopes. Also, drainage areas (watershed, or catchment, areas) are negligible on ridge crests. But these catchments can be appreciable on lower slopes. And in an area of sudden cloudbursts, and little or sparse vegetation at best, we agree that the high ground is the place to be with your route location.

Mr. R. K. Coates

The average haul distance of fill borrow should be less along ridge crests because this is where the more favorable quarry sites occur. In addition, if cuts are required at the larger changes in grade (vertical alignment), then the rock excavated in making the highway cuts can be used in the embankment farther along the route. In other words, some quarry sites will correspond to road cuts in harder rock, which are also places of minor or negligible runoff and consequent slope erosion and minimum permafrost deterioration. Moreover, because most quarry sites can be located on high ground, the loaded equipment hauling fill or surfacing material should be mainly downslope rather than upslope. This is a distinct advantage.

BORROW PROSPECTS MAPPED FROM AIRPHOTOS

Mile 166 to Eagle River (see annotated mosaics)

Generally speaking, whitish-appearing ridge crests and low escarpments have been mapped for field checking and examination. The whiter-appearing areas on the photos are likely to correspond to dominantly sandstones or sandy shales. Yet these lighter airphoto tones may also be related to burned-over areas and to youthful hillside surface erosion. The whiter-toned areas are also likely to have a shallower residual and colluvial cover over solid bedrock.

We feel that the bedrock should be rippable owing to long-continued frost-action shattering and breakage effects within the near-surface layer.

The upper slopes of steeper sandstone ridges (over 5° to 8°) may be characterized by solifluction lobes, terraces, and sheets. This is true just south of the Eagle River and also again in vicinity of Mile 270.

We have mapped a number of point bars in the Eagle River which we feel you should inspect. They are whitish-toned on the airphotos and occur as bars along the river in vicinity of your proposed Eagle River crossing. It may be necessary to harvest materials from these river bars at a time of the year that does not interfere with fish spawning.

Generally, the larger and thus fewer the number of borrow pits developed the better. Also, we have considered ease of borrow-pit drainage in marking places for you to field check. If quarries can be located on or adjacent to the highway right-of-way, so much the better.

Eagle River to Mile 275 (see annotated strip mosaics)

The proposed route traverses a number of ridges and saddles north of the Eagle River. Generally the highway route here trends across the trend of the geologic structure and also the topographic grain of the landscape. Thus, from the Eagle River crossing to roughly Mile 242, the grade line is rolling. Again, mainly the ridge tops have been marked for field checking.

Mr. R. K. Coates

Running north from about Mile 242 to Rock River, bedrock strata below the route appear to consist mainly of shales with a cover of thick slopewash deposits that spread out on to the plain from narrow mountain valleys and from between a string of "flat-iron" ridges and buttes at the base of the Richardson Mountains. We expect these streaked-appearing colluvial deposits (slopewash and coalescing alluvial-fan materials) will be dominantly silty in texture and high in ice content. The higher and older rock ridges to the east have been marked as more-distant quarry sites. Probably they are too high and too remote and inaccessible to be economically competitive sources of fill borrow or surfacing aggregate. There appears to be very little or no coarse, clean granular deposits south of Rock River.

From Rock River to Mile 275 we have mapped some granular alluvium in braided stream beds and have also marked some undercut (laterally eroded) stream terraces for you to check visually in the field. We expect the stream terraces will be 1) high in silt sizes, 2) frozen and contain segregated ice. Thus, bedrock quarries may still be your best bet.

Classical solifluction forms appear at the base of bedrock ridges just as one enters the pass in to the high Richardson Mountains. Whether these lobes and terraces will be useful as a potential source of borrow is debatable. We have checked our airphotos showing a highway location on the Seward Peninsula of Alaska, and we note that a few coarse solifluction lobes have been used as highway fill borrow.

FIELD CHECKING PROCEDURES

We have mapped a large number of quarry prospects -- mainly near the proposed highway route because these prospects appear to be as good; generally, as the more remote ones and any ecological disturbance will likely be less if rock quarries are developed on or very near the right-of-way in well-drained situations.

If you have established a route centerline and a gradeline, you will know where the larger fill quantities are required, and you will be able to concentrate your field-inspection activities in these areas.

We are hopeful that the sandstone and sandy shales will be sufficiently frost-shattered and broken to permit ripping them. But this will be something one can only tell from careful field examination.

You may decide to circle those borrow prospects that are considered to be first choice from your construction planning and design information and then inspect these first.

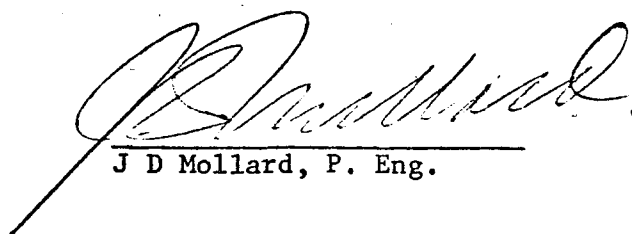
Generally the shales, sandstones, and conglomerates in the Richardson Range are older and harder and more durable than the sedimentary rocks on the Eagle Plain and on Peel Plateau.

Mr. R. K. Coates

I will try to phone you and let you know we have received the photos, interpreted them, and have a preliminary report on the way along with xerox copies of the annotated strip mosaics.

If you have any questions, please contact us.

Yours truly



A handwritten signature in cursive script, appearing to read "J D Mollard", is written over a horizontal line.

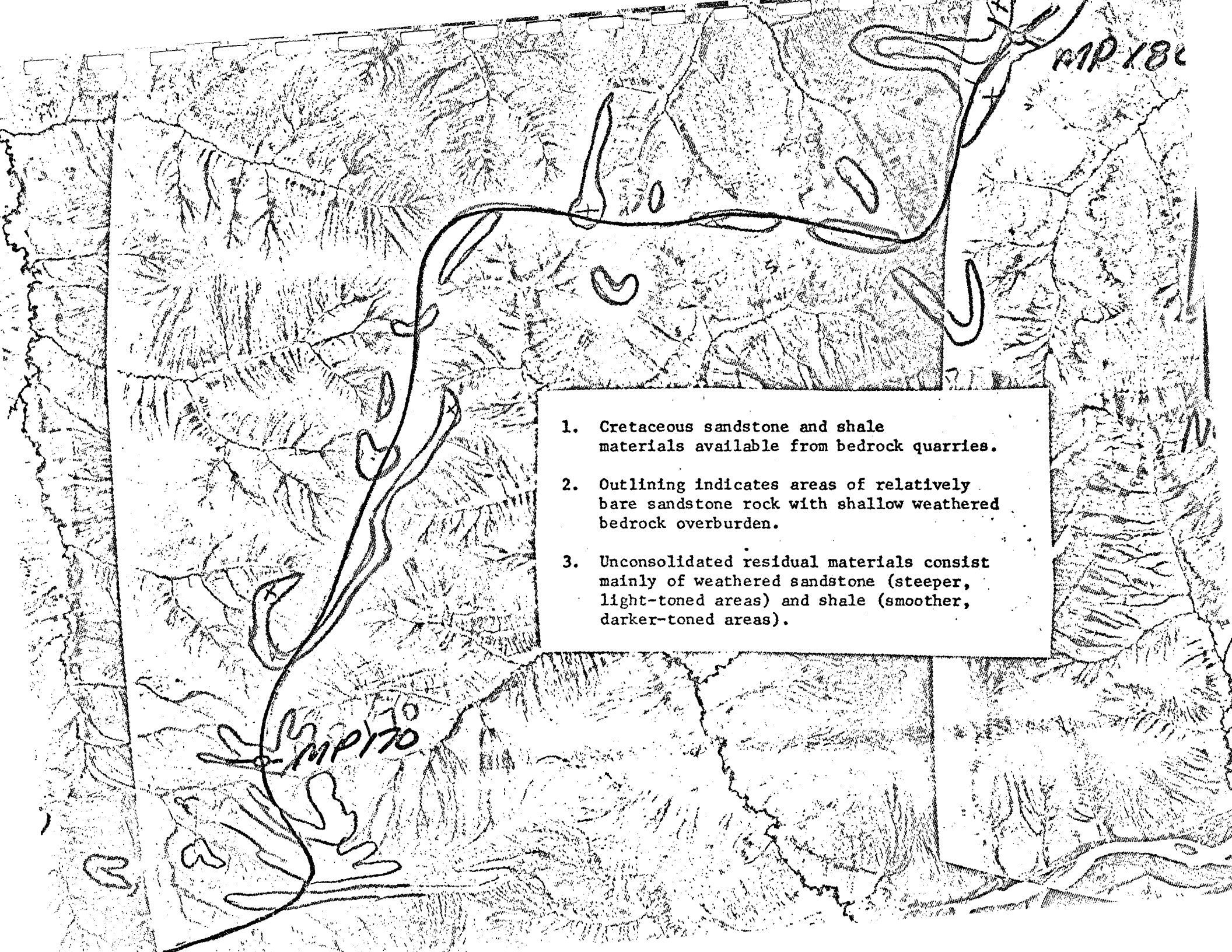
J D Mollard, P. Eng.

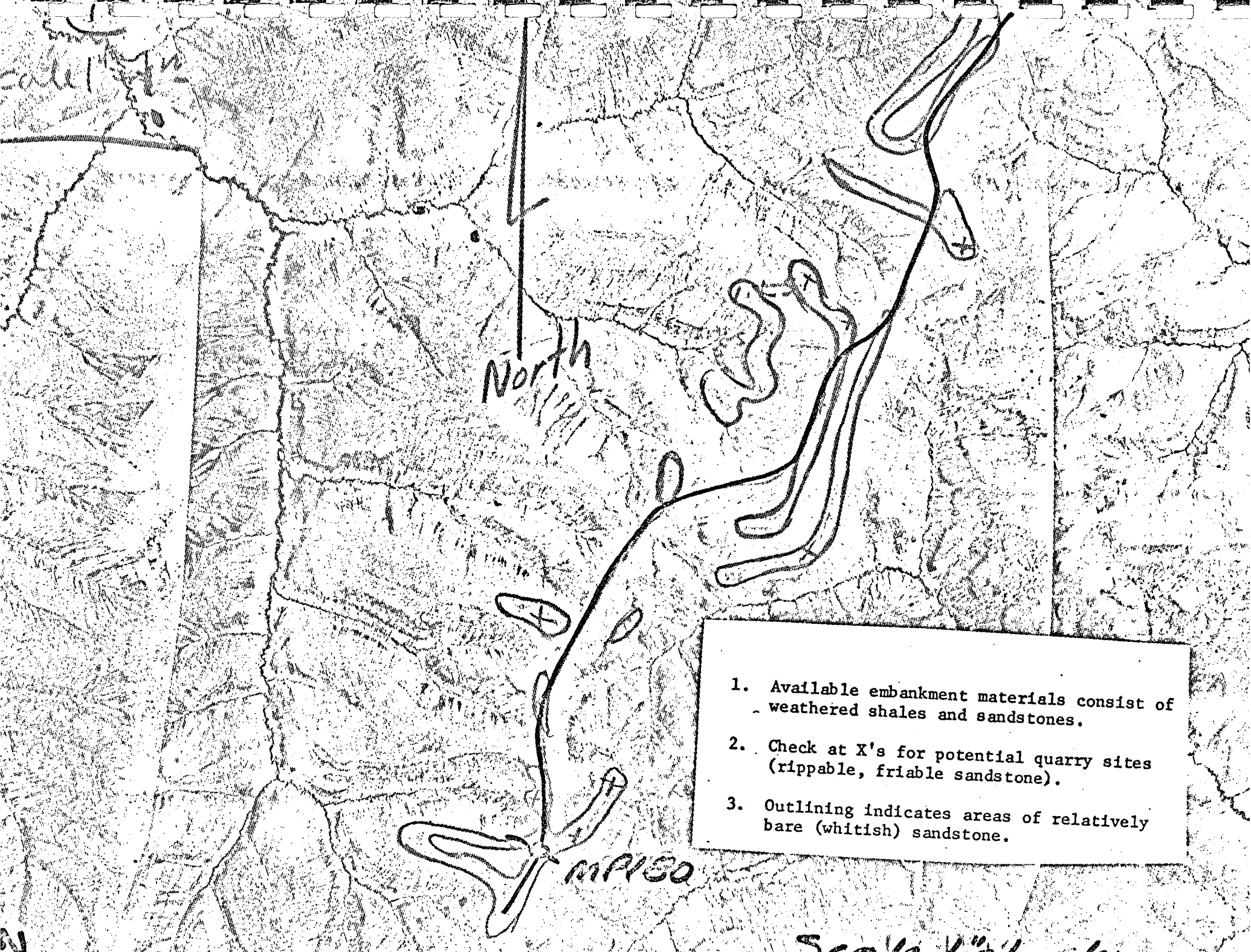
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Encl.

MP 186

1. Cretaceous sandstone and shale materials available from bedrock quarries.
2. Outlining indicates areas of relatively bare sandstone rock with shallow weathered bedrock overburden.
3. Unconsolidated residual materials consist mainly of weathered sandstone (steeper, light-toned areas) and shale (smoother, darker-toned areas).

MP 170





Scale 1/2 inch = 1 mile

North

MARIPOSA

1. Available embankment materials consist of weathered shales and sandstones.
2. Check at X's for potential quarry sites (rippable, friable sandstone).
3. Outlining indicates areas of relatively bare (whitish) sandstone.

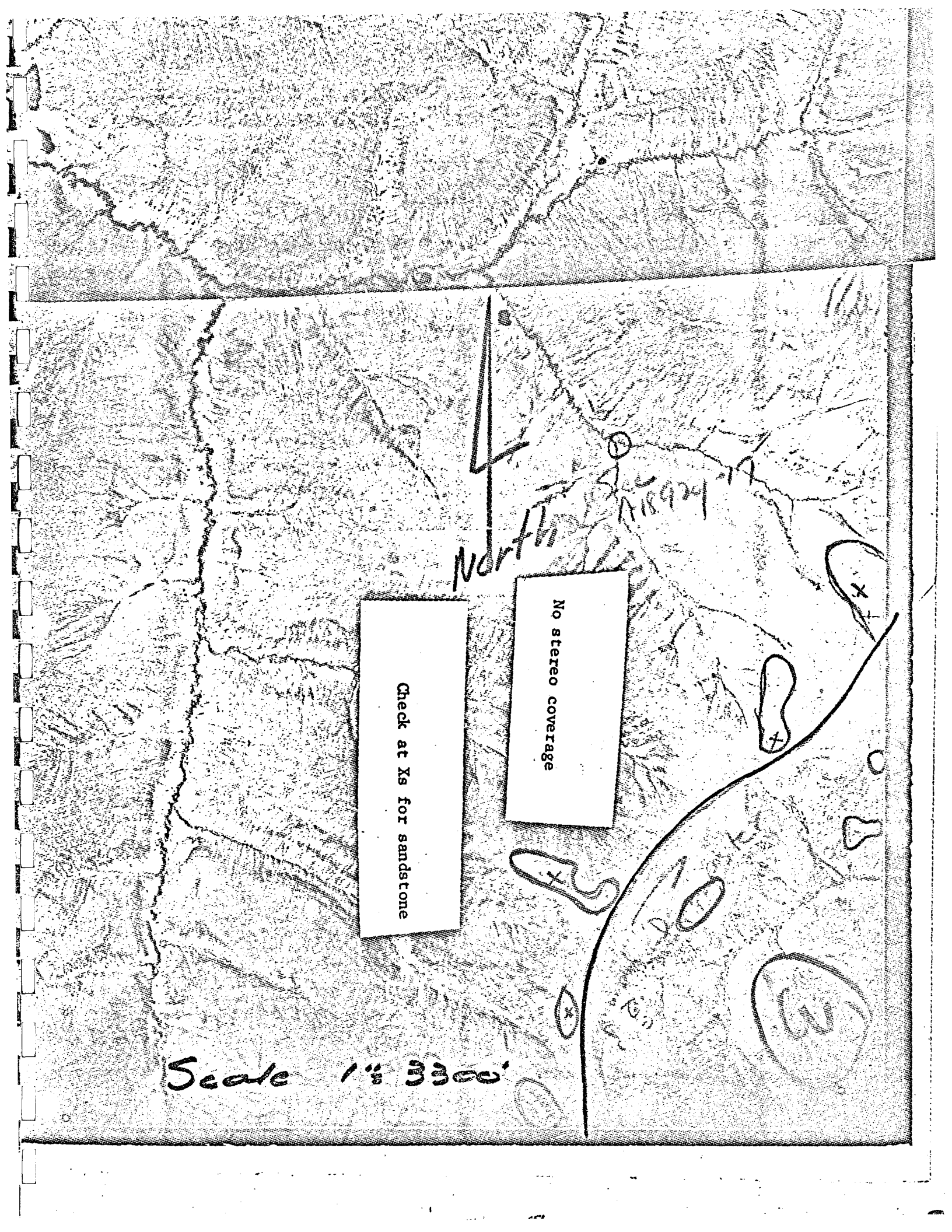
Scale 1/2 inch = 1 mile

North
18929

Check at Xs for sandstone

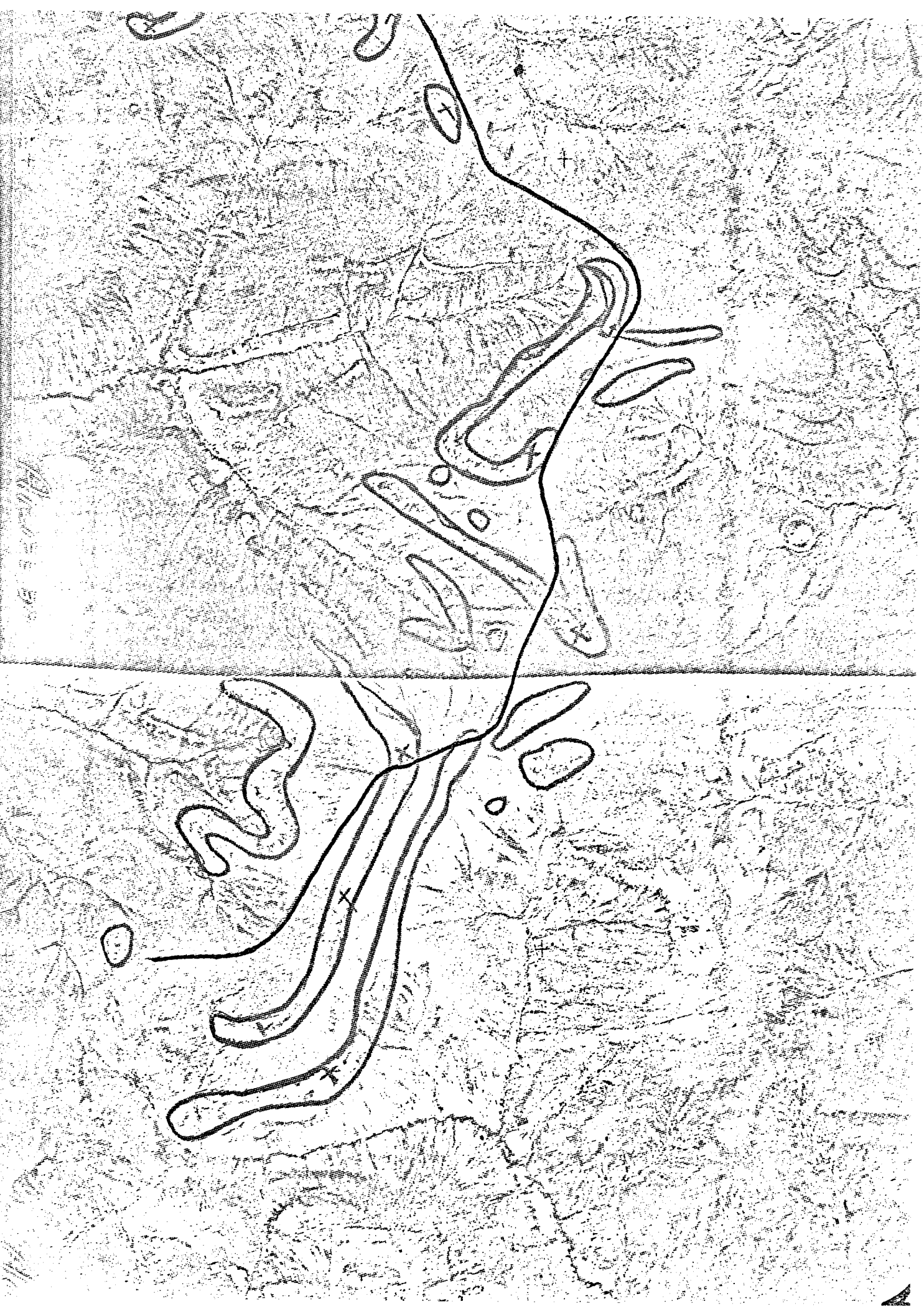
No stereo coverage

Scale 1" = 3300'



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Outlining indicates relatively bare mainly
Cretaceous sandstone ridges (see report for
recommendations).

CAMPISO

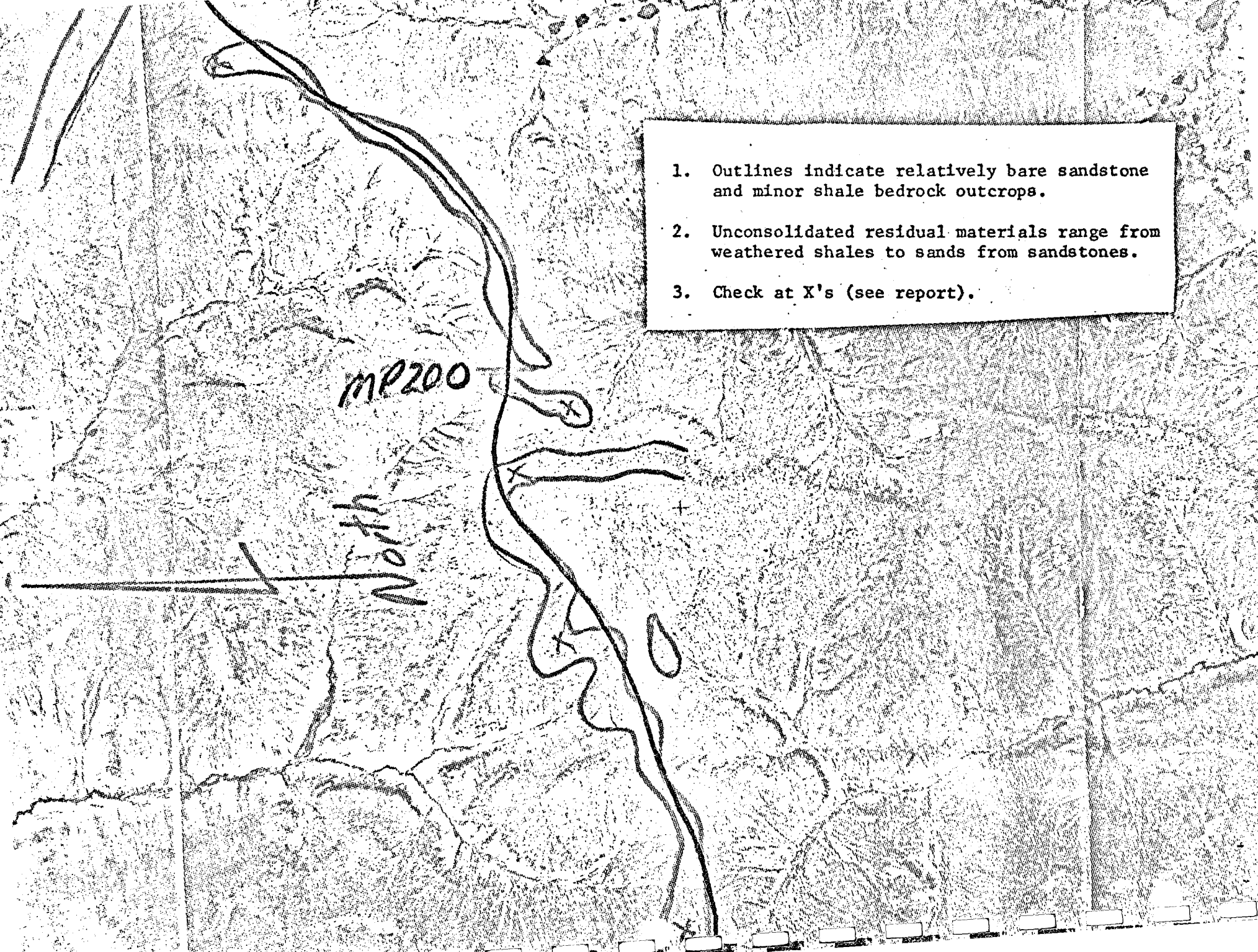
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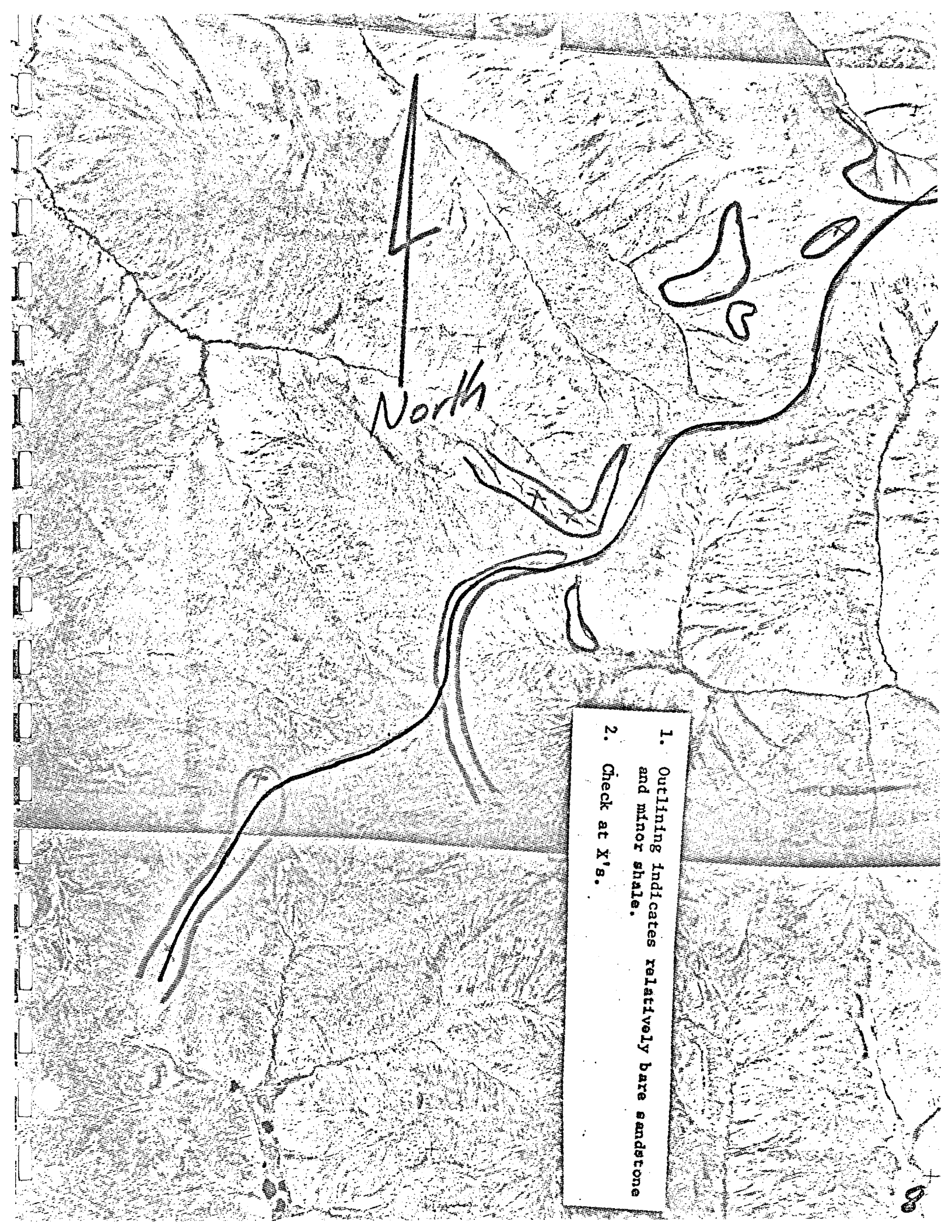
Outlining indicates
Cretaceous sandstone
recommendations).

1. Outlines indicate relatively bare sandstone and minor shale bedrock outcrops.
2. Unconsolidated residual materials range from weathered shales to sands from sandstones.
3. Check at X's (see report).

MP200

North



A topographic map showing contour lines and a network of roads. Hand-drawn black outlines highlight specific features: a large area in the upper right, a winding path in the center, and a narrow strip in the lower left. A north arrow is drawn in the upper left quadrant, pointing towards the top of the page. The word "North" is written in a cursive font below the arrow. A legend box is located in the lower right quadrant.

North

1. Outlining indicates relatively bare sandstone and minor shale.
2. Check at X's.

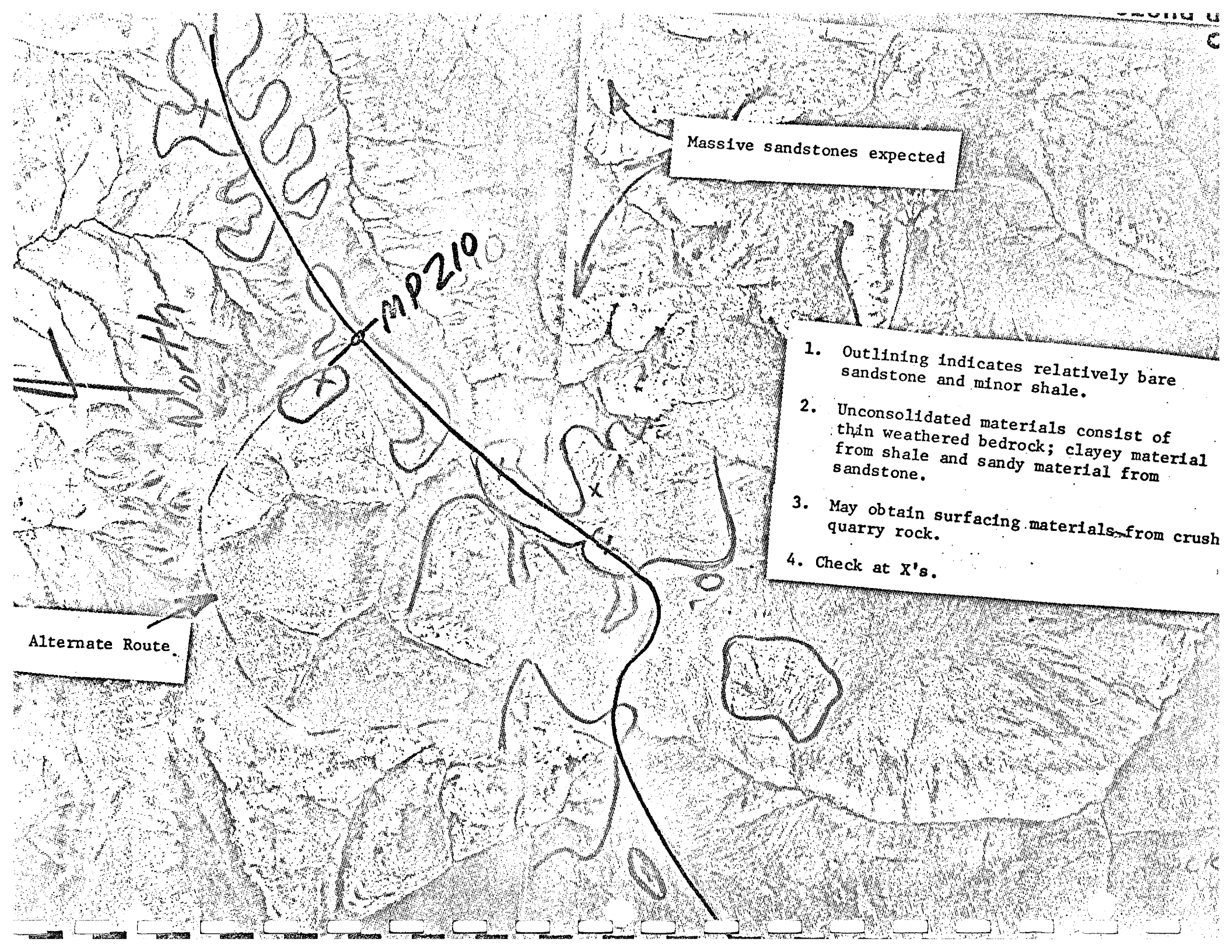
Massive sandstones expected

1. Outlining indicates relatively bare sandstone and minor shale.
2. Unconsolidated materials consist of thin weathered bedrock; clayey material from shale and sandy material from sandstone.
3. May obtain surfacing materials from crush quarry rock.
4. Check at X's.

Alternate Route.

North

MP 210



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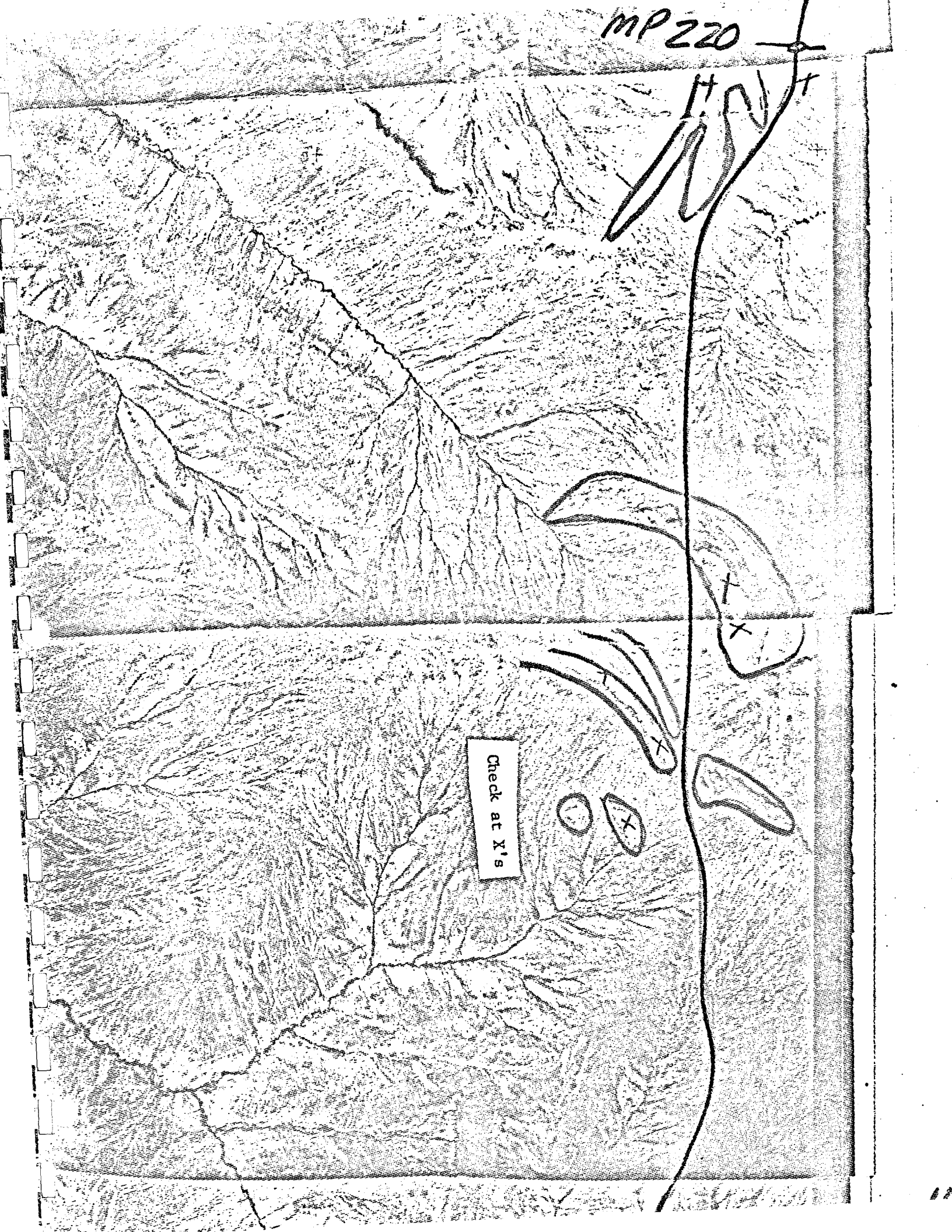
Flow line

Flow line

Burn line

Flow line

MP 220



Check at X's

Check depth and gradation
of exposed bars

North

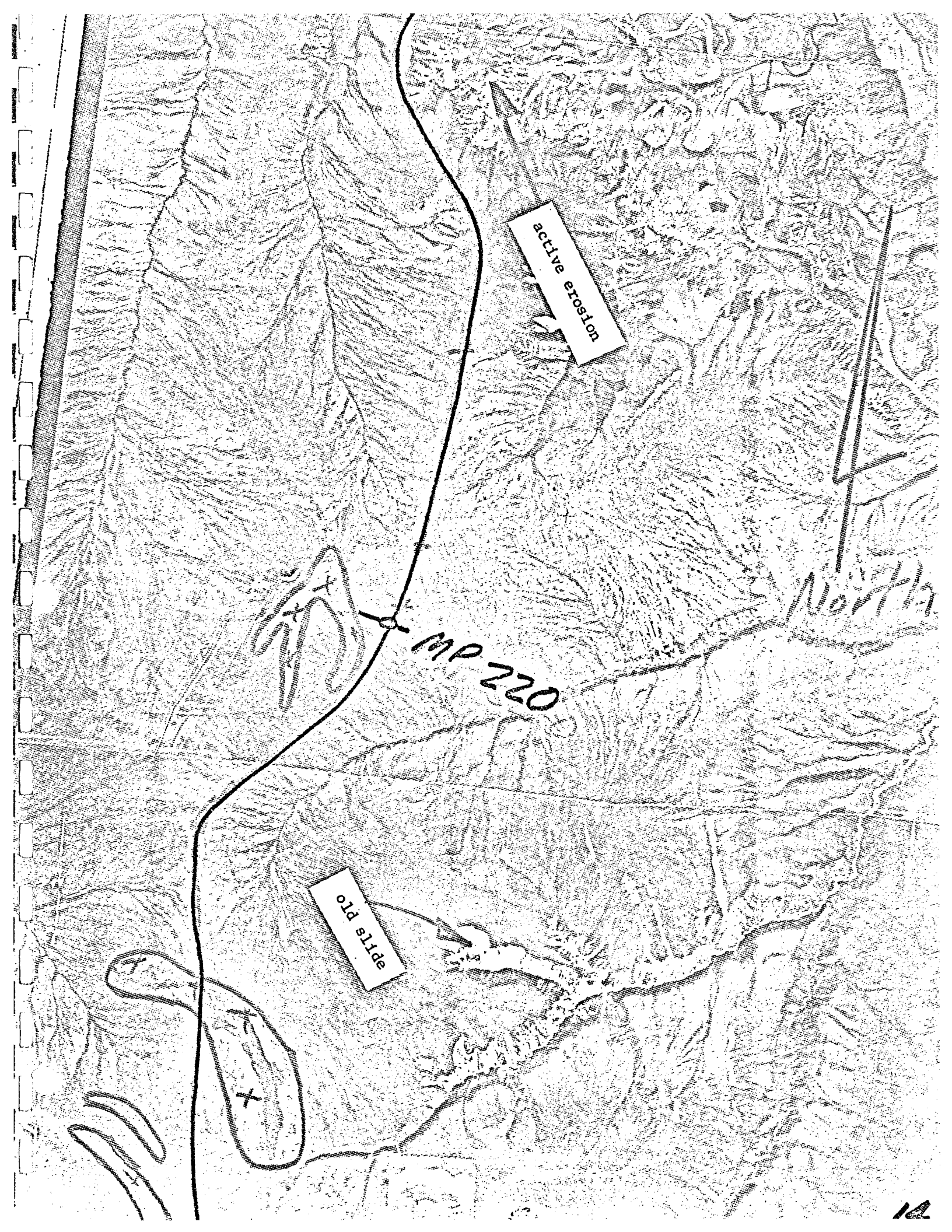
Solifluction lobes,
terraces and sheets

MP220

HNVT

old slide



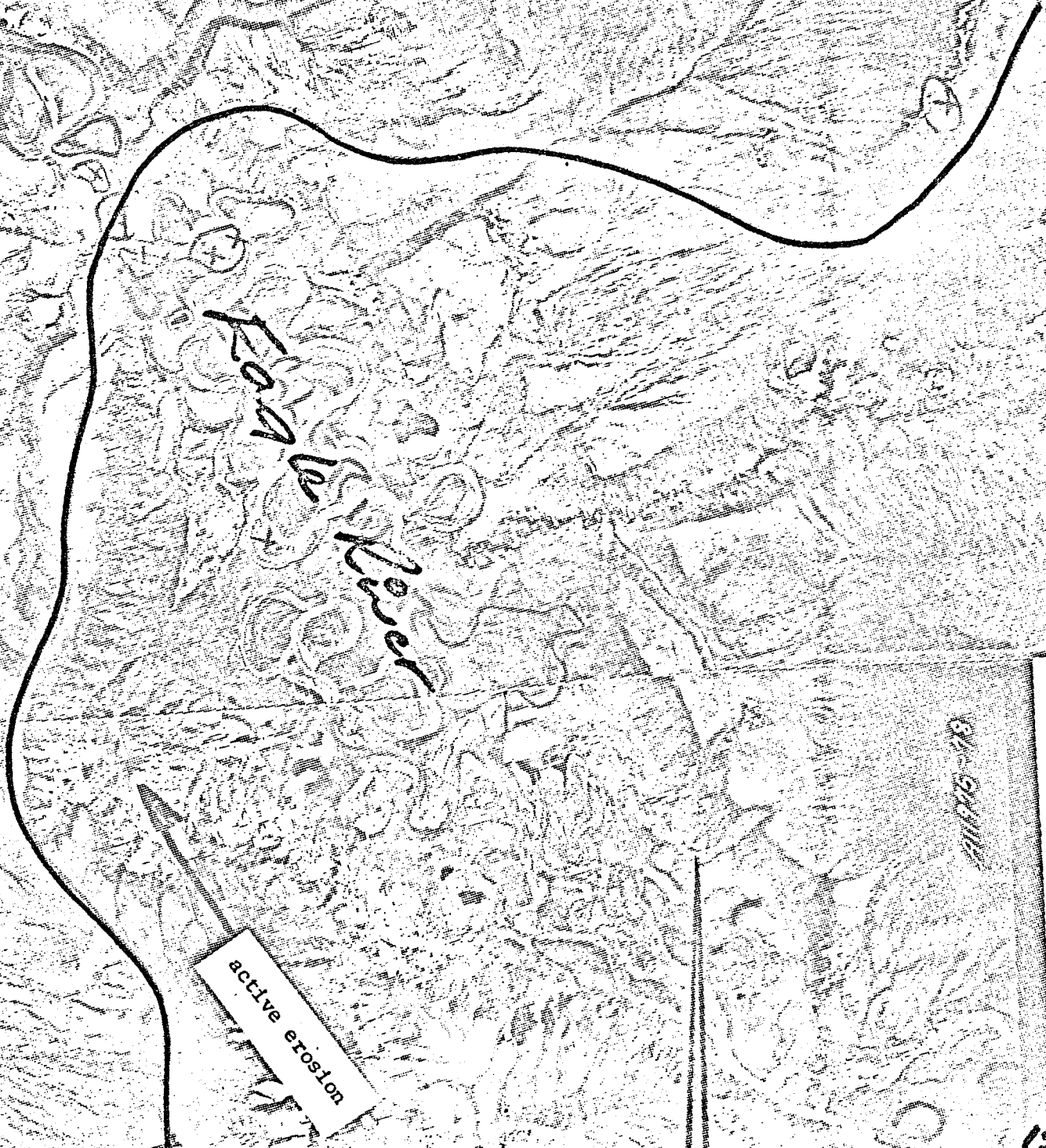


active erosion

old slide

MP 220

North



Kadla River

active erosion

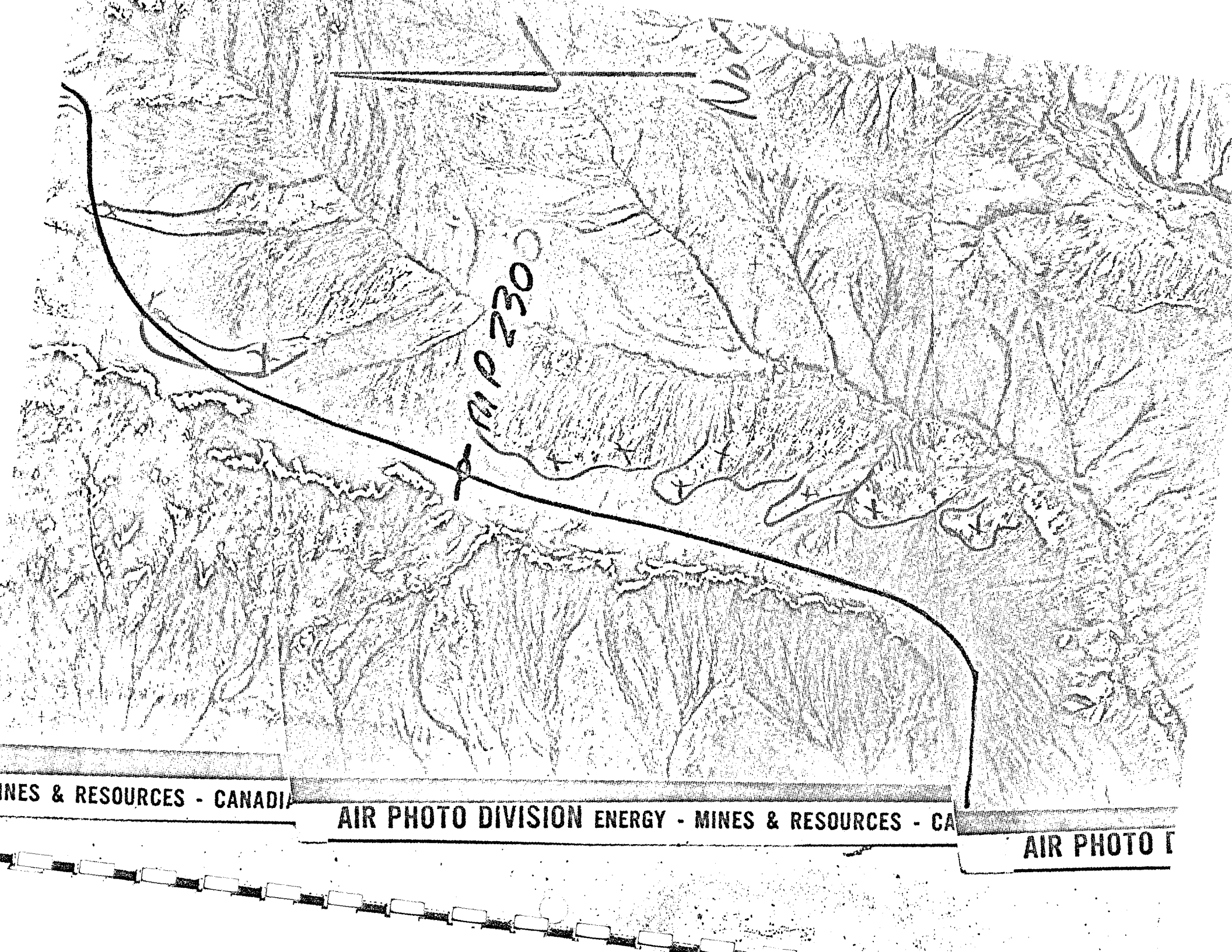
MINES & RESOURCES - CANADI

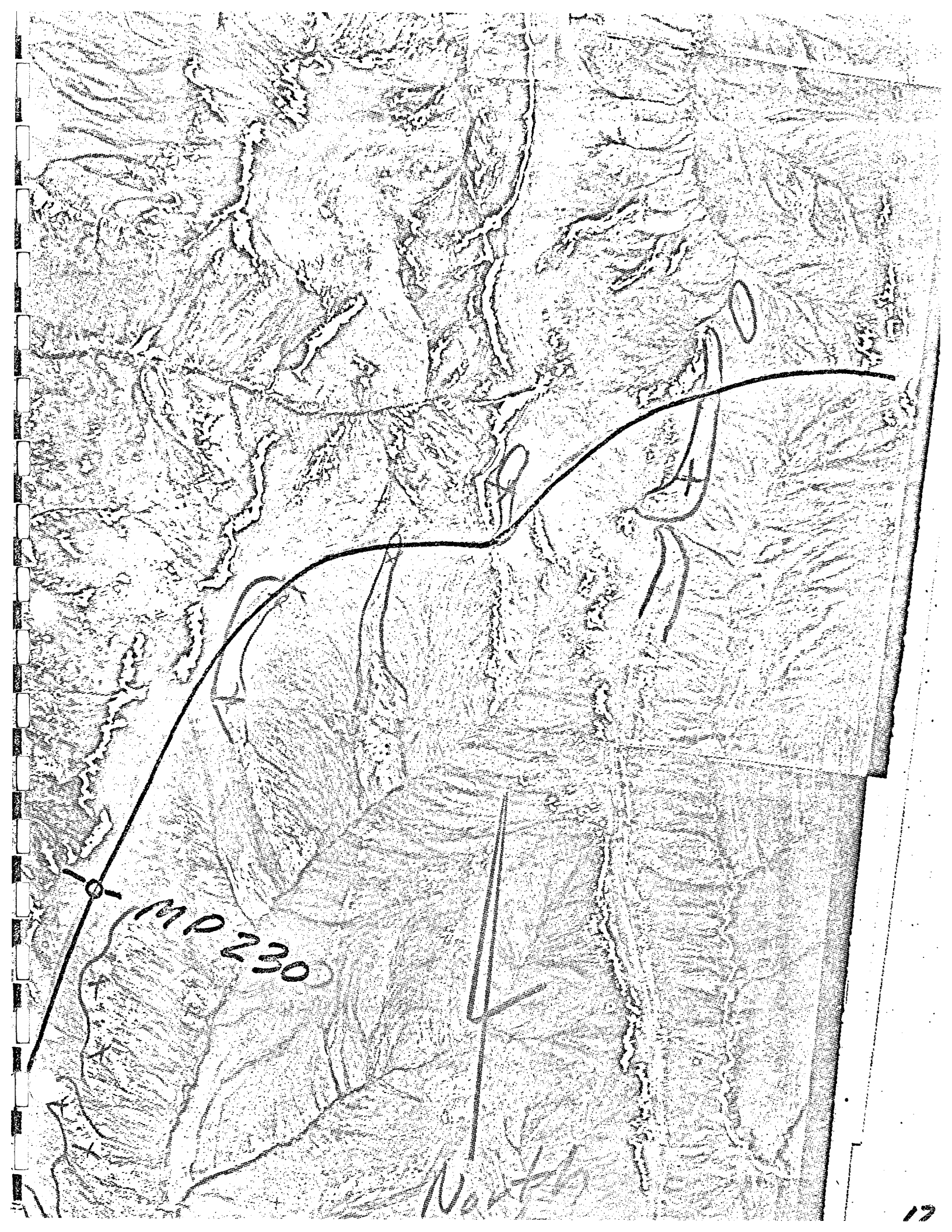
AIR PHOTO DIVISION ENERGY - MINES & RESOURCES - CA

AIR PHOTO I

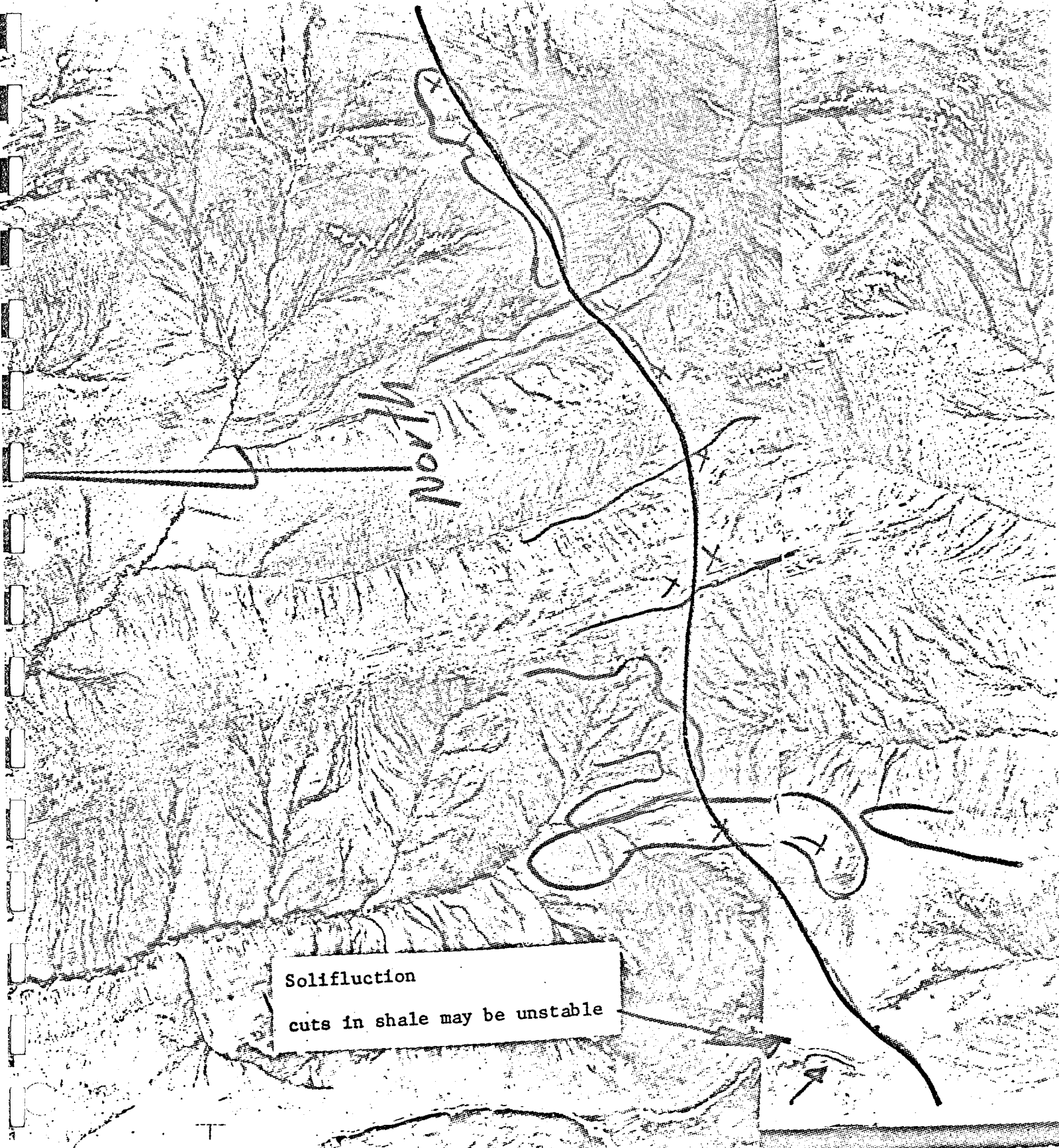
MAP 230

Map



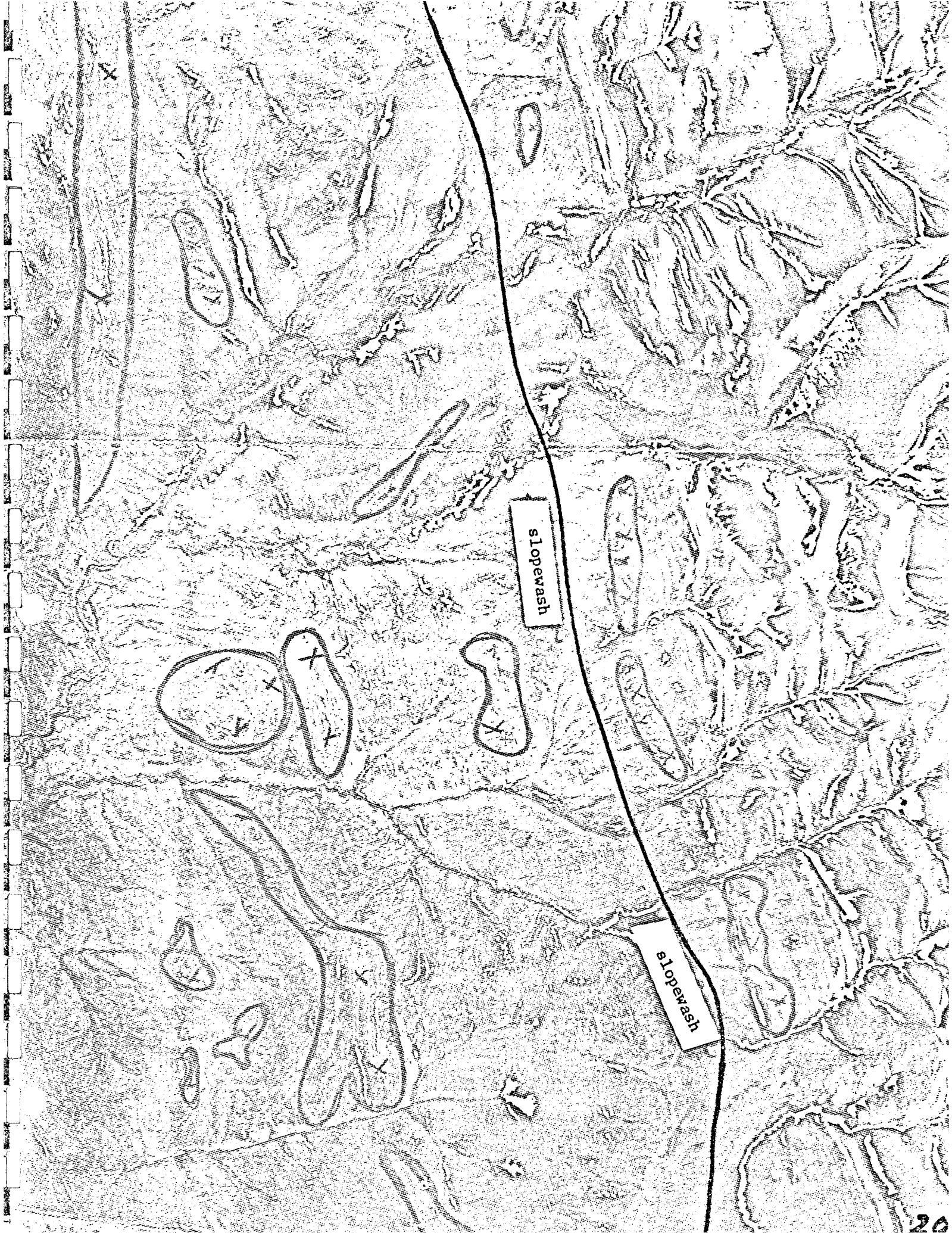


MP 230



North

Solifluction
cuts in shale may be unstable

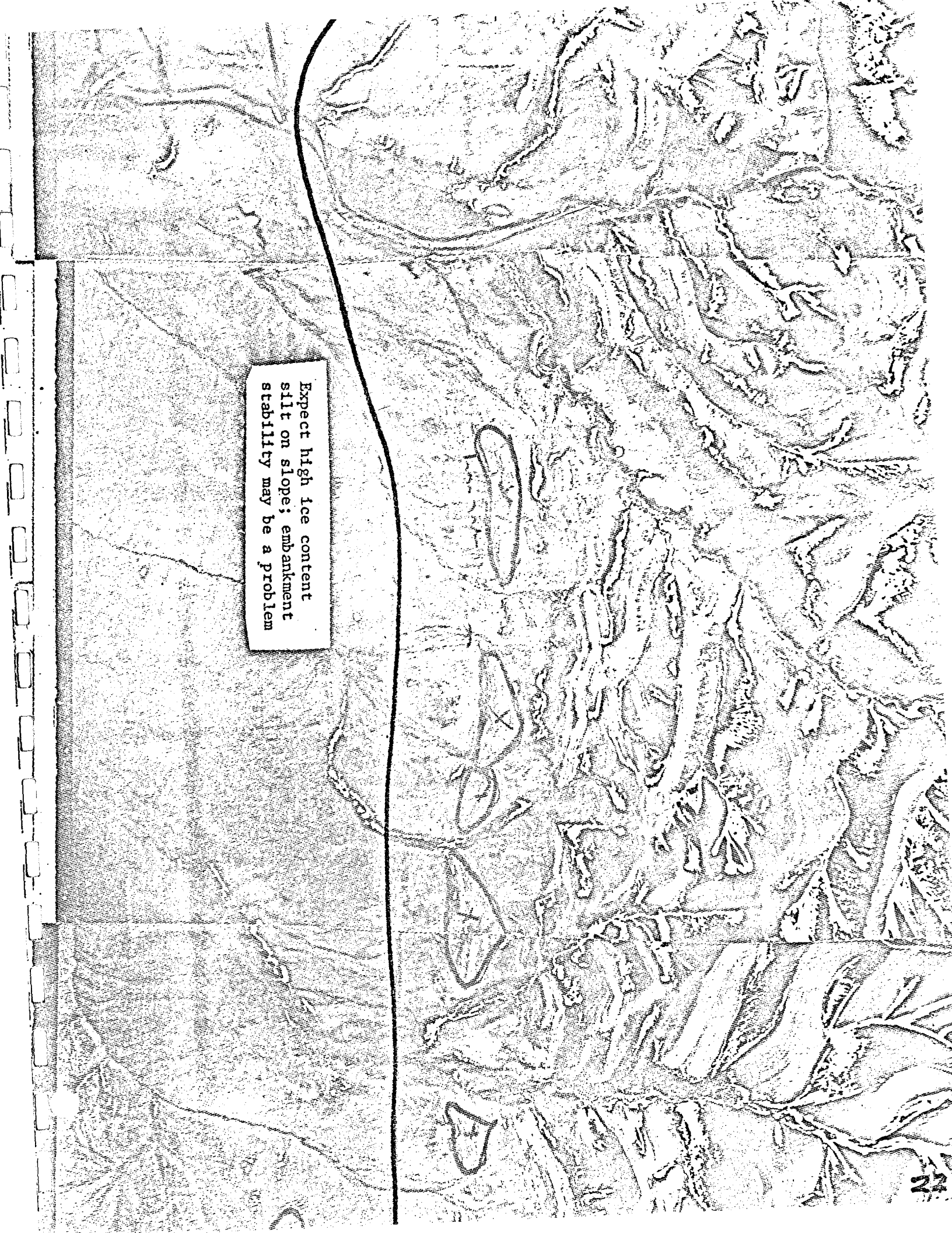


slopewash

slopewash

MP 250





Expect high ice content
silt on slope; embankment
stability may be a problem

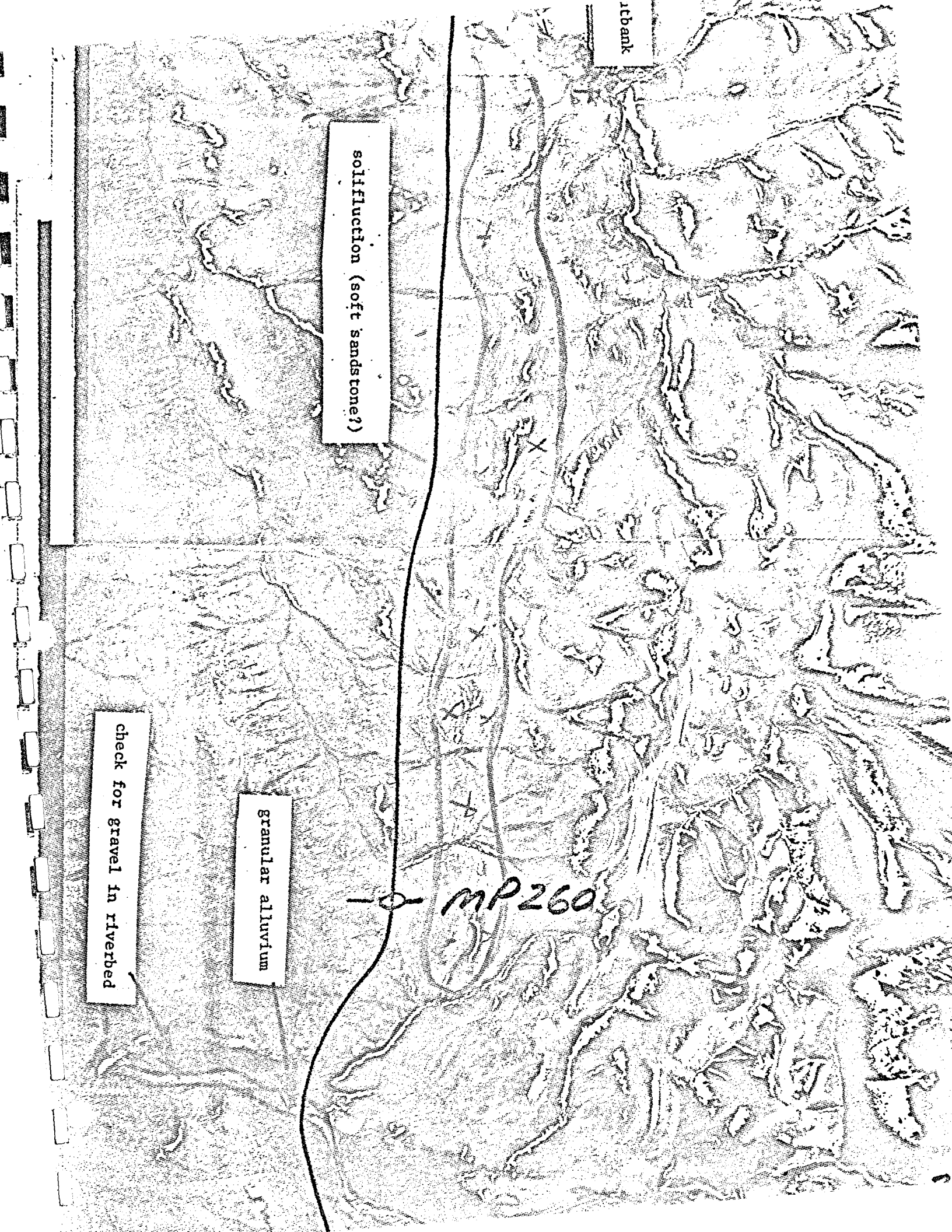
rtbank

solifluction (soft sandstone?)

granular alluvium

check for gravel in riverbed

MP260



27 9/20/77
MP 270
Outlined areas indicate mainly sandstone bedrock highs

ice-wedge polygons;
expect high ice content
in silty to clayey
overburden (weathered
shale + colluvium)

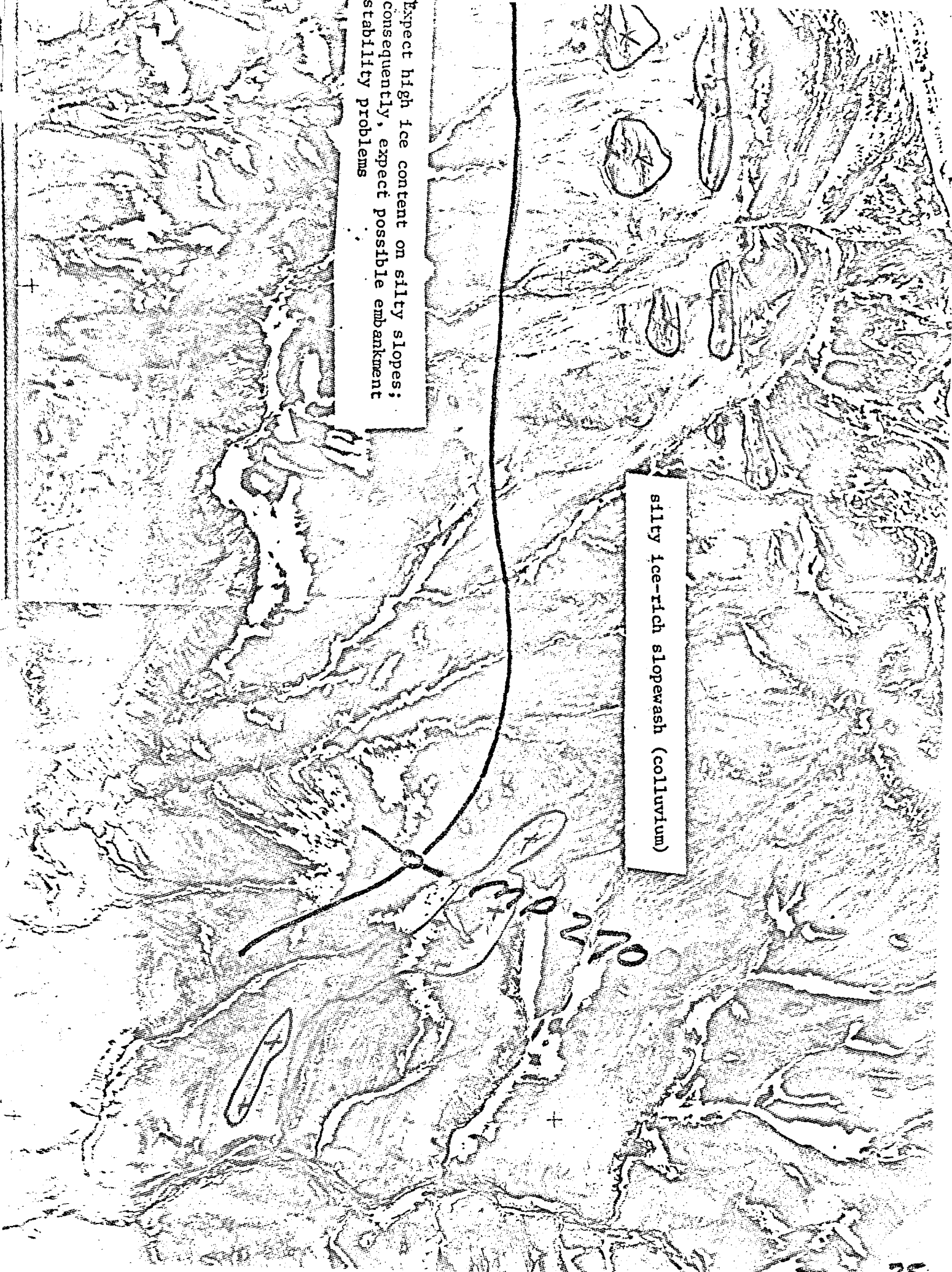
gravels

frozen sands

check cutbank

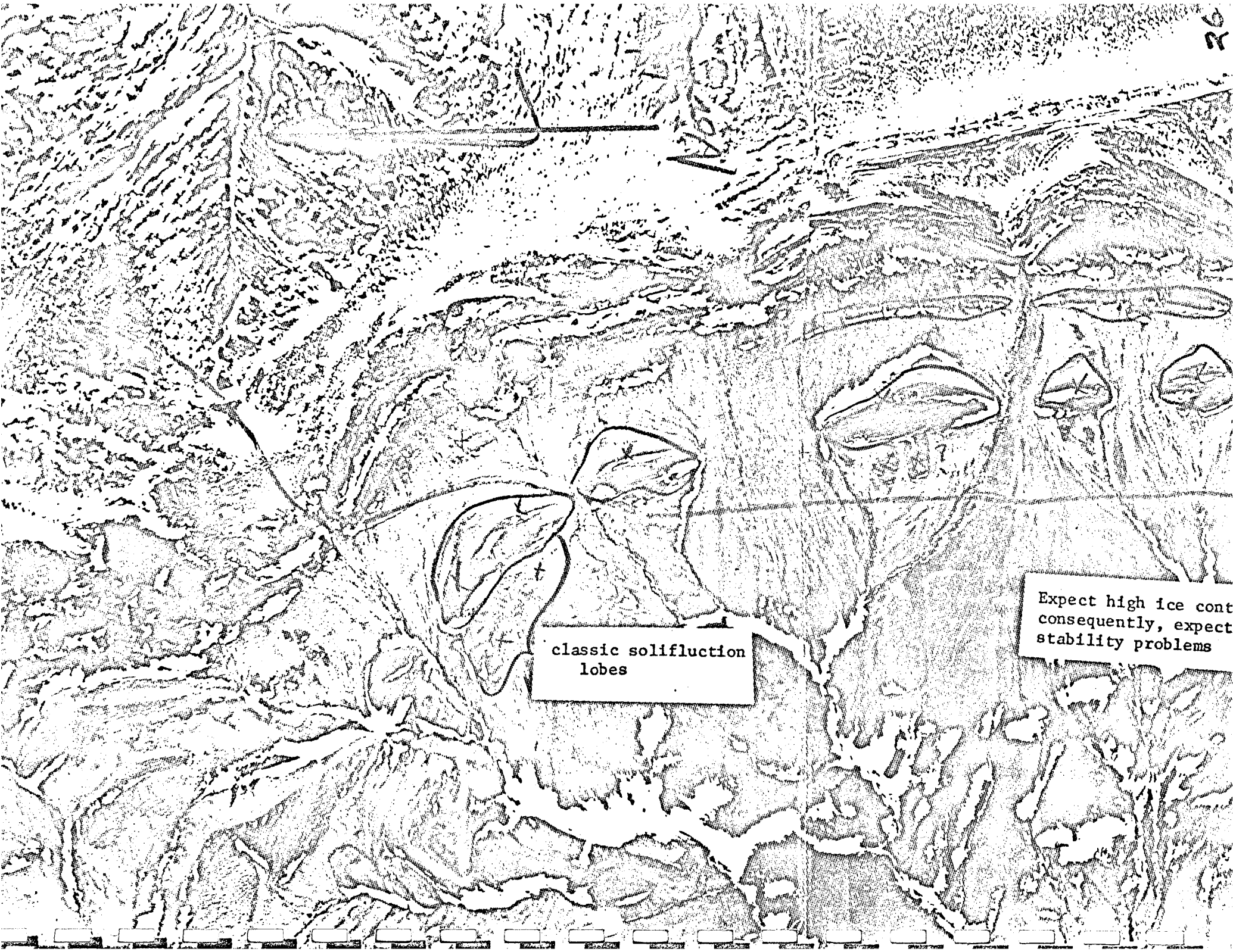
granular
alluvium





Expect high ice content on silty slopes; consequently, expect possible embankment stability problems

silty ice-rich slopewash (colluvium)



classic solifluction
lobes

Expect high ice cont
consequently, expect
stability problems