INDEX

IN FOLDER

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GEOMORPHOLOGY

The Permit Numbers 5295 and 5296 lie on the interior plains area of the Northwest Territories about 140 miles west of the edge of the Pre-Cambrian Shield. The area was completely glaciated during Wisconsin time as is shown by the abundance of glacial landforms and by modification of the bedrock surface. These glacial features are not so dominant as to obliterate all other surface forms and features and much non-glacial geological information can be had from the mosaic. The direction of ice movement was obviously northwest-southeast.

The drainage pattern is not well defined in this area but, in general, the drainage is to the north towards Whitefish River and eastwards towards Great Bear Lake. Within the mosaic much of the drainage is internal towards small lakes which have no drainage. The east part is drained by several creeks which flow directly into Great Bear Lake. Many of the small streams are intermittant and hold water only during the spring. The general drainage pattern is dendritic but it has been greatly altered by the glacial affects and the many lakes. It does not appear to be controlled by any subsurface feature.

There are no topographic forms present which indicate any geological feature.

GLACIAL FEATURES

The surface of the area has been modified on a very large scale by the passage of the glaciers and their subsequent melting. The bedrock itself, however, probably did not exert any influence on the ice flow pattern or the direction and pattern flow of the meltwater streams. There is a possibility that the strong lineations were present before glaciation and that the glacial flow simply took the line of least resistance and followed pre-existing lineations. This net effect would be an accentuation of the pre-glacial trends.

Small moraine belts are present throughout nearly all of the mosaic area. Nearly all of these are maturely dissected but the typical knob and kettle topography remains. The kettle lakes are very small compared to other lakes in the area often the small depressions contain no water at all. The knob hills are usually low and well rounded. The moraines are not as large or as conspicuous as those in the Province of Alberta.

Scattered throughout the moraine are countless drumlinoid forms. These are formed near the edge of the moving glacial ice and are parallel to the direction of movement of the ice. They are usually less than 50 feet high and several hundred feet in length. True drumlins are a distinct, easily recognised shape, but in this area post-glacial erosion has obliterated most of these features and no "drumlin fields" are present. Drumlins are almost

always composed of glacial till material and in their unaltered state are good indicators of the direction of ice flow. They are present in the northeast corner of the mosaic.

Transverse ridge is the term applied to all drift ridges formed at right angles to the direction of ice flow. Many of these features are present throughout the two Peraibo and good examples can be seen in the area east of Tunago Lake. They are characterized by being short in length and are seldom more than a few tens of feet in height. These features often occur as small ridges in drumlin-fields and are at right angles to the long axis of the drumlins. On aerial photographs the transverse ridges give the terrain a cross-hatched appearance.

Ice block ridges are usually seen in glaciated areas but none can be seen on this mosaic. If they were once present they have been removed by erosion. Typically they are small ridges which surround or nearly surround irregularly shaped depressions. These ridges were formed in streams between ice blocks into which ablation material was sloughed as the individual ice blocks melted.

Perhaps the most striking glacial feature anywhere is the esker. These are long sinuous ridges of gravel and till laid down by sub-glacial drainage streams. Some can be traced for astonishing distances - over 200 miles on the Canadian Shield.

previously described would appear to contain an adequate source within the bituminous shales. This section should be considered in any exploratory plans for this area.

CAMBRIAN

[illegible] GROUP

The type section of the Mackenzie Group is located about [illegible] miles southwest of Permits 3095 and 3096 in the Dodo Canyon of the Mackenzie River. At the type section the Mackenzie is divisible into a number of formations which total 997 feet in thickness. The base is placed at the bottom of a 130 foot thick chocolate brown shale while the top is placed above 50 feet of evenly bedded limestone with shale partings. The lithology is made up of interbedded limestones, sandstones, reddish coloured gypsum, white, petroliferous shales, red and green shales as well as chocolate coloured shales. The Imperial River section which was mapped by Norman lies 30 miles to the northwest of the type section. The section, which is 1,839 feet thick with the base not exposed, consists of alternating sandstones, limestones, gypsum and red-coloured shales. The lower part consists of sandstones with minor shale interbeds which appear to be a shallow water deposit. Also they are ripple marked and cross-bedded. The section becomes increasingly shaly upwards. The gypsum content is also greatest near the top. A 145 foot thick bed of black to dark grey, [illegible], algal limestone is located near the top of the section. Stromatolitic algae up to 3 feet in diameter are present. At Norman Wells the Mackenzie Group contains a bed of salt 2,000 feet thick

which is correlated with the Saline River Formation. This salt section is believed to be present to the north, west and south of Norman Wells for the following reasons:

1. The western margin of the Saline River salt is known in the Norman Wells area and a postulated extension of this margin can be made to the north, west and south of Norman Wells.

2. The overlying Ronning carbonates are brecciated at exposures in the northern Richardson Mountains west of Inuvik, suggesting salt solution collapse.

3. The type section at Saline River which lies 100 miles south of the Permits under discussion, contains salt as evidenced by the presence of salt springs.

4. Aeromagnetic coverage north of Inuvik has disclosed two features which bear a marked similarity to known salt domes in the Arctic Islands.

5. The gypsum in three diapiric structures which intrude Cretaceous beds on the east margin of the Richardson Mountains west of Inuvik contains evidence of early Paleozoic origin.

Since the Saline River salt is evidently so wide spread it certainly should be present under the Permits 5295 and 5296,

with the eastern edge lying some unknown distance to the east. The solution of this salt creates the possibility of salt structures in the overlying carbonate banks similar to those found to be productive in southeast Saskatchewan and at Rainbow Lake in northwestern Alberta. The algal laminate at Imperial River indicates some organic activity in the Macdougal seas and this coupled with underlying salt features, could give rise to hydrocarbon bearing reservoirs within this sequence. The petroliferous shales within the Macdougal should be adequate source material. The Macdougal has been reached by very few of the wells drilled in this region and nowhere has it been fully penetrated. Imperial Vermilion Ridge No. 1, which is about 70 miles west of the Permits drilled 3,177 feet of Macdougal beds without reaching the underlying Katherine Group. To date no reservoirs have been tested in the wells which have drilled to the Macdougal.

ORDOVICIAN-SILURIAN

RONNING FORMATION

Rocks of Ordovician age have not, as noted by various authors, been definitely identified in this region; however, it seems to be generally accepted that they are present in the Norman Wells region. The contact with the underlying Macdougal is unconformable. Stelck mapped 1,500 feet of shales and argillites at outcrops in the Upper Peel River area, which lies some 300 miles to the west of these Permits. About 150 miles southwest of the Permits, at the Keele and Twitya River confluence, the Ordovician section was mapped by Keele as 4,000 feet of alternating

beds of argillite, dolomite and limestone with 1,500 feet of sandstone overlying and separated from them by a 100 foot thick diabase sill. He mapped this same sandstone 35 miles to the east as being 4,500 feet thick with only occasional shale partings. The sections described in outcrop by Keele and Stelck along with the scattered subsurface control available have been used to establish some regional lithofacies trends for the Ordovician.

The Upper Peel River section is mapped as an open marine basinal sequence of shales and argillites. Flanking this basin are shelf-edge carbonates which are reefal in part. These shelf-edge carbonates are found along the MacKenzie Mountains and on the Peel Plateau. Back of the shelf-edge carbonates are the shelf carbonates proper, which are generally clean, finely crystalline carbonates with variable porosity. They are present over most of the interior plains and should underlie the Permits under discussion.

The distribution of Silurian age strata covers a much wider area than do the beds of Ordovician age. Lithologically, the Silurian rocks are very similar to the underlying Ordovician beds and for this reason as well as ease of working with them, they have been grouped together as the Ronning Group. The sedimentary pattern for the Silurian is very similar to that established in the underlying Ordovician. In the Norman Wells area the Ronning Group can be divided into two formations, a lower unit named the Franklin Mountain and an upper unit named the Mount Kindle. The

The section at Bear Rock near Fort Norman, which is 30 miles west of Mt. St. Charles, consists of 600 feet of limestones, dolomites and shales with the brecciated sediments of the Bear Rock overlying them and the Macdougal red and green, gypsiferous shales underlying them. The Mount Kindle is apparently not present here. Imperial Loon Creek No. 2, in 65°, 07', 20" N., and 126°, 128', 51" W., which is about 75 miles southwest of the Permits, penetrated 1,270 feet of Ronning which is close to the same thickness as mapped at Mt. St. Charles. The Loon Creek well found the Ronning to consist mainly of white to grey, micro-crystalline to granular dolomites with some evaporitic plugging. Scattered poor porosity was present throughout; however, no tests were run. Outcrops of the Ronning are found about 70 miles to the northwest of the Permits along the Mare Indian River. The section consists of 750 feet of limestones, overlain by the Bear Rock with the base not exposed. The section is not identified as Mount Kindle but regionally it should be present at this location.

Stelck mapped 100 feet of massive, crystalline, porous limestones containing some coralline fauna at Schooner Creek, which is 4 miles north of Norman Wells. He correlated them with the lower portion of the Mount Kindle Formation. This section can be interpreted as a porous, carbonate bank deposit. The Mount Kindle is likely to have a number of these carbonate banks or low transgressive reef fronts in this area, since, as can be seen from the various sections described above, it undergoes both facies changes and thickness changes in this region. Since the Mount

Kindle is present on Mt. St. Charles to the south of the Permits, as well as to the north of them it will doubtlessly be present under them. The section may contain carbonate banks or low reefs fringing the eastern shoreline of the Mount Kindle sea. Oil staining has been described in the Upper Ronning Group at wells in the Norman Wells area.

The trapping conditions which can be outlined in this area, are quite varied. A few of these potential traps are outlined below:

(a) The marked disconformity which separates the Ronning Group from the overlying Middle Devonian - Bear Rock Formation may have produced erosional features, such as scarps and monodnocks, which would be sealed by the basal evaporites of the Bear Rock. Leaching should enhance the reservoir properties and make this an effective hydrocarbon trap.

(b) As outlined previously, low reef fronts or carbonate banks may be present and coupled with a seal provided by overlying Bear Rock evaporites could present an extensive trap. Lateral facies changes from porous to semi-evaporitic carbonates also provide a potential trap of considerable areal extent.

(c) Selective Solution of the underlying Cambrian

Saline River salt may give rise to one or two stage salt solution structures such as are found to be productive of oil in the Hummingbird area of southeast Saskatchewan. Partial solution of the salt prior to or during Mount Kindle deposition would have served to provide local elevations on the sea bottom where the salt was not removed. These local elevations would provide the loci for reef and/or carbonate banks to grow on. Traps of the Hummingbird type would involve early local solution of the salt. This may have occurred in late Cambrian or early Ronning time. The depressions created would receive an extra fill of sediments over that being deposited where the salt was not removed. Once sedimentation within the sink caught up, subsequent sediments would be deposited on a normal sea floor. The second stage in the formation of the Hummingbird type trap would involve the removal of the salt surrounding the original sink at some time subsequent to Mount Kindle deposition. This would leave the Mount Kindle reservoirs overlying the site of the original salt solution structurally high. The Bear Rock evaporites should provide an effective reservoir seal. Evidence to support one or two stage salt removal in this region is present in the brecciated nature of the sediments composing the Lower Ronning and Bear Rock sediments in known sections.

(d) Gentle to tight anticlinal folds may have been formed by some of the numerous periods of structural activity which have occurred in this region.

MIDDLE DEVONIAN

BEAR ROCK FORMATION

The Bear Rock Formation overlies the Sunning Group and is separated from it by a marked disconformity. The contact with the overlying Hume (Ramparts) may also be disconformable. The type section is located about 70 miles southwest of Permits 5295 and 5296 at Bear Rock, near Fort Norman. The type section is mapped as two distinct facies, a basal 60 feet to 80 feet of white, gypsiferous, massive lensing dolomite or limestone and an upper 175 feet of breccia composed of brown, dolomitic limestone fragments set in a matrix of dolomitic limestone. Separating the two facies is a 30 foot section of poorly bedded, dark grey limestone and dolomite. The contact with the overlying Hume (Ramparts) is gradational and consists of a 10 foot interval of bedded limestone and dolomite breccia.

The Bear Rock is a very widespread formation which undergoes a number of facies changes from open marine basinal shale facies to an evaporitic sequence. The basinal shale facies which is present in the Richardson Mountains continues southward along the western side of the Mackenzie Mountains. The basinal shales are flanked by a belt of shelf-edge limestone and dolomite which

[illegible] ([illegible]) Formation. The [illegible]. St. Charles section [illegible]. The thickness variation between these two [illegible].

[illegible]

[illegible] in the literature [illegible]

[illegible]

The Upper Ramparts limestone at this section is 180 feet thick and is mapped as limestone, black to grey-brown, massive, grading to shale at the base. The upper portion consists of limestones, grey to dark grey, massive, with thin black shale partings.

The term Ramparts was discarded by Basset in his paper. The section as redefined by Basset consists of: the Hume Formation which he equates with the Lower Ramparts of Hume; the Hare Indian, which is considered the correlative of the Middle Ramparts Shale and the Kee Scarp which is correlated with the Upper Ramparts.

The type section of the Hume is located in the MacKenzie Mountains on the east branch of the Hume River where it consists of 600 feet of thinly bedded limestones which are light grey, argillaceous, very fossiliferous and of shallow water origin. The Hume is correlated diachronously with the lower portion of the Keg River Formation of northern Alberta. The correlation is based on unbroken zones within the Hume and Lower Keg River Formations. The Hume has been found as far north as the Anderson River. The thickness of the Hume is quite variable as is readily apparent if the type section is compared to the section at Schooner Creek, which is 8 miles south of Norman Wells. The Hume here is only 8.5 feet thick and consists of limestone, black, shaly to slaty and fossiliferous. The basal 1 foot to 2 1 foot thick conglomerate unconformable contact with the underlying Bear Rock.

The Hume Formation is generally encountered as a non-porous rock both in outcrop and in subsurface. The Keg River platform of northern Alberta is also normally a non-porous rock; however, it does develop into a marginal shoal along the north flank of the Peace River Arch. This marginal shoal is a very porous, granular, reefy dolomite which yields large quantities of water when drill stem tested. The marginal shoal is in turn replaced by back shoal mud flats, which are the lateral equivalent to shoreline sands. The sands have been found productive of oil in some locales. The facies pattern developed along the north flank of the Peace River Arch should have been repeated in this area along the margins of the Pre-Cambrian Shield. The marginal shoal and the shoreline sands may have been removed by one of the many periods of deep erosion that have occurred in this region; however, the acreage covered by Permits 5295 and 5296 must be considered as very well placed to evaluate these possibilities.

The Hume has been described at various localities as being very petroliferous in part. This situation is also duplicated in the Keg River platform where it is overlain by the productive Keg River pinnacle reefs in northwestern Alberta. The Keg River platform is almost certainly the source of the oil in these prolific reefs, and because of the similarities outlined above any reservoirs developed in the Hume must be considered as prospective.

HARE INDIAN

The contact of the Hare Indian with the underlying Hume is generally sharp and probably represents a sudden influx of mud into a clean well aerated sea. It appears to represent a mud bank deposit with the source area lying to the northeast, partially filling a large basin. The contact of the Hare Indian with the overlying Kee Scarp is somewhat diachronous, since it is generally placed at the point the section changes from predominant shale to predominant limestone. Facies changes thus account for the diachronous nature of the contact as well as having been the cause of some of the confusion which has surrounded Devonian correlations in this region. The section at Carcajou Ridge serves to illustrate this problem. Carcajou Ridge lies along the Mountain River west of Norman Wells. The section can be mapped as Kee Scarp Reef 6 feet to 70 feet thick, overlying 900 feet (plus) of Hume Formation with the intervening Hare Indian Shale going from zero (0) feet to 21 feet in thickness. The section should probably be mapped as containing much more Hare Indian, only as a limestone and shale facies and not strictly as a shale facies in this case. The Hare Indian generally consists of 500 feet to 700 feet of slightly calcareous, light greenish-grey to medium grey, bituminous (in part) shale with abundant micro fossils. However, due to the facies changes, as mentioned above, it can thin to less than 100 feet in a few miles.

The Hare Indian has been recognised as far north as Anderson River, is present at Fort Good Hope as a 700 foot thick

Scarp in the area is 495 feet. The Kee Scarp is overlain by the [illegible] Formation, or, in its absence, the Fort Creek shales which Bassett redefined as part of the Imperial Formation.

The oil in the Norman Wells field is trapped in the updip end of a discrete Kee Scarp reef. The thickness of the reef ranges up to a total of 495 feet. Reserves in the reef have been estimated as high as 60,000,000 barrels while the productive area of the field is placed at 2,500 acres.

The platform unit of the Kee Scarp is undoubtedly the correlative of the Upper Ramparts limestone unit mapped by Hume. This fact, as mentioned above, means the Kee Scarp is a widespread unit. Since the Kee Scarp reef grows upwards from the platform unit any wells drilled in this area and any acreage held, must be considered as possibly containing discrete Kee Scarp reefs. Platform reef growth, regionally, has generally been found on the margins of Hare Indian shales, however, the presence of them does not enclose Kee Scarp reefs. The margins of the two Hare Indian shales, which were described under the discussion of that formation, have not yet been found to contain reefs; however, they have not been adequately explored either. The trend of the [illegible] shale to towards the Permits under review which makes [illegible] prospective for finding Kee Scarp reefs.

UPPER DEVONIAN

CANOL FORMATION

The Canol Formation was defined by Basset to include the black to very dark brown, non-calcareous, bituminous shales which overlie the Kee Scarp, or, in its absence, the Hare Indian Formation. The Canol is overlain by the Imperial Formation. The Canol may be the equivalent of the lower part of the Bear River shale of northeastern British Columbia. The Canol thickness ranges from zero (0) feet to 400 feet in the Norman Wells area. The thickness varies in relation to the underlying Kee Scarp reef much in the same manner that the Ireton thickness is related to Leduc reefs within the Province of Alberta, i.e. the Canol thins over the reefs to nil in places and thickens in the off-reef direction. The Canol Formation should be present under the Permits in question.

IMPERIAL FORMATION

The Imperial Formation was redefined by Basset to include all beds of Devonian age overlying the Canol Formation and which are unconformably overlain by Cretaceous strata. He recommended that the term Fort Creek Formation be discontinued as the above definition of the Imperial includes the Fort Creek shales within it. The Imperial consists of a sequence of greenish-grey shales overlain by a series of fine sandstones, siltstones and thin limestone beds. The Imperial is capped at many places by a grey shale sequence. The Imperial is extremely variable in lithologies which makes correlations within it very difficult. The Imperial may reach a thickness of more than 3,000 feet where the processes

of erosion have not cut very deeply.

CRETACEOUS

SANS SAULT GROUP

The Sans Sault Group is the basal group of Cretaceous sediments which lie directly above the disconformity separating Cretaceous and Devonian sediments. The top of the Group is usually placed at the base of the first bentonite bed in the overlying thick shale sequence. The sequence consists of shales and sandstones of marine origin. The thickness is about 1,411 feet at the Sans Sault section.

SLATER RIVER FORMATION

The Slater River which overlies the Sans Sault Group, consists of thin bedded, black, friable shales with abundant ironstone concretions. There are also some beds of white and yellow alum and sulphur. Sandstone is only occasionally present. There are many beds of bentonite, which in outcrop are 1/8" to 1" thick. The Slater River Formation also contains a fish scale horizon which is thought to indicate an upper Cretaceous age for the formation. This formation is about 1,000 feet thick at the type section.

LITTLE BEAR FORMATION

The type section of this formation is west of Fort Norman on the Little Bear River. The beds consist of sandstone, some conglomerates, sandy shales and coal seams. The beds are not correlatable between areas due to their lenticular nature. The beds are 780 feet thick at their type section and contain marine,

brackish and fresh water fossils.

[illegible] FORMATION

The [illegible] formation is made up of a sequence of [illegible] stratified, gray, carbonaceous and pyritic [illegible] shales. There are some thin [illegible] sandstone members and thin [illegible] coals. The thickness of this formation is [illegible] on the East Fork of the [illegible] River.

The thickness of Cretaceous rocks present [illegible] Permits 1895 and 1896 is very difficult to determine. A. G. [illegible] noted coal deposits on Sharon Point which [illegible] east of the Permits on the east side of Grand [illegible]. The coal which is lignite, is contained in about [illegible] of sandstone. The outcrops usually contain several coarse [illegible] of clay, sand, or silt. The width of one seam is [illegible] 17-1/2 feet and may be about [illegible] feet in length. The age of the coal is not given, but it may be part of the [illegible] formation.

The unconformity which underlies the Cretaceous in this area has probably removed much of the [illegible] from the area covered by Permits 1895 and 1896. [illegible] and surface control is so sparse in this area, any [illegible] of the depth of this erosion is very difficult to make. North of Norman Wells this erosion has in places removed the entire Upper Devonian sequence, leaving the Middle Devonian Formation at outcrop.

body. The engineering conclusion must in fact be world wide".

External forces such as earth tides obviously fit these requirements. Some internal forces may also apply such as the action of many regional tectonic forces, and the most probable of these is isostatic adjustment. Isostatic rebound following the melting of the glaciers may still be taking place and this will further accentuate fractures present before glaciation.

In general it can be said that fracture patterns are caused by either internal or external forces. If the forces are internal the result could be different orientation of the fracture systems in areas of similar tectonic history but different position. If the forces are external the orientation of the fracture arrangement should have world wide similarity. However, stable areas such as the masses of the continents may develop fracture patterns due to external forces and tectonically active areas may develop their own pattern due to internal forces.

If joints form early in the history of a sediment then systematic joints must be successively younger upwards through the section and the joint pattern is imposed on each new layer of sediments when they have become consolidated enough to fracture. This upward propagation is caused by the fatigue caused by stress, which in turn is caused by diurnal earth tides.

EXPRESSION OF FRACTURE

Fractures have been observed in aerial photographs from every climate and on every continent in the world. They are expressed as topographic relief, vegetation differences and soil tonal differences.

TOPOGRAPHIC RELIEF LINEAMENTS

A common type are relief lineaments which can be manifested by a change (usually abrupt) of topographic elevation on either side of a relatively straight line. They may be also expressed as straight valleys or hills or by straight streams where the stream course is controlled by a fracture zone.

VEGETAL LINEAMENTS

Vegetal lineaments are the most common in the parkland and muskeg areas of western Canada and many excellent examples of fractures can be seen on almost any aerial photograph of northern Saskatchewan, Alberta or British Columbia. Straight lines of both deciduous and evergreen trees as well as scrub growth are universally visible. However, the most common vegetal lineament seen by this writer is a straight "edge" to a clump of trees or bushes. In many cases these fractures control the size and shape of the clumps of trees as well as the size and shape of cultivated fields. Excellent examples of this latter expression of fractures are present in the western part of the Peace River district.

SOIL TONAL LINEAMENTS

These reflect differentiation in soil moisture and general ground water conditions. These are common in the southern parts of Alberta and Saskatchewan, especially near large rivers.

Surface investigations have shown that fractures are associated with bedrock joints; however, in glaciated areas such as Western Canada, the photoanalyst must take care to establish the direction of ice flow over an area before he begins to statistically plot and analyse the fractures. Most areas in Western Canada show an abundance of grooves and flutes caused by the glacier and these must not be mistaken for fracture traces caused by subsurface structural conditions. In parts of the Lloydminster area of eastern Alberta the glacial scars are so deeply impressed on the surface that fracture analysis is at best difficult and often impossible.

INTERPRETATION OF FRACTURE DATA

The object of Fracture Analysis (Photogeophysics) is to locate shallow to deep-seated structural and stratigraphic anomalies. The actual count of fractures per unit area is made and values are contoured on a "Fracture Intensity Map". In areas of known reefs the fracture intensity is 2 - 3 times greater on the flanks of the reef than directly above the reef.

In any fracture pattern there are two main systems of fractures; the axial system and the shear system. In both systems

the shape of the lakes and of tree growth in the area. In any area such as this the photoanalyst is faced with the difficult problem of eliminating the glacial scars from the fracture pattern without creating false anomalies. The removal of all fractures from a 10 - 12 degree arc in any area will create fracture anomalies and it requires delicate weighting of the whole pattern to adjust for these effects.

In any fracture pattern there are two main systems of fractures: the axial system and the shear system. In both systems the fractures are sub-parallel and in general, the two systems are at approximate right angles to each other. Within Petroleum and Stutsman the Permian [illegible] and [illegible] the statistical mean direction of the axial system is North 60 degrees West and the statistical mean direction of the shear system is North 30 degrees East. A third shear system, more normal the sub-axial system, trends [illegible].

[illegible] fractures of great length can be seen and on which are considered to originate within the basement. It is [illegible] fracture pattern on the [illegible] within the [illegible]. Furthermore, on the fractures are short [illegible] to be more likely those may originate in the upper [illegible] of the [illegible]. In the [illegible] of the [illegible] in [illegible] to [illegible] the [illegible] [illegible] [illegible] the [illegible]

incidence anomalies on a mosaic are considerably larger than the subsurface feature which causes them and thus any anomaly under Permits 5295 and 5296 is probably quite small.

There is one area on the mosaic where the fractures are less intense than the surrounding area.

Some fractures are always present within these areas but they usually have a lower incidence than the surrounding area. These low intensity areas are important and it is quite likely that they are due to some subsurface feature. The type of feature will be discussed in the next section of this report.

STRUCTURE

Petroleum and Natural Gas Permits 5295 and 5296 are located on the interior plains of the Northwest Territories about 140 miles to the west of the edge of the Pre-Cambrian Shield. The strike of the sedimentary rocks is about North 40 degrees West and the units dip to the southwest at a few tens of feet per mile.

Structural features which could be present and which could cause the low incidence anomalies mentioned in this report are discussed in order of probability.

1. PRE-CAMBRIAN TOPOGRAPHY

Basement topography under Permits 5295 and 5296 is thought to be much the same as it is today along the southwest edge of the Shield. Low rounded hills separated by gentle to abrupt valleys are seen on the Shield and these features are undoubtedly present under the subject Permits. The effect of this Basement relief on the overlying sedimentary rocks is often great. The Granite Wash sand is usually present in the topographic 'lows' on the Basement but absent on the 'highs'. The Granite Wash is an excellent potential reservoir.

Further effects of Basement topography on beds higher than the Granite Wash is the gentle folding present over Basement hills. These folds are anticlines in every sense and could form traps for oil or gas.

[redacted]

4. [redacted]

[redacted]

5. [redacted]

[redacted]

6. [redacted]

[redacted]

[redacted]

[redacted]

[redacted]

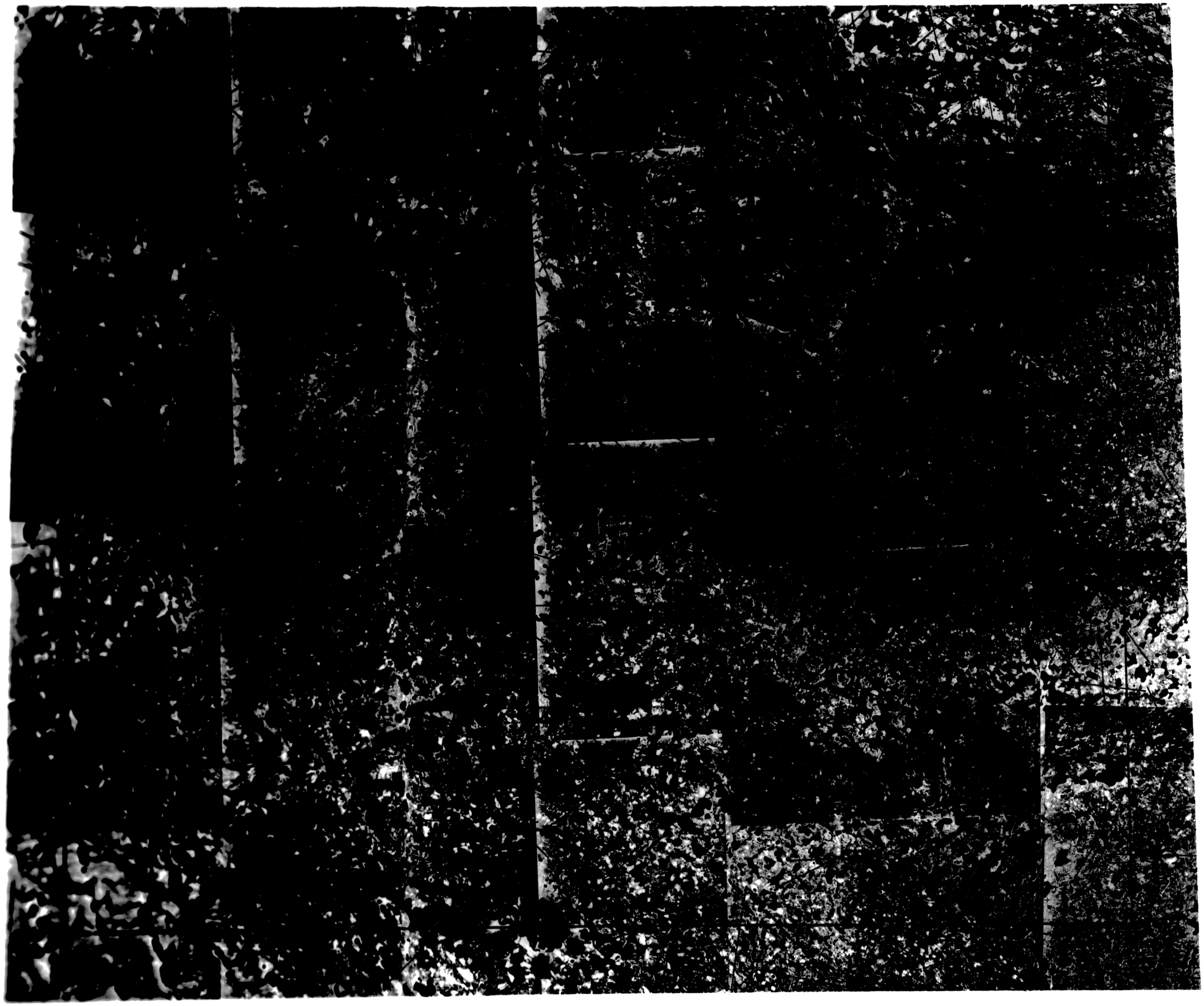
[redacted] : Imperial River. Canal Reports Lower [redacted] River. Canal Reports.

[redacted]

[redacted], Three Sons. Reports. Bedhomer Creek Canal Reports. Cherokee and Little Bear River Divide Area Canal Reports. Bear Rock and Bluefish Creek Canal Reports.

[redacted]

[redacted] and Petroleum Textonics of North [redacted] Cherokee Area, Canada, Bull. Amer. Assoc. Petrol. Geol., Vol. 43, No. 10, pp 2399 - 2455.



PARIS INVESTMENTS LIMITED

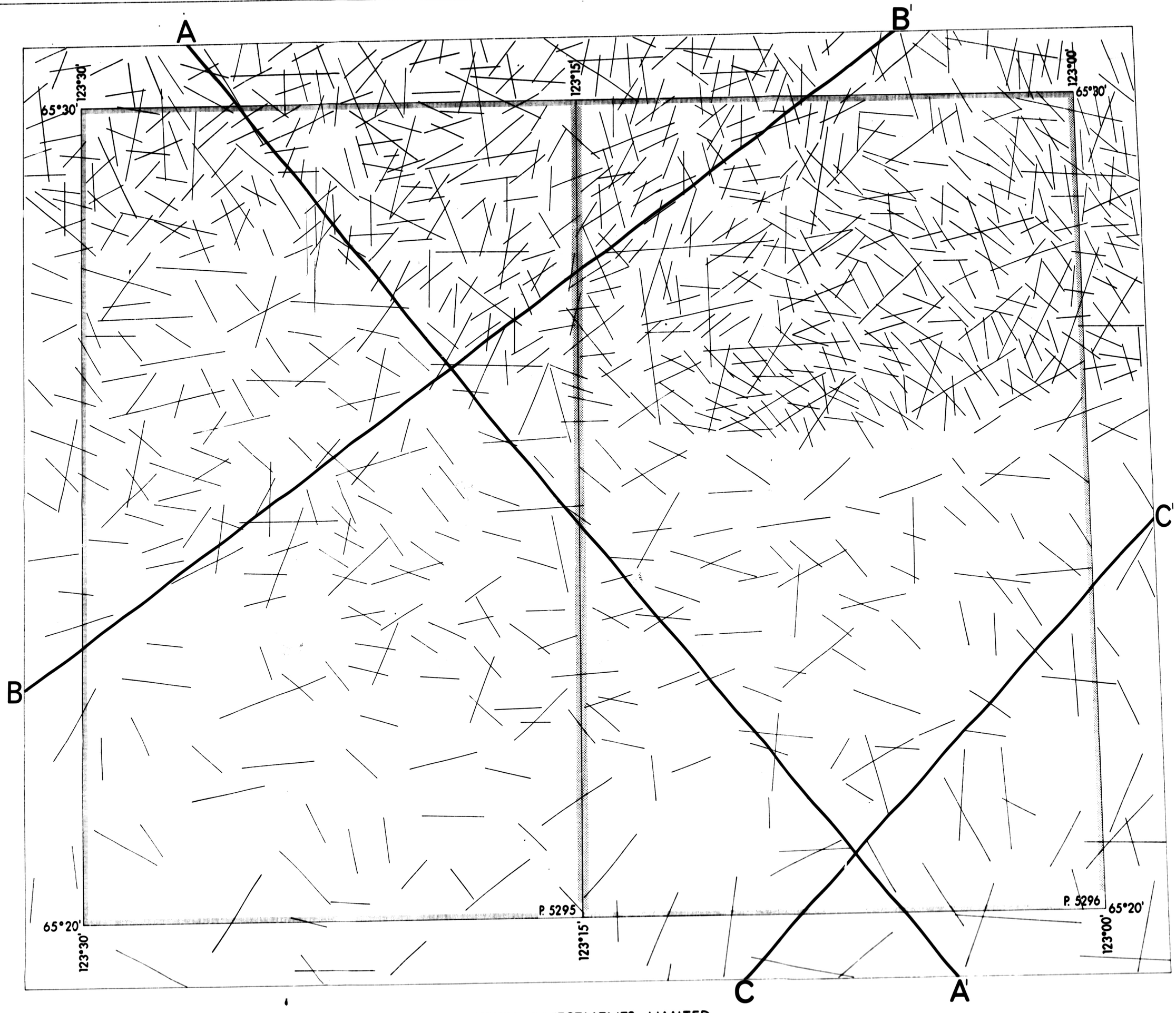
P & N.G. PERMITS 5295 & 5296

689-2.6.5

SCALE IN MILES

1 0 1 2 3

THIS IS AN UNCONTROLLED MOSAIC AND SHOULD NOT BE TAKEN AS AN ACCURATE TOPOGRAPHIC MAP



PARIS INVESTMENTS LIMITED

P. & N.G. PERMITS 5295 & 5296

TOTAL FRACTURE PATTERN

609-A.6.8

SCALE IN MILES

0 1 2 3

LOW DENSITY

NORMAL DENSITY

HIGH DENSITY

65°30'
123°30'
123°15'
123°00'
65°20'
P. 5295
P. 5296

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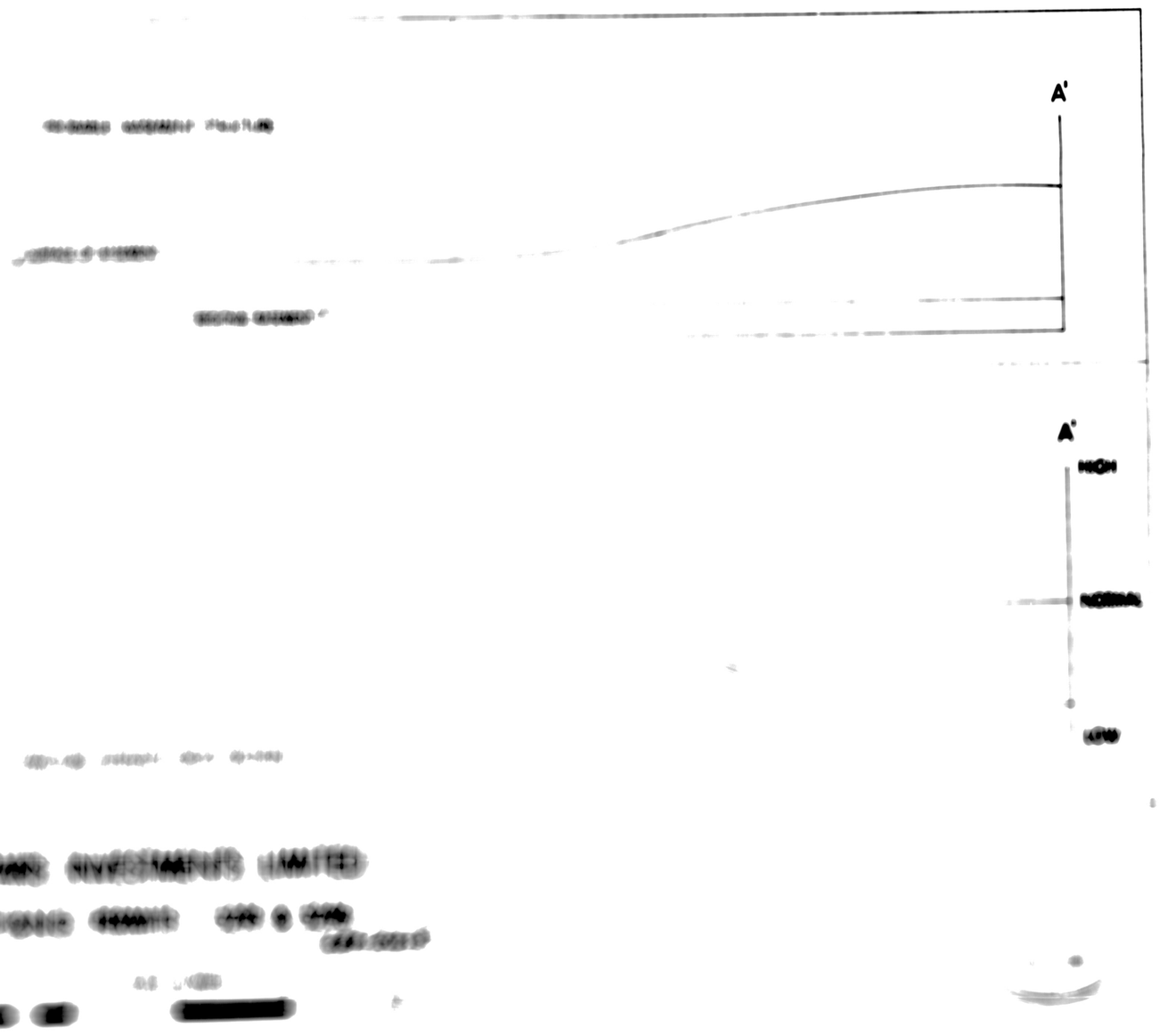
P. & N.G. PERMITS 5295 & 5296

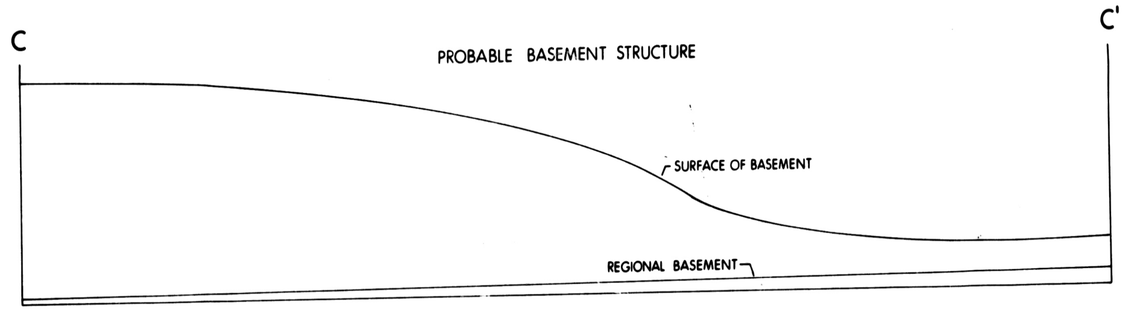
MEGA FRACTURE PATTERN

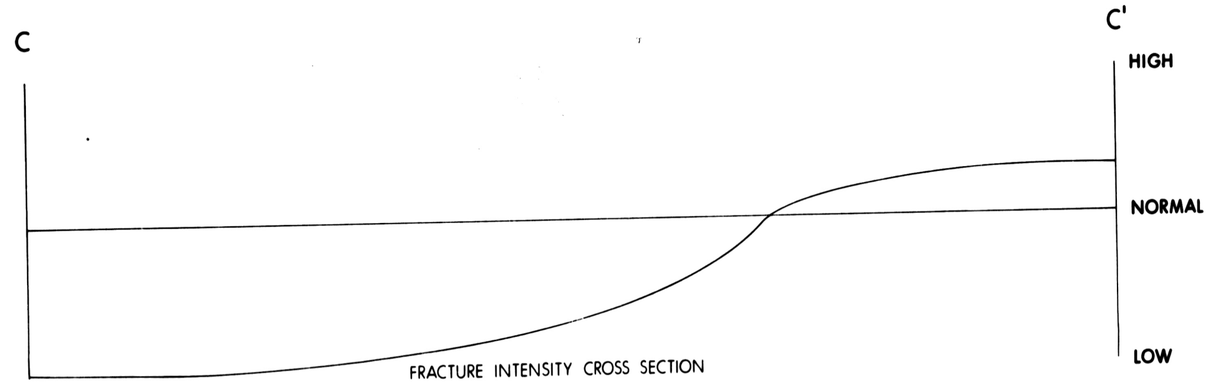
SCALE IN MILES

609-26-5

1 0 1 2 3


A'
A'





FRACTURE INTENSITY CROSS SECTION

PARIS INVESTMENTS LIMITED

P. & N.G. PERMITS 5295 & 5296

689-2.6.5

SCALE IN MILES

1 0 1 2 3

B

PROBABLE BASEMENT STRUCTURE

SURFACE OF BASEMENT

REGIONAL BASEMENT

B

FRACTURE INTENSITY CROSS SECTION

PARIS INVESTMENTS LIMITED

P & N G PERMITS [illegible]