DU PONT OF CANADA EXPLORATION LIMITED

TENAS JOINT VENTURE

Report on the Geology of the T, TENAS WOP, BAR and MAL claims

NTS: 105-K-1

by

L.K. Eccles, G. MacLaren, K.A. MacLean
F.M. Smith

Nov. 1977

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DU PONT OF CANADA EXPLORATION LIMITED

TENAS JOINT VENTURE

Report on Geology of Project Area

T, TENAS, WOP, BAR and MAL claims

62°03'N, 132°20'W

NTS: 105-K-1

by

G.M. Ditson, L.K. Eccles, G. McLaren

Conducted under the supervision

of

F. Marshall Smith, P.Eng

and

K.A. MacLean, P.Eng

November, 1977

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 DESCRIPTION OF PROGRAMME

The 1977 programme included approximately one months work by three graduate geologists who set out to map the sparse outcrops occurring on the TENAS, WOP, MAL, BAR and T claim blocks. These claim blocks were united into one project area by Du Pont of Canada Exploration Limited under agreements with Welcome North Mines Limited, Teck Mining Corporation and R.E. Chaplin. The T claims were staked by Du Pont late in 1976 and early in 1977, while the TENAS, WOP, MAL and BAR were all staked prior to 1973.

The reader should realize that the object of this ongoing programme is to find massive sulphide deposits of the Anvil Range type, and that the geological mapping was done to help delineate permissive rock units. Thus the volcanic centres and their proximal and distal sediments received the most detailed geological investigation. In addition to the mapping, the 1977 programme included geochemical soil sampling by the Du Pont field crew, a gravity survey over a large part of the claim block by C.A. Ager and Associates and 610 m of diamond drilling.

This report is intended primarily to fulfil requirements of the Yukon Quartz Mining Act for recording of representation work on the T claims, although geological mapping covered the TENAS, WOP and BAR claims to some extent. Under the conditions of the Act, only physical work such as drilling or bulldozing can be claimed as representation after three years from the recording date, but the reader should be aware of the work done on the older claims and its value to interpreting the geology of the T claims.

The three geologists mapped different sectors of the project area under the supervision of F.M. Smith, P.Eng (BC). K.A. MacLean, P.Eng (BC) compiled and edited this report which was jointly prepared by the authors.

1.2 LOCATION AND ACCESS

The location of the field area is shown in Figure 1, lying almost entirely within N.T.S. sheet 105-K-1, and approximately 10 km north of the community of Ross River. The mouth of Tenas Creek, a centrally located feature, lies at 62°03' north latitude; 132° 20' west longitude. From this point the area stretches approximately 13.8 km to the southeast and 11 km to the northwest and averages 3.5 to 5 km in width. The North Canol Road (Highway 8) traverses the southeastern half of the property and marks the boundary between the Whitehorse Mining District to the north and west and the Watson Lake Mining District to the south and east. This road also provides direct access by truck to much of the property.

The Ross River which also traverses half of the property, made the use of an aluminum boat necessary, and to a limited extent, provided access to various points along its banks.

The northwestern half of the property is traversed by a number of old cat roads in a moderate state of disrepair, and these were expected to provide access to the northwestern portion of the T group and to the Mal group. However, the Muskeg Bombardier contracted for this purpose proved totally unreliable, therefore helicopter support was required from Ross River for crew mobilization into the more remote areas.

WHITEHORSE M.D. CLAIMS

Claims	Record Nos.	Expiry Dates
T 108-111	YA8313-16	October 27, 1977
T 152	YA8317	October 27, 1977
T 153-158	YA11695-11700	October 28, 1977
T 159-160	YA8318, 8319	October 27, 1977
T 191-216	YA8320-8345	October 27, 1977
T 219-272	YA8346-8399	October 27, 1977
T 275-281	YA8779-8785	March 29, 1978
T 290	YA8786	March 29, 1978
T 302 Fr, 303 Fr	YA18061-18062	June 9, 1978
T 305 Fr	YA18063	June 9, 1978
T 307 Fr	YA18064	June 9, 1978
T 309 Fr	YA 18065	June 9, 1978
T 311 Fr	YA 18066	June 9, 1978
T 313 Fr	YA 18067	June 9, 1978
T 318 Fr, 319 Fr	YA18068, 18069	June 9, 1978
T 321 Fr-327 Fr	YA18070-76	June 9, 1978
T 350 Fr, 351 Fr	YA18077, 18078	June 9, 1978
T 353 Fr, 354 Fr	YA18079, 18080	June 9, 1978
T 357 Fr	YA18081	June 9, 1978
BAR 1-18	Y80328-Y80345	August 17, 1979
MAL 1-44	Y80379-Y80422	August 27, 1979
TENAS 1-33	Y80346-Y80378	August 27, 1979
TENAS 34-41	YA3416-YA3423	August 25, 1980
BELL 15 Fr, 16 Fr	YA4124-YA4125	December 8, 1977
WOP 1-28	Y79660-Y79687	July 22, 1980
WOP 29-66	Y80208-Y80245	August 16, 1980

cont....

WATSON LAKE M.D. CLAIMS

Claims	Record Nos.	Expiry Dates
T 1-14	YA11548-61	October 27, 1977
T 15, 16 Fr	YA11562-63	October 28, 1977
T 17-100	YA11564-YA11647	October 28, 1977
T 101 Fr-105 Fr	YA11648-52	October 28, 1977
T 106-107	YA11653, 11654	October 28, 1977
T 112-151	YA11655-94	October 28, 1977
T 161-190	YA11701-11730	October 28, 1977
T 217-218	YA11731, 11732	October 28, 1977
T 282-289	YA12636-12643	March 30, 1978
T 300 Fr, 301 Fr	YA20201-20202	June 13, 1978
T 304 Fr	YA20203	June 13, 1978
T 306 Fr	YA20204	June 13, 1978
T 308 Fr	YA20205	June 13, 1978
T 310 Fr	YA20206	June 13, 1978
T 312 Fr	YA20207	June 13, 1978
T 314 Fr-317 Fr	YA20208-11	June 13, 1978
T 320 Fr	YA20212	June 13, 1978
T 352 Fr	YA20213	June 13, 1978
T 355 Fr, 356 Fr	YA20214, 20215	June 13, 1978
TENAS 100 Fr, 101 Fr	YA20197-20198	June 13, 1978
WOP 500 Fr, 501 Fr	YA20199-20200	June 13, 1978

1.4 TOPOGRAPHY AND VEGETATION

Most of the central axis of the field area lies in a broad valley containing the Ross River and Tenas Creek. River elevations are at approximately 800 m a.s.l. Outside of the relatively flat valley floor, delineated through parts of the area by steep sandy slopes and benches, the land slopes upward, moderately at first but becoming steeper and reaching 1300 m and 1100 m a.s.l. on the north and south flanks respectively.

The Ross River and Tenas Creek valleys are locally swampy, with many oxbow lakes and old meander scars, and tend to be thickly vegetated with willows, young spruce and poplar. The vegetation on the upper slopes vary from thick spruce and poplar bush to open stands of tall poplar in old burn areas.

A thick glacial till blankets the entire area, producing a number of sinuous sandy slopes topped by flat benches representing glacial strandlines. This material effectively masks most of the bedrock except where it has been locally removed by downcutting streams or where knolls in bedrock topography protrude. The resulting outcrop pattern is extremely sparse and sporadic, as can be seen from the geology map which accompanies this report.

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2.0 GEOLOGY

2.1 INTRODUCTION

A discussion of the geology will be broken down into descriptions of important units, followed by generalized regional overview and geologic history.

Regional geologic, and particularly structural, interpretations are greatly impeded by the lack of outcrop since extrapolation of features beteen outcrops is highly tenuous.

2.2.0 Geologic History

Hypabyssal andesites, andesite flows and tuffs, followed by intercalated extrusive andesite and rhyolitic tuffs, laid down in a subaqueous basin, were later overlain by greywackes and phyllites derived from the weathering of the continental platform found further to the northeast.

Following deposition of the greywackes, conglomerates then intercalated red and green cherts were deposited. Later, some Jurassic volcanic rocks of andesitic and basaltic composition were deposited. These younger cherts and volcanics were dominantly found in the south central section of the mapped area.

The youngest known rocks found in the area are Cretaceous intrusions of quartz monzonite and quartz feldspar porphyry. These rocks are found mostly in the northern part of the mapped area.

2.2.1. Table of Formations

Map Unit	Age	Type	Description
1	Cretaceous	Granitic rocks	Intrusive contacts into sediments and volcanics. Quartz monzonite and quartz monzonite porphyry Disseminated pyrite and traces of malachite. Mostly along northern edge of clai. blocks.
		Intrusive contact with younger rocks	
2	Jurassic	Red Chert, green chert, green basalts, andesites Rhyolitic fragmentals. Red and green slates conglomerates.	
3	Unknown	Andesite	Fine grained massive pale to dark green andesite flows. Calcareous matrix. Pyrite cubes. Local serpentine and talc alteration, chloritic alteration. Intercalates with Unit 4 Local small domes of andesitic composition.
4	Unknown	Rhyolites	Consider as proximal sediments. Sporadic occurrence Local pods intercalates with andesites and distal phyllites. Massive foliated or bedded in textures Sedimentary structures. Calcareous locally.
5	Unknown	Distal Sediments	
		Greywacke	dark grey, phyllitic, pyritic, cherty.
		Pearly grey phyllites.	thinly laminated, micaceous, occ graphitic
		Phyllitic argillites.	quartz veins and sulphide pods and veins.

2.3 GRANITICS - UNIT 1

The youngest rocks in the area are Cretaceous intrusives related to the large batholith to the north. Along the main contact, intruded sediments and volcanics are metamorphosed and riddled with aplitic, porphyritic and pegmatitic dykes. Quartz veins and lenses also become prominent as the intrusive contact is approached. Composition appears to be that of a quartz monzonite, and textures vary considerably. Outcrops at the north ends of lines 8900 and 9300 E expose intrusives invaded by aphanitic rhyolite dykes along N-S fractures.

Quartz feldspar porphyry is composed of euhedral, doubly-terminated quartz crystals, potassium feldspar, hornblende and biotite in a fine to medium grained feldspathic or pale green/grey aphanitic groundmass. Disseminated pyrite can be seen and locally traces of malachite are present.

In the north central part of the Mal group a tongue of the quartz feldspar porphyry intrudes into andesite, and is split by a north-south trending fault producing 2 small scarps 5 m high and up to 20 m wide. The andesites and sediments adjacent to the intrusion have been metamorphosed to either a quartz mica schist with large biotite grains defining a pronounced schistosity, or to a thinly banded gneiss consisting mainly of quartz, some feldspars and biotite.

2.4 JURASSIC ROCKS - UNIT 2

Jurassic rocks which overly the older sedimentary package consist of volcanics and minor sediments which are easily distinguished from other units in the area. As granites bound sediments to the north, Jurassic rocks bound them to the south; the southwestern portion of the 1977 survey grid covers a considerable area of these rocks which tend to form resistant ridges.

Rock types included in this unit are red chert (jasper), green volcanics ranging from rhyolite to basalt, and conglomerate. Red chert makes up the majority of outcrop, volcanics and conglomerate being subordinate in exposed extent.

Jasper is the most easily recognized as it tends to be massive, brick-red, and shot with milky white quartz veins which sometimes carry minor black hematite. Green chert has been seen inter-layered with jasper, which, along with an intimate association with volcanics, is suggestive of an igneous origin.

A 2 m high scarp at the south end of line 700W reveals massive jasper overlain by a green fragmental unit of sheared pale rhyolite and darker andesite, which is in turn overlain by a unit of sheared, mixed red and green slates. Foliations and contacts are close to flat-lying. Other outcrops of pale green rhyolite may show bomb-like, sheared fragments up to 10 cm in length. More basic volcanics are found between lines 300 and 900E on the south side of the river, where they are very fine grained black to dark green basalts and andesites.

Conglomerate, the basal unit of the Jurassic formations, is rather limited in outcrop extent, appearing mainly near the major curve in the Canol Road west of the Ross River near Tenas Creek.

Well-rounded pebbles within the dark grey/black conglomerate are often elongate, about 2 mm to 5 cm in diameter, and are embedded in a matrix of sandy greywacke. One outcrop showed coarse, sandy layers with fine (less than 5 mm) pebbles alternating with coarser layers with much large pebbles. Many clasts are felsic, often with considerable pyrite; black, slaty clasts are also not uncommon, and one andesitic fragment was seen. Outcrops are usually massive, but may take on a pronounced fracture cleavage. This unit is also seen to lose its pebbly character near line 300W (south end) where it becomes a massive, dark grey rock with anastamosing quartz/carbonate veinlets.

2.5 ANDESITE - UNIT 3

The andesite unit is distributed across the entire area, with large areas of outcrop located in the southeast quadrant of the Wop group and the adjacent T group, in the T group south of Thunder Pickle Creek, and in the eastern half of the Mal group.

The rocks can vary appreciably across the area, ranging from a medium grained hypabyssal equivalent in the cores of the volcanic domes, through massive flow-type greenstones, to an andesitic tuffaceous material further out on the dome flanks where this member intercalates with rhyolites, rhyolitic tuffs and some proximal phyllitic sediments.

The subunit most commonly found appears to be a fine grained, massive, pale to dark green, andesitic greenstone, likely of flow origin. Texturally, it is unvaried throughout, but a calcareous matrix, complete with calcite and/or siderite veinlets, is common, as are euhedral pyrite cubes which may be particularly associated with the carbonates. Small pods and spots of alteration to serpentine and talc may locally be found around inclusions of a black, more basic basaltic material. In a few cases this alteration has developed small patches of serpentine asbestiform minerals.

Chlorite characterizes a much more common alteration assemblage, and leads to an increasing degree of foliation in the rock. This may partially reflect a larger tuffaceous, slightly less resistant component, of the andesites. Grey to green, foliated metaandesite, with a well-developed fracture cleavage and a higher carbonate and chlorite content most likely represents the original andesite tuff, which now has a more phyllitic texture. This member intercalates with pale green, banded to massive, rhyolitic tuffs and/or a pearly dark grey phyllitic argillites of Unit 4.

The andesite dome matrix material is evident in a few locations across the area. South of Thunder Pickle Creek, a medium to coarse grained intrusive-textured rock outcrops with the massive andesites. Here a pale green to dark grey mottled texture is produced by biotite, amphibole and pyroxene crystals distributed through a matrix of plagioclase and minor quartz. The mafic minerals tend to be well chloritized. Overall the texture is gabbroic and locally hornblende becomes sufficiently dominant to produce amphibolite. Disseminated pyrite is almost always present throughout all phases and produces limonite weathering surfaces and fracture coatings. This core material grades very quickly into the massive flow type andesites.

A similar dome of andesitic material outcrops for 2/3 of the way around and on top of a hill located on line 3050E, at 1650N. Here a massive green andesite, in part displaying a hypabyssal texture, composes the crest of the hill and represents the core, dome matrix material. Flanking this, both in the sense of the hill and in relation to the dome, is a series of rocks, each of which intercalates with its successor, composed of andesitic greenstones of probable flow origin, calcareous andesitic tuffs, local pods of rhyolitic tuffs, and finally, grey graphitic and calcareous phyllites. These rocks appear to exhibit well the nature of the local andesitic domes distributed through the field area.

In the southeast quadrant of the Wop grid the core rocks seem slightly less basic than those south of Thunder Pickle Creek, never having enough hornblende to produce amphibolitic rocks. These rocks are also well chloritized perhaps accounting for the less amount of noticeable pyroxenes and amphiboles.

2.6 RHYOLITES - UNIT 4

A minor constituent of the proximal sedimentary package is the felsic volcanic member which can be either massive, foliated and/or banded in texture and rhyolitic in composition. The rocks are quite sporadic throughout the field area and appear to occur as localized bands or pods intercalating with both the andesites and the more distal grey phyllites.

The massive variety, observed only on the south side of Ross River tends to be pale grey to white, highly siliceous with small quartz eyes, and often contains much disseminated euhedral pyrite cubes producing a limonitic weathering. Locally this member may take on a slight foliation and develop pale green to chalky white alteration bands composed of chlorite, talc, and perhaps sericite. This more phyllitic member becomes calcareous in part due to thin calcite veinlets.

The banded rhyolites seen only on the north side of Ross River are very fine grained showing well developed bedding as well as other sedimentary structures such as load casts and graded bedding. Alternating light and dark bands often displayed differential weathering indicating carbonate-rich layers. Staining showed that the layers between calcic and potassic composition. The rock is very hard and quite siliceous, often having the typical, powder white, weathered surface of rhyolites. Small scale folds with amplitudes in the order of tenths of metres showed up very well in these rocks.

2.7 DISTAL SEDIMENTARY UNIT - UNIT 5

The distal sediments form a medium to very fine grained, laminated unit, composed mainly of a dark grey, turbiditic, phyllitized wacke, and a dark grey, fissile, argillaceous phyllite which hosts the only mineralization observed in the area.

They are exposed throughout the field area and appear to develop during periods of relative volcanic quiescence on the flanks of and in pockets peripheral to the andesitic dome centres. Due to the fairly small size of some of the domes these rocks may be found quite close to a massive andesite, possibly to the exclusion of the normally intervening, proximal sediments. Rhyolites and rhyolitic tuffs may intercalate with this unit but they are considered more proximal in origin and, hence, rock descriptions in this section are limited to the grey phyllite and greywackes.

2.7.0 Greywacke

2.7.1.1. Lithology and distribution

A major portion of the distal sediments are dark grey phyllitic greywackes. In hand specimen samples are seen to be composed of quartz and biotite; thin section examination confirms the composition, showing mica and elongate quartz aligned in a herring-bone manner. Grain size is usually fine, but gritty, medium grained components are common. Biotite varies in amount, is usually concentrated along cleavage planes, and lends rocks a schistose character when coarse-grained. Foliations vary in intensity from less than 1 mm to 6 cm, and infrequently are absent altogether when rocks take on a massive, cherty appearance. Colour may also vary on a small scale from dark to light grey, to greys with green or pink tinges. Iron-staining is not uncommon, and occurs to varying degrees, often a result of fine, visible disseminated pyrite occurring along foliation planes and/or fracture surfaces. Quartz veining is frequently seen as fine stringers parallel to foliations, but may also occur as larger (up to 10 cm wide) veins.

The major occurrence of these sediments is on the south-facing slope of the Ross River valley, north of the Canol Road. In the far western corner of the Mal claims porphyritic dykes intrude rocks which are similar to these greywackes, but are highly deformed and should more properly be termed gneisses and schists. However, alteration here resembles portions observed below the major intrusive contact north of the Canol Road (see below "Intrusive Effects), and small areas of recognizable greywacke were seen.

Outcrops around 200S on line 5900W reveal medium grey, slaty, unphyllitized argillites assumed to be less metamorphosed equivalents of the main greywacke unit.

2.7.1.2 Intrusive effects

The intrusion of Unit 1 has resulted in slight alterations of the sediments which become more evident as one approaches the intrusive contact. Phyllites may take on a gneissic appearance either as fine (2 mm) light and dark (some pure biotite) bands or as wide (2 cm) alternating bands of coarse biotite and milky quartz. Finer-grained gneisses may appear to be augened.

Another common product of the intrusion is a coherent, silicic sediment which has lost its foliated appearance in favour of a massive, undirected texture. It was on the surface of a sample such as this that blue kyanite crystals (1 cm in length) were seen.

2.7.1.3 Structures

As mentioned earlier, thin section study reveals a herring-bone structure of quartz and biotite. This texture may be interpreted as a primary alignment of components which has been modified by foliations perpendicular to it. This secondary foliation has altered originally plan surfaces into chevron patterns, the apices of which form the major foliation direction seen in the field.

Lineations, foliations and minor warping are the major macroscopic structural features within the greywackes. Lineations were not always measured because of their frequent inconsistency, but they can be quite regular and easily visible on cleavage surfaces.

Foliations were described briefly above on a small scale, but on a larger scale they can be seen to trace a major warp on the north side of the Canol Road. Lineations tracing the axis of this warp ($52^{\circ}/35^{\circ}$W) are visible along a folded surface of 0.5 metre amplitude above station 1780N along line 4550E. Foliations east of the general axis area usually strike northwest; to the west strikes are more northeasterly.

In foliations north of the Canol Road create a dip slope along the hillside, minor warping perpendicular to major foliations is easily visible. Frequencies are normally around 2 metres; amplitudes 10 cm.

2.7.1 Distal Sediments

2.7.2.1 Pearly grey phyllites, phyllitic argillites

This member of the distal sedimentary package generally consists of a thinly laminated, dark grey to silver pearly grey, graphitic and argillaceous shale which is intercalated with a grey to white, medium to fine grained siliceous siltstone. These rocks are usually sheared and phyllitized with slickensided graphitic or micaceous laminae developing along shear planes or as indepenant thin bands a few millimeters to a few centimeters thick. The high graphite content produces a grey-black oily lustre while the development of micaceous-sericitic partings produces the common pearly grey lustre. Normally they are quite calcareous and contain disseminated pyrite throughout as discrete grains or as thin laminae, producing very rusty weathering lamelae. Quartz is commonly present as small eyes, stringers or veins, or even large gashes and boudins up to 60 cm across in areas of more intense faulting. Calcite and/or siderite is associated with the quartz and locally may become dominant in veins. The siltstone member may become much coarser and richer in quartz fragments, as in the area of 6150W on the baseline where it appears to grade towards a graphitic wacke member, suggesting an oscillatory relation between the grey phyllites and the wackes.

Structurally, these graphitic phyllites are either flat lying or dip gently in a general sense. However, in small scale, there are abundant crenulations only a few millimeters in amplitude, as well as many tight isoclinal folds up to 2 cm in amplitude. Any quartz veins present suffer this recumbent folding as well, and, in areas of more intense distortion, may develop boudinage structures, or individual quartz grains may be stretched in the core of some anti-formal structures. Shearing can be intense and appears to be subparallel to the original sedimentary banding, however this is difficult to see clearly due to the slaty cleavage developed in response to the compressive shear forces.

Outcrops of this unit occur sporadically across the area with clusters in the Mal group, in the northern part of the Wop group, and, as mentioned, in the T group in the vicinity of Thunder Pickle Creek.

2.7.2.2 Mineralization

A large north-south trending vertical fault cuts these flat lying grey phyllites to produce the Thunder Pickle Creek gorge, as though dilatancy, is likely responsible for the large quartz veins and boudins and the outcropping mineralization here. Abundant chunks of massive sulphide float, weighing as much as 23 kg, and consisting of varying amounts of pyrite, pyrrhotite, galena, sphalerite, chalcopyrite and arsenopyrite, persist for the length of the gorge, however no obvious source for these could be found. Thin sulphide bands, 5-10 cm thick and continuous for up to 50 m occur within the grey phyllites on canyon walls and appear to be concordant with the shaly laminations. These mostly consist of fine grained pyrite with sphalerite, or a distinct yellow and grey, punky alteration material which is cored by fresh galena.

Towards the mouth of the gorge one highly silicified, quartz rich zone outcrops over a small area, with sulphide mineralization. The silicified zone, having been exposed by hydraulic methods, is approximately 2 m thick and appears to dip at approximately 45^{o}, this being strongly discordant with the horizontal graphitic phyllites 5 m away on the opposite wall of the gorge. The underlying grey graphitic sediments, and those across the creek reveal no similar sulphides. The silicified zone itself is essentially quartz with abundant disseminated pyrite grains and cubes, plus some arsenopyrite grains. One highly pyritized layer is well gossanized, having developed good boxwork textures coated in fine gypsum crystals. The prime sulphide specimens come from a vertically fractured zone and consist of coarse grained galena and pyrite plus medium to fine grained sphalerite and arsenopyrite. Siderite is a common accessory. Traces of pyrrhotite hosted in pearly grey phyllites were located in the next creek to the west, but no extensions could be found.

3.0

STATEMENT OF QUALIFICATIONS OF AUTHORS

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Louise Eccles graduated from the University of British Columbia in April of 1976 with a degree of Bachelor of Science. During the summer of 1974 and 1975 Louise worked in the field with Cyprus Anvil Mining Corporation and Du Pont of Canada Exploration Limited respectectively. With Du Pont again in 1976, Louise was a senior field geologist on a project in the Northwest Territories and conducted extensive geologic mapping of volcanic rocks. Earlier in 1977, Louise worked on a programme of drilling for placer gold near Atlin, BC for Du Pont. She has also performed assignments for the G.S.C. and junior mining companies in Vancouver.

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Graeme earned a B.Sc.(Hons.) in Geology at the University of Toronto in 1974. During the summer of 1972 he worked as a lab technician in a geochemical analytical laboratory, while in 1973, he worked on detailed mapping of claim groups and regional prospecting in Northwest Ontario with Selco Exploration. In 1974, he gained experience in the oil exploration industry, working as an assistant wellsite geologist and measuring sections for Westcoast Petroleum Ltd. In 1975, working for McIntyre Porcupine Mines Ltd. Graeme measured and correlated stratigraphic sections on the company's property. In 1976 he began his association with Du Pont of Canada Exploration Limited, as a senior field geologist mapping volcanic sequences in a massive sulphide search in the Northwest Territories.

Graeme is currently working towards a Master of Science degree at the University of British Columbia.

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Gwen Ditson graduated from the University of Southern California with a B.Sc. in Geology in 1974 and came to Canada to study towards a Master of Science Degree at UBC. She has worked on field projects for Du Pont during 1976 and 1977 and has conducted laboratory courses for first-year geology students at UBC. During 1976 she was part of the team carrying out mapping of a part of the Northwest Territories in a search for massive sulphide deposits, and joined Du Pont again in 1977 to work on projects in the Ross River area, Y.T.

STATEMENT OF QUALIFICATIONS

1. I am a member of the Association of Professional Engineers of British Columbia (Registration Number 9140) and a member of the Professional Engineers of Ontario (Number 3129600).

2. I am a Fellow of the Geological Association of Canada.

3. I hold a Bachelor of Science degree from Carleton University, Ottawa, Ontario (May 24, 1963) and the degree of Master of Science (Applied), McGill University, Montreal, Quebec (June 2, 1971).

4. I have been practising my profession of Geologist since 1963 and I am employed by Du Pont of Canada Exploration Limited.

5. I have been associated with the Tenas Project since its inception in January 1977, having supervised the 1977 drilling programme (August 1-September 1) and part of the geological mapping and prospecting programme (June 9-19) as well as the performing in the compilation of the Geological Report concerning the project area.

6. I regard the Authors G.M. Ditson, L.K. Eccles and G.P. MacLaren as competent field geologists who performed their work professionally and conscientiously.

Signed at Vancouver this 24th Day of October 1977

K. A. MacLean, P.Eng

DIVISION OF ASSESSMENT WORK CREDITS

	Whitehorse	Watson Lake	Total
Diamond Drilling	$14,928.92	$44,608.34	$59,537.36
Geology, Geochemical Soil Surveys(58-42%)	29,519.47	21,376.17	50.895.65
Contract Geophysics (56-44%)	28,147.84	22,116.16	50,264.00
	$72,596.23	$88,100.67	$160,696.91
Work required (Compiled from "C" forms)	54,500.00	87,800.00	142.300.00

I, Keith Alexander MacLean, Geologist, Du Pont of Canada Exploration Limited, 102-1550, Alberni Street, Vancouver, B.C. hereby certify that this is a true statement of expenditures made on behalf of the Tenas Joint Venture by Du Pont of Canada Exploration Limited.

Dated at Vancouver this __________ day of ____________

K. A. MacLean, P.Eng

APPENDIX A

DIAMOND DRILLING AND ASSOCIATED COSTS

1.

T-77-1	746'	BQWL Watson Lk MD, Claim T 54	Aug.3-Aug.14/77
T-77-2	748'	BQWL Watson Lk MD, Claim T 51	Aug.15-Aug.20/77
T-77-3	502'	BQWL Watson Lk MD, Claim TENAS 8	Aug.20-Sep.1/77
	2002'		

2. Drilling costs by Arctic Diamond Drilling Ltd.

Aug.15/77	Invoice	$16,256.70
Sep.10/77	Invoice	27,379.32
		$43,636.02

3. Assaying charges Bondar Clegg & Co. 142.00

4. Salaries and burden

K.A. MacLean	32 days @ $130.15	4,164.80
L. Eccles	8 days @ 48.94	391.52
		4,556.32

5. Miscellaneous - Truck rental subsistence 1,732.23

6. Aircraft support 9,470.69

$59,537.26

Per foot $29.74

Whitehorse MD	$14,928.92	(DDH T-77-3)
Watson Lk MD	$44,608.34	(DDH T-77-1, 2)

APPENDIX B

GEOLOGICAL AND GEOCHEMICAL SURVEYS

1. Salaries incurred in Yukon Territory:

		Daily Rate	Days	Total
F.M. Smith	Proj.Supervisor	$106.86	32½	$3,472.95
K.A. MacLean	Proj.Supervisor (Relief)	130.15	12	1,561.80
G.M. Ditson	Geologist	45.88	40 3/4	1,869.61
L.K. Eccles	Geologist	48.94	43	2,104.42
C.A. Hatfull	Student Assistant	34.66	30¼	1,048.47
P.J. Burnham	Student Assistant	36.80	41	1,504.70
T.M. Harrison	Geologist	46.90	40½	1,899.45
S.A. Harrison	Cook	38.74	39½	1,530.23
M.R. Carlson	Student Assistant	35.68	41	1,462.88
G.P. MacLaren	Geologist	55.06	31	1,706.86
G.M. Strain	Student Assistant	38.74	41	1,588.34
				$19,749.71

2.	Assaying (Min-En Laboratories, North Vancouver, and Vangeochem, Ross River)	3,501.00
3.	Linecutting Eastern Associates Ltd., Whitehorse	4,140.00
4.	Camp Supplies	6,162.22
5.	Travel Expenses	5,264.60
6.	Freight Hauling Storage	3,205.24
7.	Travel Expenses Rental 3,295.74 Expenses 1,113.58 4,409.32	4,409.32
8.	Accommodation Rental	400.00
9.	Boat Rental	100.00
10.	Bombardier Rental	180.00
11.	Equipment Purchases	3,092.84

cont....

Appendix B (cont.)

		Total
12.	Snow Removal (Y.T.G.)	352.72
13.	Air Photo Mosaic (Northwest Surveys Ltd.)	338.00
	TOTAL	$50,895.65

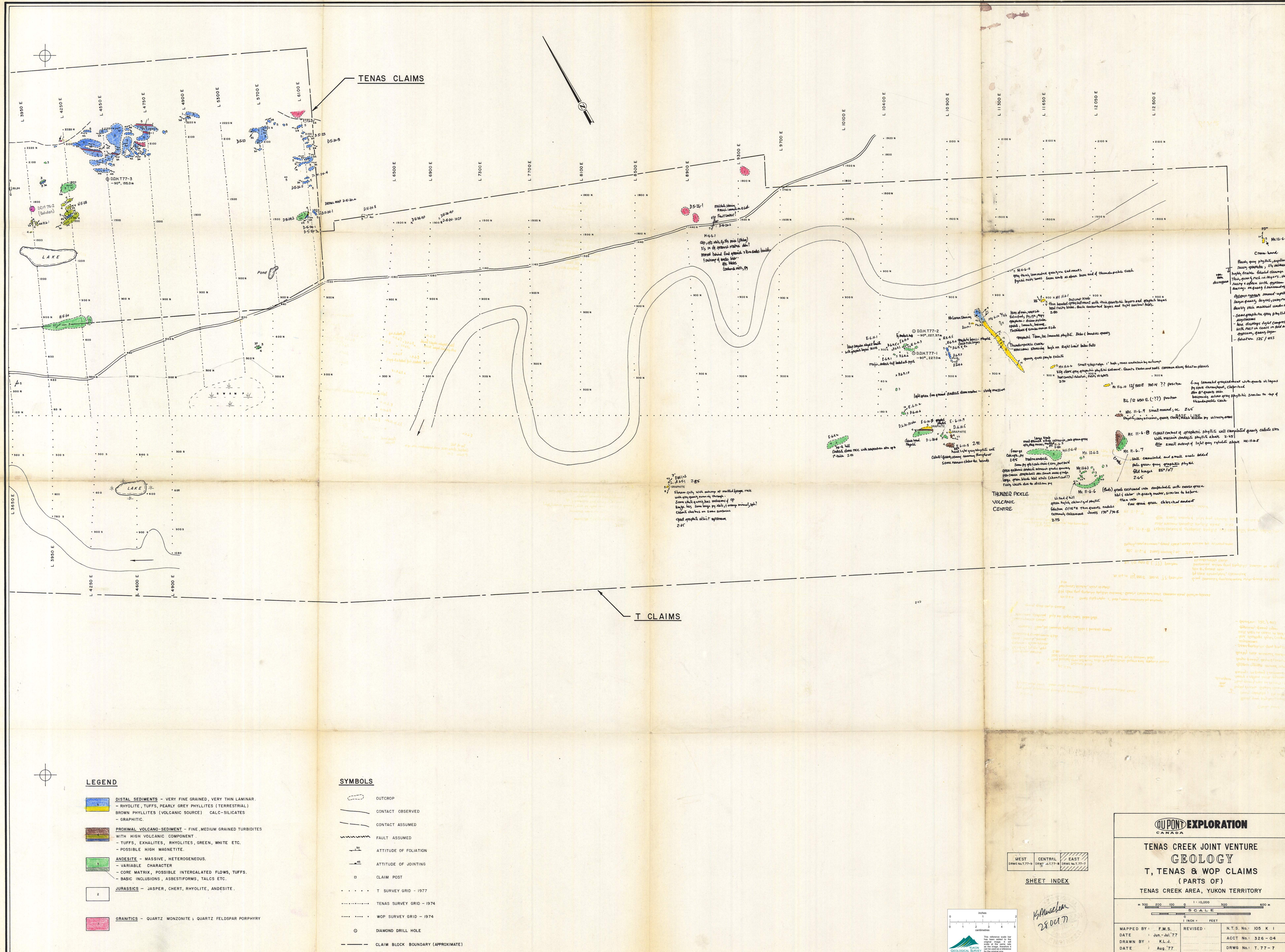
APPENDIX C

GEOPHYSICAL SURVEYS

C. A. Ager and Associates

Invoice for gravity survey - T and Wop Claims	$50,264.00

TENAS CLAIMS
WOP CLAIMS
BELL CLAIMS
TENAS CLAIMS
BAR CLAIMS
T CLAIMS
BASE LINE
LAKE
ROSS
RIVER
TO ROSS RIVER
T CLAIMS
T CLAIMS
LEGEND
5 DISTAL SEDIMENTS - VERY FINE GRAINED, VERY THIN LAMINAR.
- RHYOLITE, TUFFS, PEARLY GREY PHYLLITES (TERRESTRIAL)
BROWN PHYLLITES (VOLCANIC SOURCE) CALC-SILICATES
- GRAPHITIC.
4 PROXIMAL VOLCANO-SEDIMENT - FINE, MEDIUM GRAINED TURBIDITES WITH HIGH VOLCANIC COMPONENT.
- TUFFS, EXHALITES, RHYOLITES, GREEN, WHITE ETC.
- POSSIBLE HIGH MAGNETITE.
3 ANDESITE - MASSIVE, HETEROGENEOUS.
- VARIABLE CHARACTER.
- CORE MATRIX, POSSIBLE INTERCALATED FLOWS, TUFFS.
- BASIC INCLUSIONS, ASBESTIFORMS, TALCS ETC.
2 JURASSICS - JASPER, CHERT, RHYOLITE, ANDESITE.
1 GRANITICS - QUARTZ MONZONITE ; QUARTZ FELDSPAR PORPHYRY
SYMBOLS
OUTCROP
CONTACT OBSERVED
CONTACT ASSUMED
FAULT ASSUMED
50 ATTITUDE OF FOLIATION
45 ATTITUDE OF JOINTING
CLAIM POST
T SURVEY GRID - 1977
TENAS SURVEY GRID - 1974
WOP SURVEY GRID - 1974
DIAMOND DRILL HOLE
CLAIM BLOCK BOUNDARY (APPROXIMATE)
WEST
CENTRAL
EAST
DRWG No. T.77-7
SHEET INDEX
DU PONT EXPLORATION
CANADA
TENAS CREEK JOINT VENTURE
GEOLOGY
T, TENAS & WOP CLAIMS
(PARTS OF)
TENAS CREEK AREA, YUKON TERRITORY
1 : 10,000
m 300 200 100 0 300 600 m
SCALE
0
1 INCH = FEET
MAPPED BY : AH F.M.S.
DATE : Jun.-Jul.'77
DRAWN BY : K.L.J.
DATE : Aug.'77
REVISED :
N.T.S. No.: 105 K 1
ACCT No.: 326 - 04
DRWG No.: T.77-8
DU PONT EXPLORATION
CANADA
TENAS CREEK JOINT VENTURE
GEOLOGY
BAR, BELL, MAL, T, TENAS & WOP CLAIMS
(PARTS OF)
TENAS CREEK AREA, YUKON TERRITORY
1 : 10,000
m 300 200 100 0 300 600 m
SCALE
0
1 INCH = FEET
MAPPED BY : F.M.S.
DATE : Jun.-Jul.'77
DRAWN BY : K.L.J.
DATE : Aug.'77
REVISED :
N.T.S. No.: 105 K 1
ACCT No.: 326 - 04
DRWG No.: T.77-7


TENAS CLAIMS
T CLAIMS
THUNDER PICKLE VOLCANIC CENTRE
LAKE
Pond
LEGEND
DISTAL SEDIMENTS - VERY FINE GRAINED, VERY THIN LAMINAR.
- RHYOLITE, TUFFS, PEARLY GREY PHYLLITES (TERRESTRIAL)
BROWN PHYLLITES (VOLCANIC SOURCE) CALC-SILICATES
- GRAPHITIC.
PROXIMAL VOLCANO-SEDIMENT - FINE, MEDIUM GRAINED TURBIDITES
WITH HIGH VOLCANIC COMPONENT.
- TUFFS, EXHALITES, RHYOLITES, GREEN, WHITE ETC.
- POSSIBLE HIGH MAGNETITE.
ANDESITE - MASSIVE, HETEROGENEOUS.
- VARIABLE CHARACTER
- CORE MATRIX, POSSIBLE INTERCALATED FLOWS, TUFFS.
- BASIC INCLUSIONS, ASBESTIFORMS, TALCS ETC.
JURASSICS - JASPER, CHERT, RHYOLITE, ANDESITE.
GRANITICS - QUARTZ MONZONITE ; QUARTZ FELDSPAR PORPHYRY
SYMBOLS
OUTCROP
CONTACT OBSERVED
CONTACT ASSUMED
FAULT ASSUMED
ATTITUDE OF FOLIATION
ATTITUDE OF JOINTING
CLAIM POST
T SURVEY GRID - 1977
TENAS SURVEY GRID - 1974
WOP SURVEY GRID - 1974
DIAMOND DRILL HOLE
CLAIM BLOCK BOUNDARY (APPROXIMATE)
WEST DRWG No. T. 77-9
CENTRAL DRWG No. T. 77-8
EAST DRWG No. T. 77-7
SHEET INDEX
DUPONT EXPLORATION CANADA
TENAS CREEK JOINT VENTURE
GEOLOGY
T, TENAS & WOP CLAIMS
(PARTS OF)
TENAS CREEK AREA, YUKON TERRITORY
1 : 10,000
SCALE
1 INCH = FEET
MAPPED BY : F.M.S.
DATE : Jun.-Jul. '77
DRAWN BY : K.L.J.
DATE : Aug. '77
REVISED :
N.T.S. No.: 105 K 1
ACCT No.: 326 - 04
DRWG No.: T. 77 - 7
28 Oct 77
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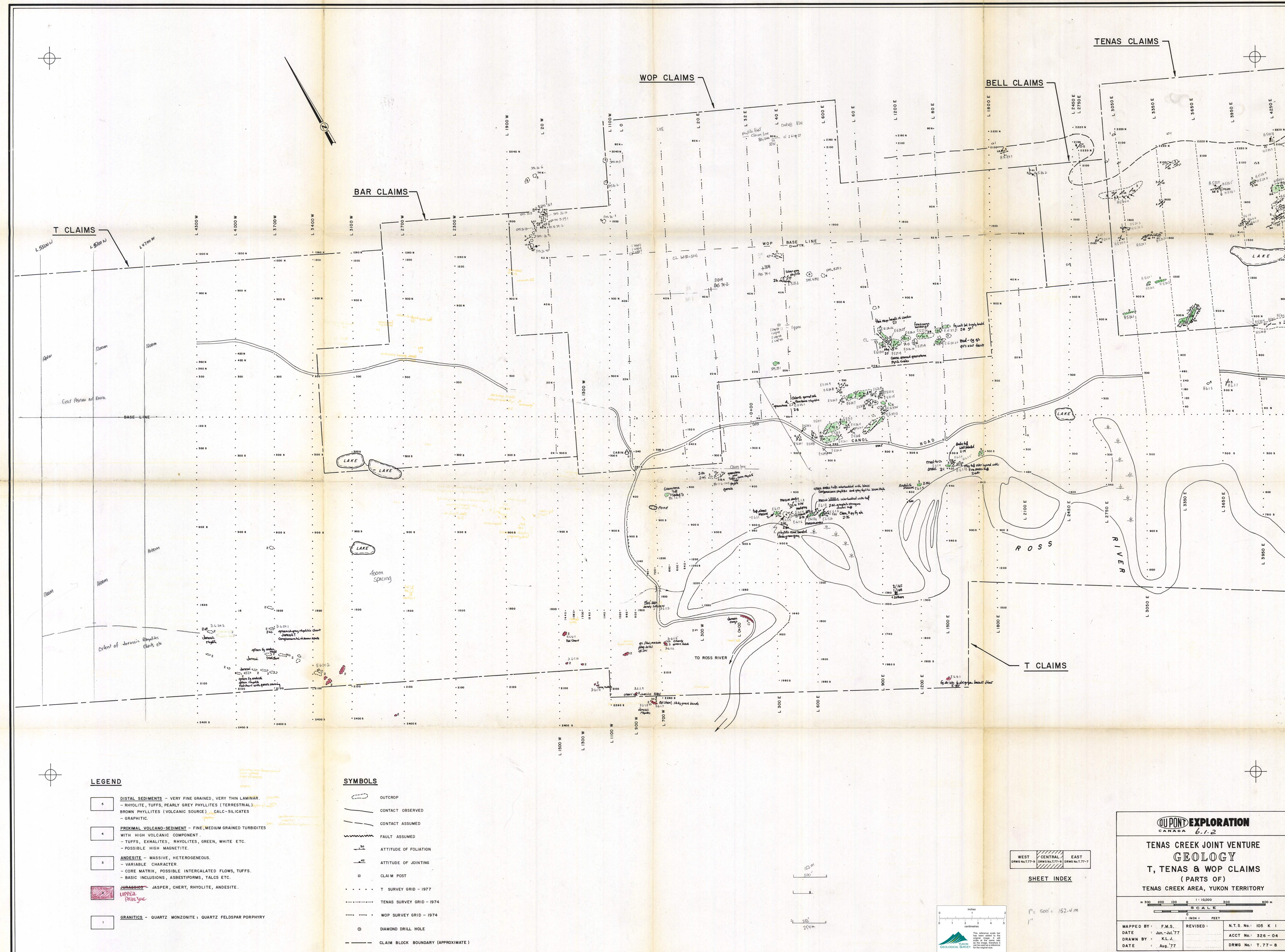
YUKON GEOLOGICAL SURVEY


T CLAIMS
BAR CLAIMS
WOP CLAIMS
BELL CLAIMS
TENAS CLAIMS
WOP BASE LINE
BASE LINE
CANOL ROAD
LAKE
ROSS RIVER
TO ROSS RIVER
CABIN
LEGEND
5 DISTAL SEDIMENTS - VERY FINE GRAINED, VERY THIN LAMINAR.
- RHYOLITE, TUFFS, PEARLY GREY PHYLLITES (TERRESTRIAL)
BROWN PHYLLITES (VOLCANIC SOURCE) CALC-SILICATES
- GRAPHITIC.
4 PROXIMAL VOLCANO-SEDIMENT - FINE, MEDIUM GRAINED TURBIDITES
WITH HIGH VOLCANIC COMPONENT.
- TUFFS, EXHALITES, RHYOLITES, GREEN, WHITE ETC.
- POSSIBLE HIGH MAGNETITE.
3 ANDESITE - MASSIVE, HETEROGENEOUS.
- VARIABLE CHARACTER.
- CORE MATRIX, POSSIBLE INTERCALATED FLOWS, TUFFS.
- BASIC INCLUSIONS, ASBESTIFORMS, TALCS ETC.
2 ~~JURASSICS~~ - JASPER, CHERT, RHYOLITE, ANDESITE.
UPPER Paleozoic
1 GRANITICS - QUARTZ MONZONITE ; QUARTZ FELDSPAR PORPHYRY
SYMBOLS
OUTCROP
CONTACT OBSERVED
CONTACT ASSUMED
FAULT ASSUMED
ATTITUDE OF FOLIATION
ATTITUDE OF JOINTING
CLAIM POST
T SURVEY GRID - 1977
TENAS SURVEY GRID - 1974
WOP SURVEY GRID - 1974
DIAMOND DRILL HOLE
CLAIM BLOCK BOUNDARY (APPROXIMATE)
WEST DRWG No. T.77-9
CENTRAL DRWG No. T.77-8
EAST DRWG No. T.77-7
SHEET INDEX
1" = 500' = 152.4 m
DU PONT EXPLORATION CANADA
6.1.2
TENAS CREEK JOINT VENTURE
GEOLOGY
T, TENAS & WOP CLAIMS
(PARTS OF)
TENAS CREEK AREA, YUKON TERRITORY
1 : 10,000
m 300 200 100 0 300 600 m
SCALE
1 INCH = FEET
MAPPED BY : F.M.S.
DATE : Jun.-Jul. '77
DRAWN BY : K.L.J.
DATE : Aug. '77
REVISED :
N.T.S. No. : 105 K 1
ACCT No. : 326 - 04
DRWG No. : T.77-8
inches
centimetres
This reference scale bar has been added to the original image. It will scale at the same rate as the image, therefore it can be used as a reference for the original size.
YUKON GEOLOGICAL SURVEY

LEGEND

Unit	Description
5	**DISTAL SEDIMENTS** - VERY FINE GRAINED, VERY THIN LAMINAR. - RHYOLITE, TUFFS, PEARLY GREY PHYLLITES (TERRESTRIAL) BROWN PHYLLITES (VOLCANIC SOURCE) CALC-SILICATES - GRAPHITIC.
4	**PROXIMAL VOLCANO-SEDIMENT** - FINE, MEDIUM GRAINED TURBIDITES WITH HIGH VOLCANIC COMPONENT. - TUFFS, EXHALITES, RHYOLITES, GREEN, WHITE ETC. - POSSIBLE HIGH MAGNETITE.
3	**ANDESITE** - MASSIVE, HETEROGENEOUS. - VARIABLE CHARACTER - CORE MATRIX, POSSIBLE INTERCALATED FLOWS, TUFFS. - BASIC INCLUSIONS, ASBESTIFORMS, TALCS ETC.
2	**JURASSICS** - JASPER, CHERT, RHYOLITE, ANDESITE.
1	**GRANITICS** - QUARTZ MONZONITE ; QUARTZ FELDSPAR PORPHYRY

SYMBOLS

- OUTCROP
- CONTACT OBSERVED
- CONTACT ASSUMED
- FAULT ASSUMED
- 50 ATTITUDE OF FOLIATION
- 45 ATTITUDE OF JOINTING
- CLAIM POST
- T SURVEY GRID - 1977
- TENAS SURVEY GRID - 1974
- WOP SURVEY GRID - 1974
- COMINCO SURVEY GRID - 1965
- MAL SURVEY GRID - 1977
- ROAD OR TRACK
- DIAMOND DRILL HOLE

WEST	CENTRAL	EAST
DRWG No T.77-9	DRWG No T.77-8	DRWG No.T. 77-7

SHEET INDEX

DUPONT EXPLORATION CANADA

TENAS CREEK JOINT VENTURE
GEOLOGY
BAR, BELL, MAL, T, TENAS & WOP CLAIMS
(PARTS OF)
TENAS CREEK AREA, YUKON TERRITORY

1 : 10 000
m 300 200 100 0 300 600 m
SCALE
0
1 INCH = FEET

MAPPED BY : F.M.S.	REVISED :	N.T.S. No.: 105 K 1
DATE : Jun.-Jul.'77		ACCT No.: 326 - 00
DRAWN BY : K.L.J.		DRWG No.: T. 77 - 9
DATE : Nov. '77		