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Final Report on the

Airborne Survey Covering

Zama Lake Pb -Zn Property

For Ivany Mining Inc.

Bistcho Lake Area, Alberta

May 17, 2010.

This report covers the 92,160 hectares (227,732.3 acres) in ten Metallic and Industrial Minerals Permits held by Estate of the late Mr. Richard G. Walker, in trust for Star Uranium Corp. under Option to Ivany Mining Inc., centered on 57° 28' N 127°22' W in NTS Map Sheet 84M.

Permit No.
9306050838
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9306050901

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Report #2008-217-3

Table of Contents

Part "B"

Part "C"

List of Figures

Part "B"

List of Tables

Final Report on the Airborne Survey Covering the Zama Lake Pb -Zn Property For Ivany Mining Inc.

1.0.0 Executive Summary

The exploration potential of the Zama Lake Pb-Zn property lies in the recognition that the discovery of sphalerite, galena, and barite grains in heavy mineral concentrates are indicative of the metal bearing hydrothermal fluids ascending through a sedimentary package which hosts carbonates and shale where they could have formed economic Pb-Zn deposits. In early 2008 total of 1676 line km of HeliGEOTEM survey was flown over the eastern four permits of the property. This report reports on the results of this survey.

The Pb-Zn potential of northern Alberta has largely been unrecognized because of the dominant focus on petroleum resources and the lack of knowledge of the possible occurrence of metallic minerals within the same geological formation. Total Budget for the recommended two-phase program is estimated at $1,400,000 and is warranted to test this grass roots Pb-Zn property in northern Alberta.

1.1.0 Introduction and Terms of Reference

In September 2007, Derek Ivany, CEO of Ivany Mining Inc. ("Issuer") requested Paul A. Hawkins & Associates Ltd. to continue to conducted exploration. Till samples, were collected to verify previous sampling. The author is independent of Star Uranium and Ivany Mining Inc.

Star Uranium Corp. acquired the property by staking, upon the release of GSC Open File 5121 (Plouffe et al., 2006). The Open File announced the discovery of anomalous concentrations of sphalerite and galena grains within the course sand fraction of bulk till samples in a regional program originally designed to assess the regional occurrence of kimberlite indicator minerals within NTS map sheets 84L and 84M as shown on Figure 1. The number of grains recovered was the highest ever reported in a till sample in Canada (Plouffe et al., 2006). This report documents assessment work conducted on the property between May 20, 2008 and May 17, 2010. The global financial crisis (2008-2010) significantly hampered the funding of exploration on the property.

These report uses NAD83 based UTM co-ordinates, while location maps use NAD27 based base maps. Control during sampling was maintained using Garmin iQue M5 and / or a Garmin GPSmap 76CSx hand held GPS units.

Project Location Map
Figure 1

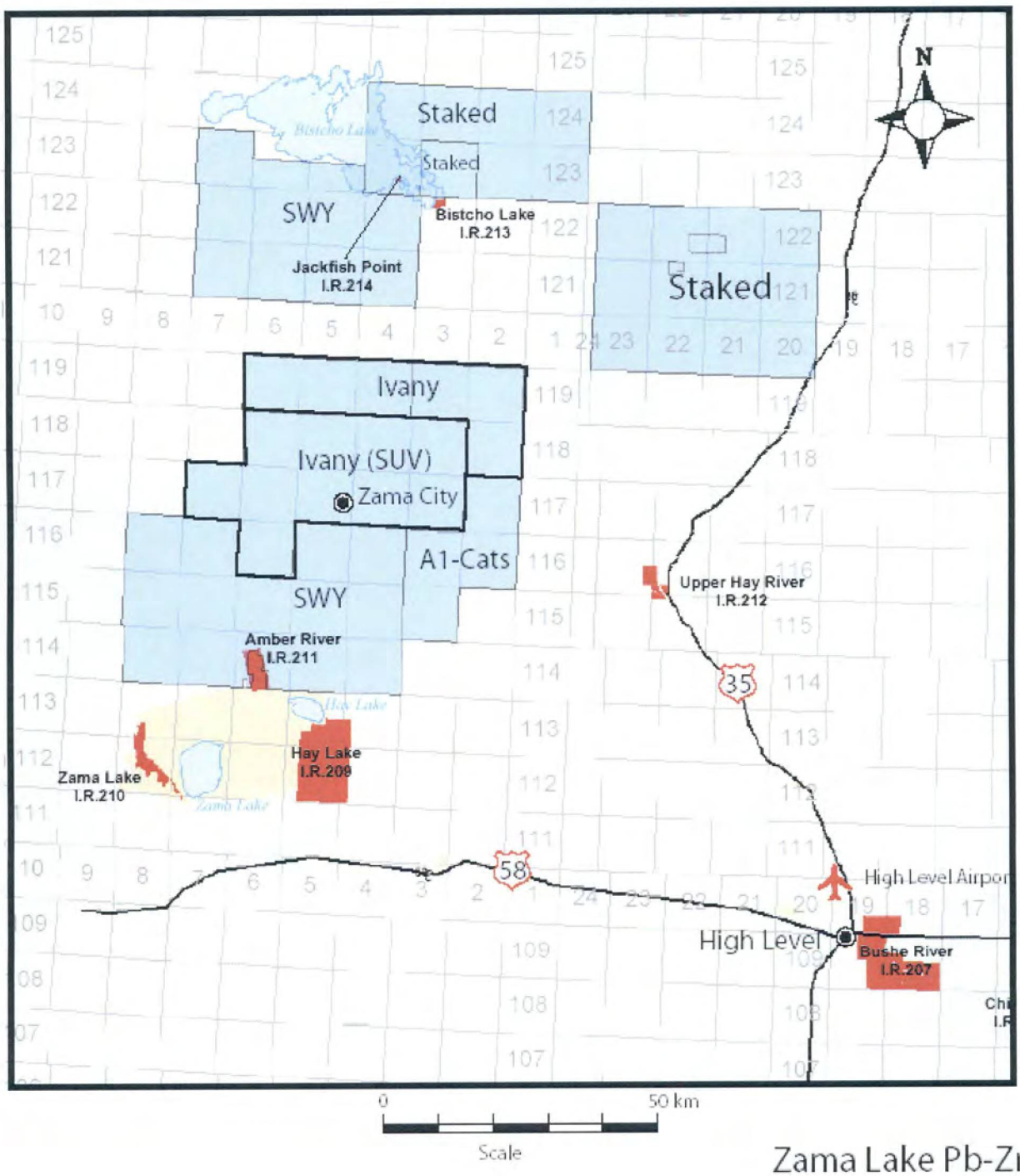
(Modified after Plouffe et al., 2006)

2.0.0 General Property Description and Location

The Zama Lake Pb-Zn consists of ten metallic mineral permits covering 92,160 hectares (227,732.3 acres) located 700 km north northwest of Edmonton Alberta. The property is a grass roots Pb-Zn Play staked as the result of the discovery of anomalous sphalerite and galena grains found in till samples collected during diamond exploration. The property area is forested and hosts parts of the Zama Lake Oil and Gas field. Zama Lake and Zama City are oil industry support bases and are located within the property. The First Nation Dene Tha' (Assumption-Habay-Chateh) settlement exists to the south of the property.

2.1.0 Property Location

The property is located in the Bistcho Lake Area of northern Alberta within the Municipal District of Mackenzie No. 23, approximately 700 km (435 miles) north northwest of Edmonton (Figure 1). The property lies on the southern margin of the Cameron Hills in N.T.S. 84M and is centred on 57° 28' N 127° 22' W. The nearest supply point to the project is the town of High Level, which is 130 km to the southeast. The town of High Level, is 800 km by road from Edmonton, has an estimated population of 4,200. The original ten permits, which make up the property, are shown on Figure 2. Access onto the property is possible from the east off of the Mackenzie Highway #35 and from the south off of the Rainbow Lake Highway #58.



Zama Lake Pb-Zn
Permit Location

Figure 2.

2.2.0 Mineral Tenure

The Metallic Minerals and Industrial Minerals Permits ("Permits") covered by this report were staked under the terms of the Mines and Minerals Act – Metallic and Industrial Minerals Tenure Regulation (AR 145/2005). The permits grants the holder:

> *(a) the non-exclusive right to explore for metallic and industrial minerals on the surface of the location,*
> *(b) the exclusive right to explore for metallic and industrial minerals in the subsurface strata within and under the location, and*
> (c) *the right to remove samples of metallic and industrial minerals from the location for the purposes of assaying and testing and of metallurgical, mineralogical and other scientific studies.* (AR 145/2005)

The regulations require that the recorded holder of permits shall perform, or have performed, exploration and development work (assessment work) on the permits to a per hectare value of $5 in the first assessment period. A permit assessment period is two years. In the second and third assessment periods this increases to $10 per hectare. In the fourth to seventh assessment period this increases to $15 per hectare. No filing fees are associated with filing assessment work. These assessment work requirements are calculated from the date of issue of the current permit. A permit may be held for fourteen years and can vary in size from a minimum of 16 hectares to a maximum of 9,216 hectares. Permit boundaries are defined by the Alberta Township Survey system. Permit locations are therefore defined by a township, range, section, and legal subdivision. A township is 9,216 hectares in size while a section is 256 hectares. A legal survey division ("LSD") is 16 hectares in size. Permits may be grouped for application of assessment work provided they are contiguous.

The holder of a permit may after two years apply for a lease provided the first year's rent for the lease is paid in advance and the Minister of Energy has been provided evidence that a deposit exists on the location applied for. The lease has a term of fifteen years and may be extended a further fifteen years upon approval of the Minister of Energy. The lease permits the holder to hold the ground fee simple without further assessment work requirements.

Prospecting for Crown minerals using hand tools is permitted throughout Alberta without a licence, permit, or regulatory approval, as long as there is no surface disturbance (AR 213, 1998). Prospecting on privately owned land or land under lease is permitted without any departmental approval, however, the prospector must obtain consent from the landowner or leaseholder before starting to prospect. Unoccupied public lands may be explored without restriction, but as a safety precaution prospectors working in remote areas should inform the local Sustainable Resource Development (forestry) office of their location.

When prospecting, the prospector can use a vehicle on existing roads, trails and cut line. If the work is on public land, the prospector can live on the land in a tent, trailer, or other shelter for up to fourteen days. For periods longer than fourteen days, approval should be obtained from the Land Administration Division. If the land is privately owned or under lease, the prospector must

make arrangements with the landowner or leaseholder. Exploration approval is not needed for aerial surveys or ground geophysical and geochemical surveys, providing they do not disturb the land or vegetation cover.

If mechanized exploration equipment is to be used and/or the land surface disturbed, the prospector or company must obtain the appropriate approvals and permits, as required under the Metallic and Industrial Minerals Exploration Regulation. Most projects require an Exploration Licence, Exploration Permit, and Exploration Approval. The following sections describe the criteria and procedures for each of these.

An Exploration License must be obtained before a person or company can apply for, or carry out an exploration program. The license holder is then accountable for all work done under this exploration program. However, the licensee cannot carry out any actual exploration activity until the Alberta Sustainable Resource Development issues an Exploration Approval for each program submitted under that licence. A fee of $50 must accompany the license application. The license is valid throughout Alberta and remains in effect as long as the company is operating in the province. If a license holder wants to use exploration equipment, such as a drilling rig, an Exploration Permit must be obtained. A fee of $50 must accompany the permit application. The permit is valid throughout Alberta and remains in effect as long as the company is operating in the province.

Approval must be obtained if an exploration project involves environmental disturbance such as drilling, trenching, bulk sampling or the cutting of grids that involves more than limbing trees and removing underbrush. Samples up to 20 kg in size may be taken for assay and testing purposes, but larger samples must be authorized by the Department of Energy. The licensee does not need to hold the mineral rights for an area to apply for an Exploration Approval.

Project approval is through the Land and Forest Service of Alberta Sustainable Resource Development. If an application has been completed and the appropriate field staff has copies of the program, approval can usually be obtained in about ten working days. Each application for exploration approval must be accompanied by a fee of $100. After receiving exploration approval, the prospector or exploration company may conduct the approved activity. However, if they modify their program, the designated field officer must be contacted to review and approve the changes. A final report must be submitted to Land and Forest Service of Alberta Sustainable Resource Development within sixty days following completion of the exploration program. The report must show the actual fieldwork, and include a map showing the location of drilling, test pits, excavations, constructed roads, existing trails utilized and all other land disturbances.

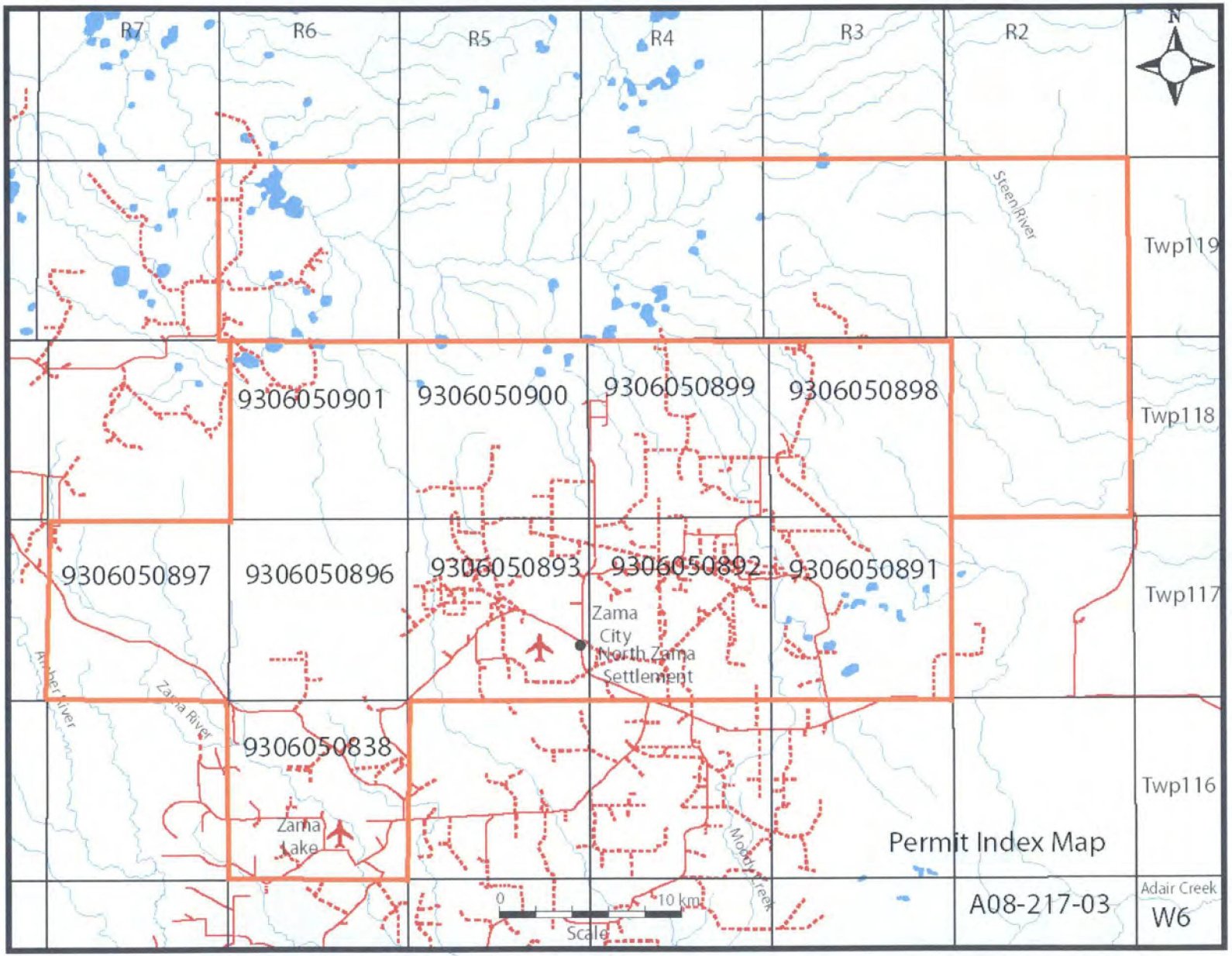
The Zama Lake property originally consisted of a single contiguous group of ten metallic minerals permits. The project has not be restricted to only six sections covering 1,554 hectares (3,840 acres) as listed below in Table 1 and shown on Figure 3A. Good survey control does exist in the area with the large amount of oil and gas development in the area. GPS technology enables good survey control in the field.

Table 1 - Permit Listing

Permit #	Legal Description	Date of Issue	Area (Hectares)
9306050891	6-03-117: 1-3, 10-12	19-May-2006	1,554
Total=			**1,554**

Under the terms of the option agreement, the issuer acquires a 100% interest in the property by making payments of $100,000 and issuing $75,000 in stock to Star Uranium. Star Uranium retains a 2% NSR which can be reduced to a 1% NSR with a $1 million payment. Star Uranium also retains the diamond rights to the property. The agreement also requires the issuer to complete $400,000 of exploration and development work by May 16, 2008. As of May 1st, Ivany Mining had made both payments and completed the work requirement.

Figure 3.


R7
R6
R5
R4
R3
R2
N
Steen River
Twp119
Twp118
Twp117
Twp116
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9306050838
Zama City
North Zama Settlement
Zama Lake
Amber River
Zama River
Moody Creek
Permit Index Map
A08-217-03
Adair Creek
W6
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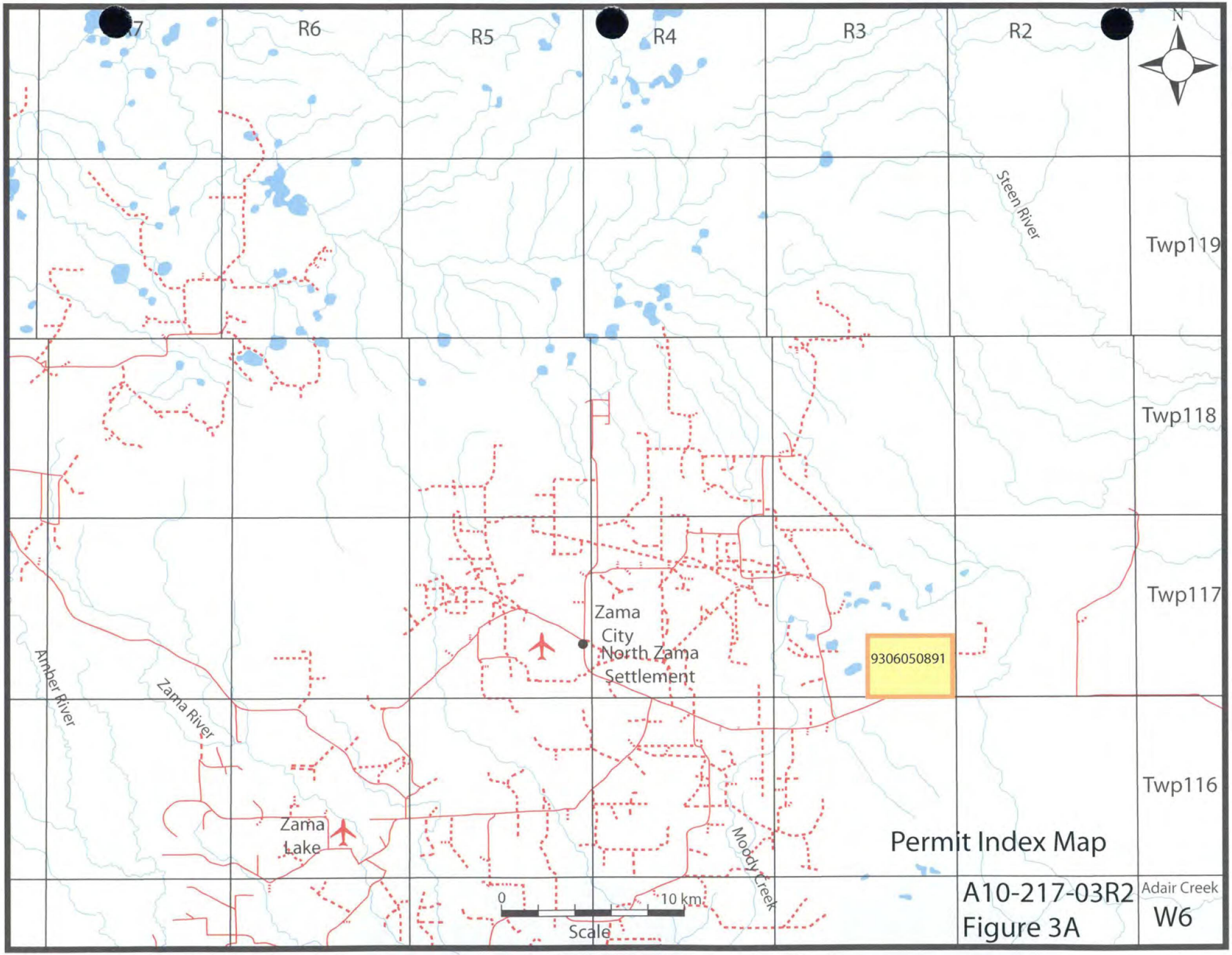
Scale


R7
R6
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R3
R2
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Steen River
Twp119
Twp118
Twp117
Twp116
Zama City
North Zama Settlement
9306050891
Amber River
Zama River
Zama Lake
Moody Creek
0
10 km
Scale
Permit Index Map
A10-217-03R2
Figure 3A
Adair Creek
W6

2.3.0 Accessibility, Local Resources, and Infrastructure

The Zama Lake Pb-Zn property is accessible by road from either the Mackenzie Highway just north of Meander River or from the south off the Rainbow Lake Highway. Both the Mackenzie Highway and the Rainbow Lake Highway are paved well-maintained provincial highways.

Access from the east originates off the Mackenzie Highway #35 about 80 km north of High Level, then 67 km west along a relatively straight all weather improved gravel road to Zama City. This road was completed in 2000, by the M.D. of Mackenzie and replaced a private road built by the oil companies who operated in the area. Access from the south originates off of the Rainbow Lake Highway #58 about 87 km west of High Level, them north towards Hay Lake and avoiding Assumption / Chateh P.O., then about 90 km northwest along gravels roads to Zama City. The road is relatively well marked but is longer, windier, and involves several turns.

Local resources on the property at Zama City with a permanent population of 250 are limited given the focus on infrastructure serving the oil and gas industry. Several open camps exist to house a temporary workforce which numbers in the winter months up to 4,000 in size. A large gas plant is operated by Apache Canada at Zama Lake. Apache also operates a 4,200 ft long paved airstrip near the plant.

The Zama Lake property has undergone significant oil & gas exploration since the Keg River Formation discovery in 1976. Numerous wells now dot parts of the property. Several oil & gas pipelines cross the property. These developments provide access into a lot of the property however most exploration drilling is done during the winter months. Granular aggregate is in short supply in the region and most roads are surfaced with fine-grained till that is used for their foundation. Only roads that are surfaced with gravel can be used during wet weather conditions. A wealth of subsurface data is available for the area but it is largely focussed on deeper oil and gas pools at 500 – 1600 m depth.

Most services are available in the town of High Level with a population of 4,200 people. The town boasts provincial government offices, a number of hotels, banks, schools, a college and hospital. A number of oil drilling contractors, construction companies and heavy equipment companies have offices in High Level. High Level has daily direct turbo-prop service to Edmonton and Calgary. The area also has courier, Greyhound bus and rail service. Fixed wing and rotary wing charter aircraft are available locally. Other industries present include farming and two forestry mills. A wide spectrum of services is provided locally, while most other services are available in Edmonton. Winter is usually the busy season for forestry and the oil & gas industry.

2.4.0 Climate and Physiography

The climate of the Zama Lake area is classified as microthermal (Cool Continental). Based on data from the High Level Airport, no summer month has an average temperature above 22°C but at least four months, average 10°C or higher. Temperatures during the summer range from 7 to 35°C while temperatures during the winter range from -10 to -40°C. Snow usually arrives in October and is gone by the end of May. Mean annual precipitation is 394 mm with mean annual snowfall at 1.55 m.

Parts of the Zama Lake area have discontinuous permafrost and typically underying peat accumulations and other bog deposits. The permafrost is easily distributed and vulnerable to melting from terrain disturbance caused by road construction, seismic lines, and drill pad construction. Much of the property is covered with muskeg and has very poor drainage. Stunted trees are common; some rare stands of commercial timber are present in better-drained areas. Trees species of the area are white spruce, trembling aspen and balsam poplar. Most formation waters are saline while some water wells north of Hay Lake / Zama Lake drilled into surficial sediments yield better water.

The Zama Lake property is located on the southern margin of the Cameron Hills within the Fort Nelson Lowland, which are subdivisions of the Alberta Plateau. Many of the soils of the area are saline as ground water in many areas is close to the surface. Many burrow pits fill quickly after excavation. Most of the area covered by a clayey till. Most exploration work because of this is conducted during the winter months from winter roads. Elevations on the property range from 670 m in the north on the margin of the Cameron Hills to 360 m in the relatively flat Hay River Valley to the south.

2.5.0 Environmental Matters

Wildlife in the area consists of woodland caribou, wood bison, white tail deer, elk, cougar, mule deer, black bear, wolf, moose, grizzly bears, and coyote. Birds in the area consist of ducks, snow geese, gulls, terns, bald eagles, horned owls, and woodpeckers. Management of the woodland caribou is the major environmental issue for the area as they have been listed under the Alberta Wildlife Act as threatened. "*This status reflects continuing declines in caribou population size and distribution, small population size, the dependency of woodland caribou on older forest, and the sensitivity of this species to human activities. Key factors directly or indirectly affecting woodland caribou population size and distribution include habitat change as a result of wildfire or human land use activities, predation, hunting, poaching, and vehicle collisions.*" (Alberta Woodland Caribou Recovery Team, 2005) Parts of townships 6-04-118, 6-05-118, and 6-06-118 have surface access restrictions on them to protect caribou range.

Any major work program will require consultations with the First Nations people of the area. The property area has had significant oil and gas development in the past. Many producing oil and gas wells dot the area. Apache Corporation operates a three gas plants, 240 km of gas gathering pipelines, and seven crude oil processing plants at Zama Lake with approximately 70 million cubic feet (MMcf) of gas and 6,000 barrels of liquid hydrocarbons per day. The area is therefore by any means pure wilderness.

2.6.0 History Property

Star Uranium acquired the property by staking on March 1, 2006, as a result of release of a GSC/AGS open file (Plouffe et al., 2006) on that date. The open file detailed the discovery of anomalous train of sphalerite (ZnS) and galena (PbS) grains in the course sand fraction from tills from the Zama Lake area. The till samples, were originally collected as part of a federally funded regional diamond exploration program. The number of sphalerite grains present in the heavy mineral sample concentrate is the highest ever detected in Canada in an exploration till sample – in excess of 1,000 grains in a 20 kg sample (Plouffe et al., 2006). Given the grain size, compaction of the till and till composition, it is likely that the source of the lead zinc is proximal to the property.

As follow-up to the GSC / AGS open file, Star Uranium conducted sampling June 23-26 (twelve till samples) and October 13-16, 2006 (seven till samples). The Ivany has assumed ongoing responsibility for these samples and associated program.

Area has previous been staked for diamonds and likely has been subjected to diamond exploration but no work has been filed. Stornoway Diamond Corporation holds fourteen permits 126,252 hectares (312,000 acres) immediate south of the property and has conducted an aeromagnetic survey over the property exploring for kimberlite pipes. A1-Cats of Grande Prairie Alberta holds four permits to the east of the property but has done no work on the property.

The property area hosts several oil and gas pools at depth, principally in the Keg River Formation. There are no historical Pb / Zn Mineral Resources or Mineral Reserves on the property. The Zama Lake property is a grass roots Pb-Zn play. "*As a result of hydrocarbon exploration, Pb-Zn occurrences are known to occur in subsurface carbonate deposits from central and northwest Alberta, but can be at depths exceeding 1000 m.*" (Rice et al., 2006) Several oil wells in the adjacent areas to the property host occurrences of Pb-Zn mineral (Pana, 2006).

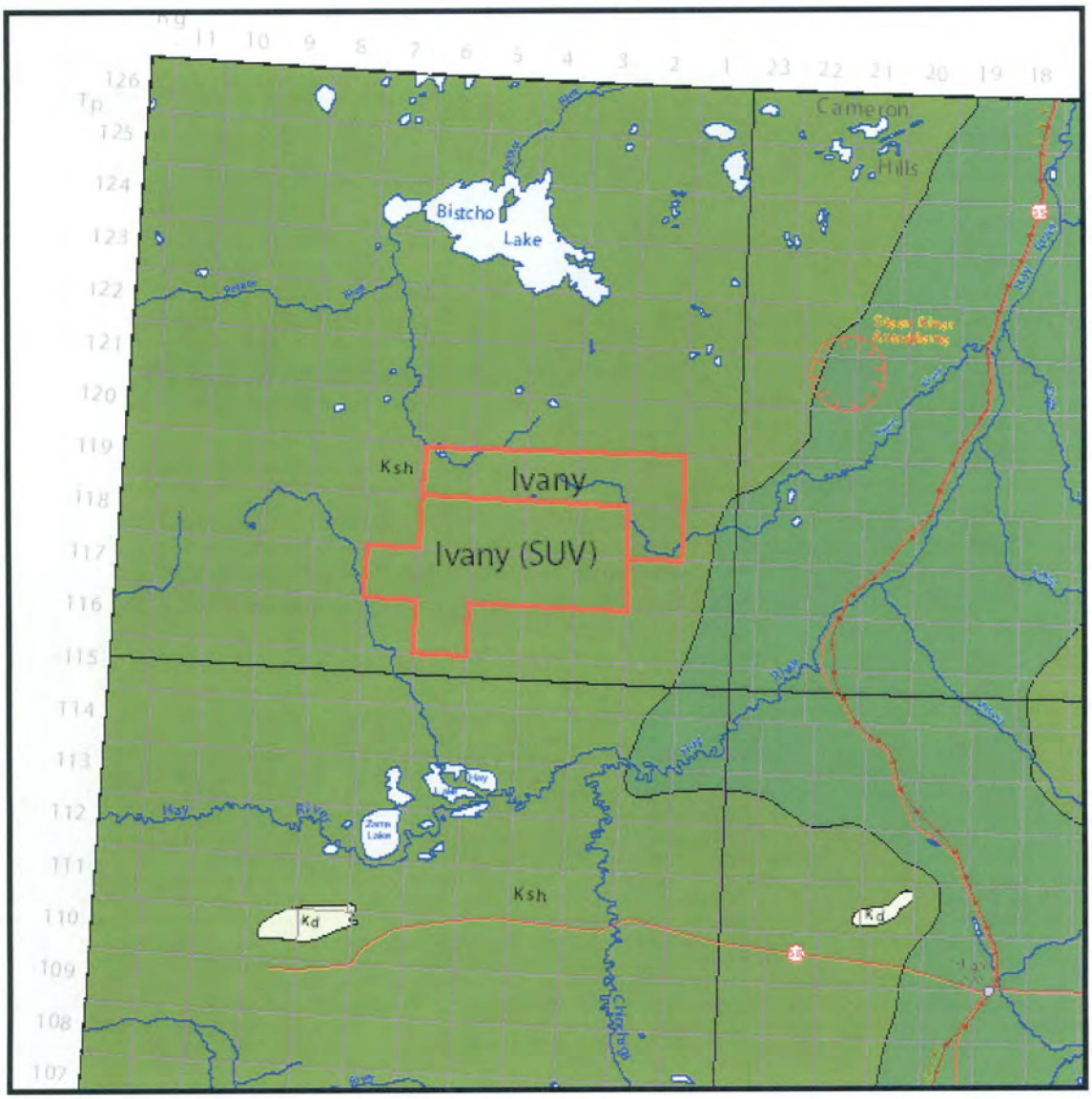
3.0.0 Geological Setting

The property is located within the Western Canadian Sedimentary Basin. The sub-crop below this nearly continuous glacial till cover consists of largely Cretaceous Shaftesbury Formation shale, which is overlain by the younger Dunvegan Formation sandstone. Underlying the Shaftesbury Formation are shales, sandstones and other strata of the Fort St. John Group, then a Late Carboniferous to Early Cretaceous unconformity, followed by Late and Middle Devonian shale, siltstone and limestone strata (Hamilton et al., 1999; Morrow et al., 2006). The limestone units include Slave Point, Sulphur Point, Muskeg, and Keg River Formations. The top of the Middle Devonian Slave Point Formation (the uppermost limestone unit) underlying the project area is at a depth of about 1000 m. Local well reports indicate depths of the Keg River Formation exceeding 1700 m (Pana, 2006). The regional basement is the Paleo-proterozoic Hottah terrane (Hoffman, 1989; Gehrels and Ross, 1989). The Great Slave Share Zone extends SW from the Pine Point area to just southeast of the property area. Several sets of northwest and northeast trending faults also occur in the property area.

3.1.0 Property Geology

The property area is relative flat as a result of the horizontal to gently dipping sedimentary bedrock, which consists largely of the Shaftesbury Formation (Ksh) as shown on Figure 4. The region is poorly drained, secondary streams are not deeply incised, and most areas are covered with muskeg. Few bedrock outcrops are apparent and most geological data comes from oil and gas drilling records. Information on the shallow parts of these drill holes is seldom recorded.

The uppermost unit in the property area is the Kaskapau Formation of Upper Cretaceous age consisting of dark grey silty shale, thin concretionary ironstone beds, inter-bedded in lower part with thin concretionary ironstone beds, inter-bedded in ferruginous oolithic mudstone of marine origin. Dunvegan Formation of Upper Cretaceous age consists of grey, fine-grained, feldspathic sandstone with hard calcareous beds, laminated siltstone and grey silty shale; deltaic to marine. The Shaftesbury Formation of Upper and Lower Cretaceous age is composed of dark grey, fish-scale bearing shale, silty in upper part, numerous nodules and thin beds of concretionary ironstone, bentonite partings, lower part with thin silty and sandy intervals; marine. The Loon River Formation consisting of a dark gray, fossiliferous, silty shale and laminated siltstone may be cut by buried channels, which cut deeply into bedrock. A table of geological formations for the property area is as shown in Table 3. Many other units occur at depth in the stratigraphic column of the area but only occur in oil and gas wells.



Regional Geology (modified after Hamilton et al, 1999)

Figure 4.

Drawing A08-217-4

Table 3.
Zama Lake Area

Table of Geological Formations

Age	Symbol	Formation Name / Group	Age	Member	Description
Pleistocene	Qsg		Recent		Unconsolidated sands and gravels, glacial till
Tertiary			65		Pre-glacial sand and gravel
Cretaceous	Ks Kpw 1WS	Smoky Group Smoky Group Paskwaskau Formation		 1st White Spec	Dark gray fossiliferous shale and silty shale, ironstone partings and concretions
	Kbh Kk	Colorado Group Bad Heart Formation Kaskapau Formation	 90-92	 2nd White Spec	Brown SST, medium to fine grained, fossiliferous, marine. Shale, dark to black, thin bedded, some sandstone
	Kd	Fort St. John Group Dunvegan Formation	92 – 95		Grey fine grained feldspathic SST, alternating SST/shale
	Ksh Kshu Kshl	Shaftesbury Formation	 95 - 98	Upper Base of fish scales?? Lower	Dark gray fish scale bearing shale, silty in upper part Numerous nodules with thin beds of Fe Silty and sandy shale
	Kp Kpc Kph Kpn	Peace River Formation	98 - 100	 Paddy Cadotte Harmon Notikewia	Massive SST Fluvial deposits Quartzose SST, Shale, conglomerate Dark gray silty shale Fine grained glauconitic SST
	Kl Bfsc	Loon River Formation		 Falher Wilrich Base of the Fish Scales	Dark grey fossiliferous, silty shale and laminated siltstone; nodules and thin beds of concretionary ironstone
	 Kb	Mannville / Bull Head Group Cadomin Gething Formation Bluesky	106	 Basal Cretaceous	Conglomerate SST, Shale, oil sands Sandstone, shale, oil sands

(Modified after Green, 1972)

Within the project area, a blanket of unconsolidated quaternary sediments, cover the underlying nearly horizontal and poorly indurated cretaceous sediments. This blanket of unconsolidated glacial and non-glacial sediments, vary greatly in thickness from 0 – 450 m (Pawlowicz et al., 2005, 2007). "*These sediments were deposited during glacial and interglacial periods of the Quaternary. For the most part, the surficial materials and present day landforms are the result of the last glacial event, the Late Wisconsin*", (25,000 to 10,000 years before present). "*Ice derived from Keewatin Sector of the Laurentide Ice Sheet flowed west and southwest across northern Alberta towards the Rocky Mountains*" (Paulen et al., 2007). Ice flow was likely topographically confined as ice lobes advanced into the area. At the glacial maximum, the ice sheet likely abutted the Cordilleran Ice Sheet.

Ice retreated from the area between 12,000 and 11,000 radiocarbon years before present (Dyke, 2004), at which time extensive glacial lakes developed over the lowland areas as a result or damming of the regional eastward drainage by retreating glaciers. Thus, fine-grained glacial lake sediments overlie till in the lower portions of the Hay and Peace River drainages basins. These finer sediments are called glaciolacustrine deposits. Glacial sediments laid down by rivers or streams are called glaciofluvial deposits.

The till covers most of the area except in rare gullies incised into the slopes of the Cameron Hills. The till consists of a mantle fine grained clay rich till derived from reworking of weakly indurated Cretaceous Shaftesbury Formation shale of the area below the advancing ice sheet. Till is derived directly from the glacial ice sheet. Erratics found in the till include Canadian Shield granitic and metamorphic lithologies, Devonian limestones & dolostones, and Proterozoic Athabasca sandstone. These far traveled erratics are generally rare and most clasts within the till are locally derived. The till is very clay rich with clasts making up only 5 to 15%. The higher elevations in the northern part of the property reflect bedrock topography but are still covered with a blanket of till between 1 - 10 m in thickness. In the flatter lowland near Hay Lake till is at least 8 m thick.

Within the region at lower elevations, a discontinuous thin layer of fine glaciolacustrine sediment veneer covers the till. The veneer varies in thickness from 1 to 4 m and consists of massive silt and clay with contorted beds of sand, silt, and clay. These deposits represent glacial lake sediments from a larger Hay Lake.

The property is blanketed by a nearly continuous till sheet, which consists of a fine-grained matrix consisting of on average 27% sand, 60% silt, and 12% clay with <5% clasts. Up ice direction for the property area is ENE from the Caribou Mountains and not from the Pine Point area. Surficial mapping for the area has recently been completed by the AGS / GSC (Paulen et al., 2006; Kowalchuk et al., 2006; and Smith et al., 2007). A recent update of Alberta geology was produced in 1998 (Hamilton et al., 1999).

No economic mineralization has been found on the property. Indicator minerals consisting of sphalerite (ZnS), galena (PbS), and gold (Au) have been recovered from heavy mineral concentrate obtained from basal / lodgment till obtained from burrow pits on the property. Barite ($BaSO_4$) grains in large numbers are also present in the concentrates. At many of the burrow pits,

where the till samples were obtained, also contain Gypsum ($CaSO_4 \cdot 2H_2O$). The presence of these minerals indicates the presence of low to moderate temperature hydrothermal activity in the property area. At least two (perhaps three) ages of events are known for the area.

The hydrothermal fluids associated with this activity could have led to the deposition of mineralization as sedimentary exhalative (SEDEX) or stratabound (MVT) within carbonate rocks as they ascended through the geological section along major and minor structures and came in contact with the reducing conditions of the Zama Lake area. These same hydrothermal fluids also likely precipitated sphalerite, galena, and barite near the present surface, which were recovered in heavy mineral concentrates obtained in the Zama Lake area. Whether these fluids are related to the same event as Pine Point in unclear, but both areas have somewhat similar lead isotopic signatures (age dates) and basement geology. Given the age of the kimberlite emplacement (Cretaceous) in the Buffalo Head Hills 300 km to the southeast, a much younger date may be possible. Levels encountered to date for Pb, Zn, and Au are only geochemically anomalous. They are only indicators of the possible presence of as yet undiscovered mineralization on the property. Examples of known Pb-Zn deposits in Western Canada are shown in Figure 5. Such potential has been further confirmed by follow-up work conducted by the AGS/GSC (Paulen et al, 2007 & 2008). The Zama Lake property is a grass roots Pb-Zn Play.

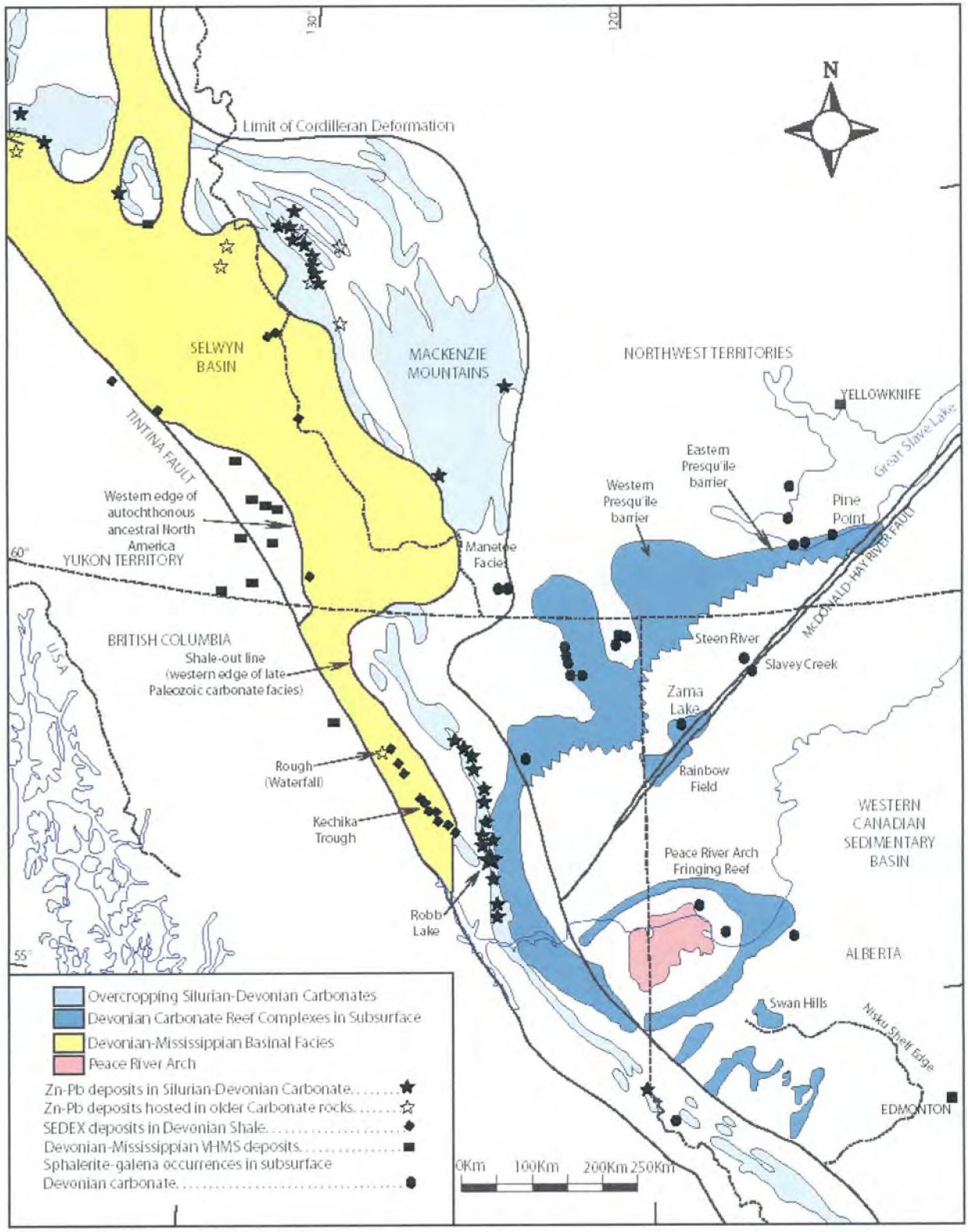


Figure 5. Location of Western Canadian Carbonate – Hosted Pb-Zn Deposits (Modified after Paradis et al., 2006)

4.0.0 Previous Exploration and Development

The property area has undergone limited metallic minerals exploration principally for diamond exploration. Significant oil and gas has been undertaken in the area and numerous producing wells occur in the general area. Several gas plants are also present.

4.1.0 GSC/ AGS Sampling

The Geological Survey of Canada ("GSC") and the Alberta Geological Survey ("AGS") collected 71 till samples for heavy mineral processing and a further 175 samples for soil geochemistry as part of a regional study. Results from the study were released in GSC Open File 5121 (Plouffe et al., 2006). Results from a further 19 samples were released in GSC Open File 5692 (Plouffe et al., 2008). This study was undertaken as part of a collaborative project between the AGS and the GSC originally designed to assess the regional occurrence of kimberlite indicator minerals ("KIM") in glacial deposits.

Access for GSC / AGS sampling of glacial sediments was by truck, all terrain vehicles, and helicopter. Samples were predominantly till but also included a few glaciofluvial samples. Samples were collected on road exposures, natural bluffs, hand-dug pits, and borrow pits dug for road construction or oil and gas drilling operations. In hand-dug pits, samples were collected below the most intensely oxidized soil horizons at an average depth of about 1 m. In deep pits dug by excavators, samples were taken from the lowest portion of the pit, often below 4 m. Two sizes of bulk glacial sediment samples were collected: large samples filling a 5-gallon pail (~25 kg) and smaller 1-2 kg bagged samples. In areas with reasonably good road access, large samples were collected on average 10 km apart, and smaller ones every 5 km. However, most of the large GSC / AGS study area has minimal or no road access, so sampling density was typically much less.

For the original study (Plouffe et al., 2006), a limited number of large (~25 kg) samples (50), from the region, were sent for heavy mineral and gold grain analyses to provide a preliminary overview of the mineral potential for the region. Glaciofluvial samples were prioritized along with a regional selection of basal till samples. They were shipped to Overburden Drilling Management ("ODM") Ltd. laboratories (Nepean, Ontario) for heavy mineral separation and identification in two batches (March and November 2005).

Following the discovery of anomalous concentrations of sphalerite grains in till samples (spring 2005), the original sites (five in total) with high sphalerite counts were resampled in the summer of 2005. Samples were collected from the same borrow pit and the same depth. In order to further confirm the magnitude of the elevated grain counts and to constrain the geographic extent of the anomaly, additional samples were collected in proximity to the original sphalerite anomaly. These samples, along with regional samples near the anomaly that had not been analyzed previously (21 in total), were submitted for analysis. These additional samples were submitted for the same type of analyses at ODM, plus a count of metamorphosed/magmatic

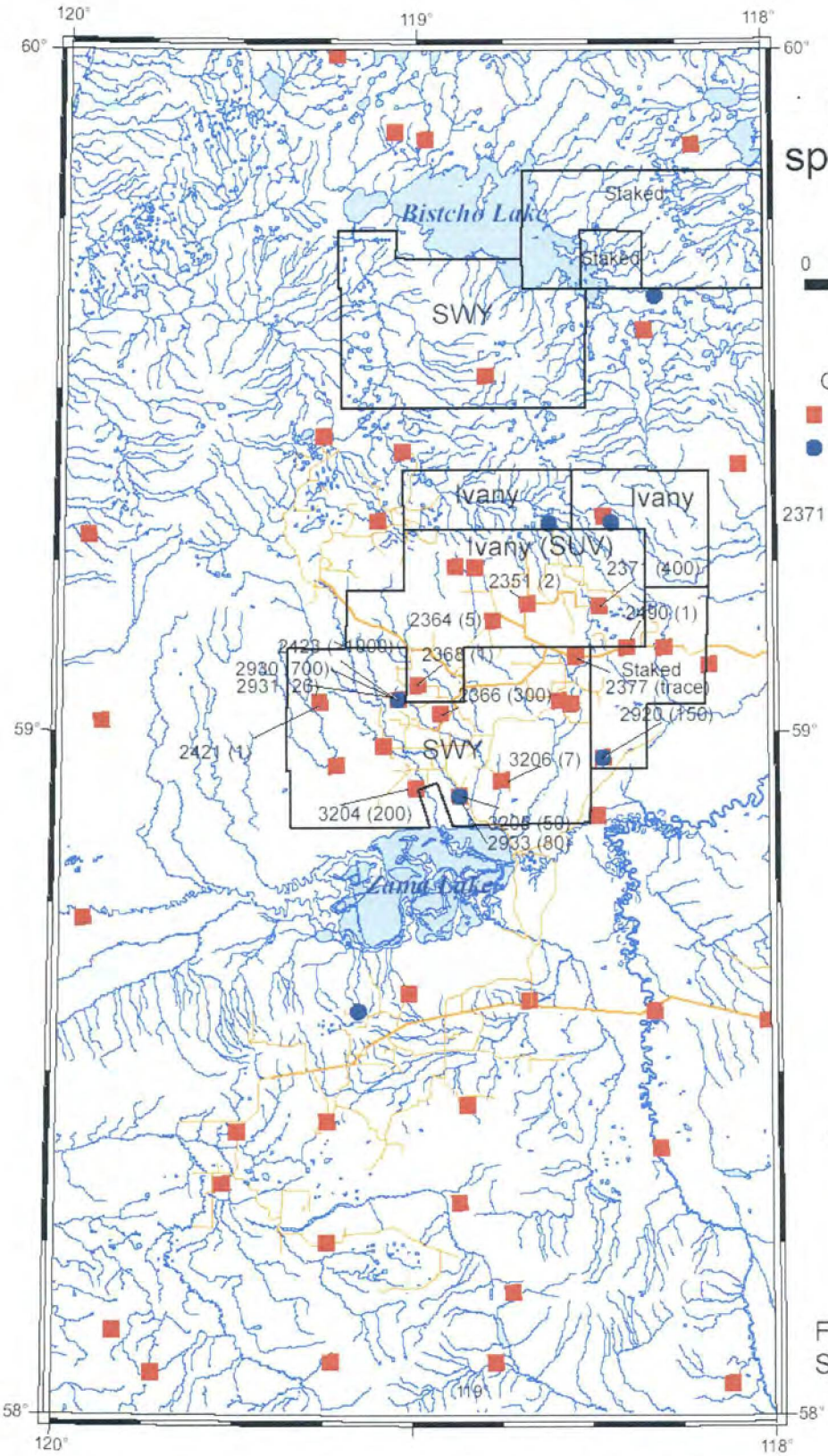
massive sulfide indicator minerals ("MMSIM"). The distribution of Sphalerite grains is shown on Figure 6 and Galena grain on Figure 7.

As follow-up to the original study results and to better define the extent of the sphalerite dispersal train in the till, an additional 19 till samples were collected within the region of the sphalerite anomaly were processed to recover indicator minerals. These results were released in January 2008 (Plouffe et al., 2008).

The heavy mineral fraction was isolated in a two-step process involving a shaking table and heavy liquids (specific gravity 3.2). Kimberlite indicator minerals, gold grains and other heavy minerals were identified in the 0.25 – 2 mm sized fraction under binocular microscopes, by ODM staff mineralogists at the laboratory.

Only till samples were submitted for geochemical analyses because of the general lack of fines in glaciofluvial sediments. The smaller bagged till samples (1-2 kg) were prepared at the Alberta Geological Survey laboratory where the silt and clay-sized fraction (<0.063 mm or –250 mesh) was separated by dry sieving. Duplicate and analytical standard samples were introduced, and then the material was sent for analyses at Acme Analytical Laboratories Limited (Vancouver, B.C.) in two batches (March and November, 2004). Three analyses were conducted on the <0.063 mm sized fractions:

1) 15 g sub-samples were submitted for inductively coupled plasma mass spectrometry (ICP-MS) analysis for a suite of 37 minor elements following an aqua regia digestion, and
2) 0.2 g sub-samples were analyzed for major elements by ICP emission spectrometry (ICP-ES LiBO2 fusion)
3) minor elements by ICP-MS (ICP-MS LiBO2 fusion) after a dilute nitric acid digestion.



Numbers of sphalerite grains

0 5 10 20 30 Kilometers

GSC / AGS Samples

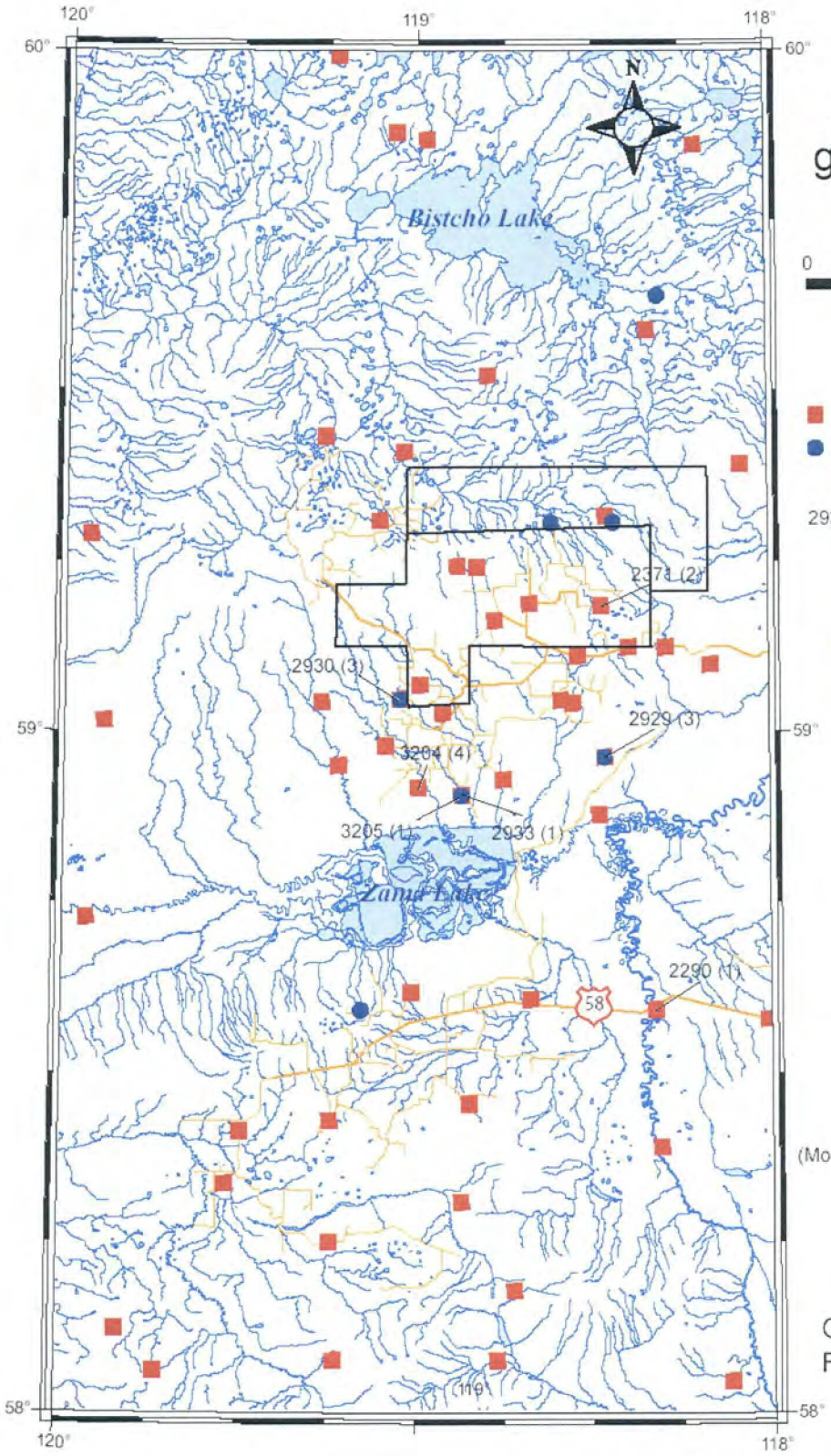
- Geochemical and KIM analyses
- KIM analysis only

2371 (400) - sample number and number of sphalerite grains

(modified after Plouffe et al. 2006)

Figure 6
Sphalerite Distribution

Drawing A08-217-6



Galena Distribution
Figure 7.

Drawing A08-217-7

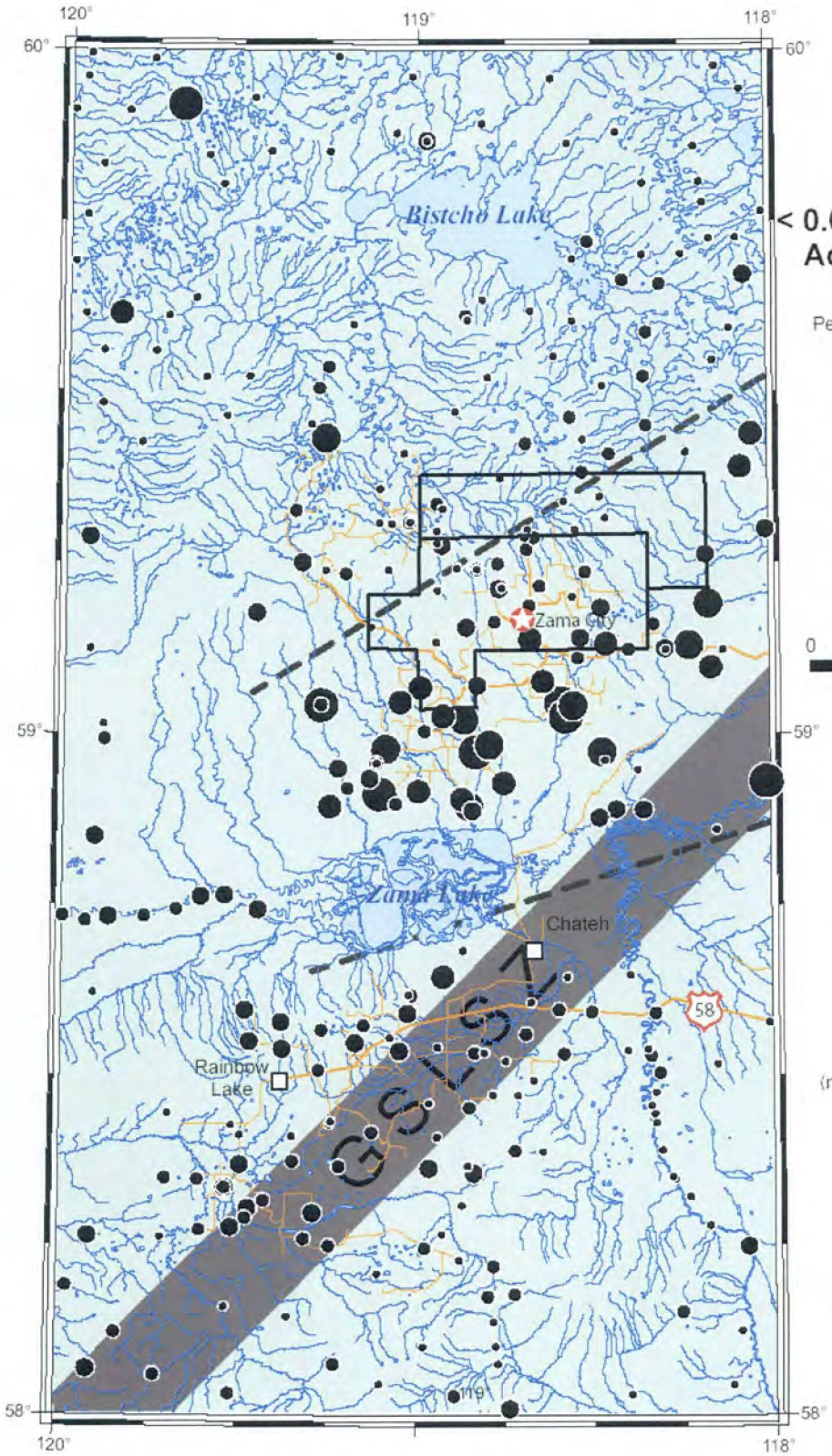
4.2.0 GSC / AGS Till Results

The general assemblage of heavy minerals, concentrated from the 2 – 0.25 mm size fraction, was evaluated as part of the KIM picking process for the samples analyzed in March 2005 and as part of a MMSIM analysis for the samples analyzed in August 2005. An anomalously large number of sphalerite (ZnS) grains (>1000) were identified in GSC/AGS till sample 2423 dominantly in the 0.25 to 0.5 mm size fraction. This is the highest concentration of sphalerite grains ever detected in a till sample by ODM (Plouffe et al., 2006). The sphalerite is found in association with abundant barite ($BaSO_4$), marcasite (FeS_2), and smaller amounts of siderite ($FeCO_3$). Sphalerite grains (up to 400 grains) are also present in seven other till samples from the same region (2368, 2366, 2371, 2377, 2421, 2920, and 3205). The number of sphalerite grains has not been normalized to the bulk sediment weight because for a number of samples the number of sphalerite grains only represents an estimate. Galena (PbS), often found in association with sphalerite in certain types of mineral deposits (e.g., MVT & SEDEX types deposits), was detected in trace amounts in till samples 2290, 2371, 2929, 2930 , 2933, 3204, and 3205, but not in sample 2423.

Till samples with the largest number of sphalerite grains were collected from the deepest portion of borrow pits in un-oxidized till at a depth exceeding 3 m. Given the high compaction of the till in the lower part of the pits and the strong clast fabric present, it most likely reflects transport and deposition at the base of the ice sheet (i.e. basal till), rather than long-distance glacial transport.

Zinc concentrations in the silt and clay-sized fraction of the till samples range from 26.7 to 588.6 ppm with an average concentration of 114 ppm and a standard deviation of 39 ppm. Geochemical results are shown in Figure 8 for zinc and Figure 9 for lead. Till samples with high sphalerite content in the sand-sized fraction did not yield high zinc concentrations in the silt and clay-sized fraction. For example, sample 2423 with a sphalerite grain content exceeding 1000 grains only contains 150 ppm zinc which is well within the zinc background concentrations in tills from this region estimated to be 153 ppm (mean plus 1 standard deviation). Only the sulphur level in sample 2423 is slightly elevated (1.73 %) compared to the rest of the samples (mean: 0.34 %). Regional zinc concentrations in till are elevated in a broad band oriented NE-SW (> 95th percentile) extending from north of Zama Lake to the southeastern sector of 84M map sheet. This band is sub-parallel and in proximity to the Great Slave Lake Shear Zone (Burwash et al., 1994).

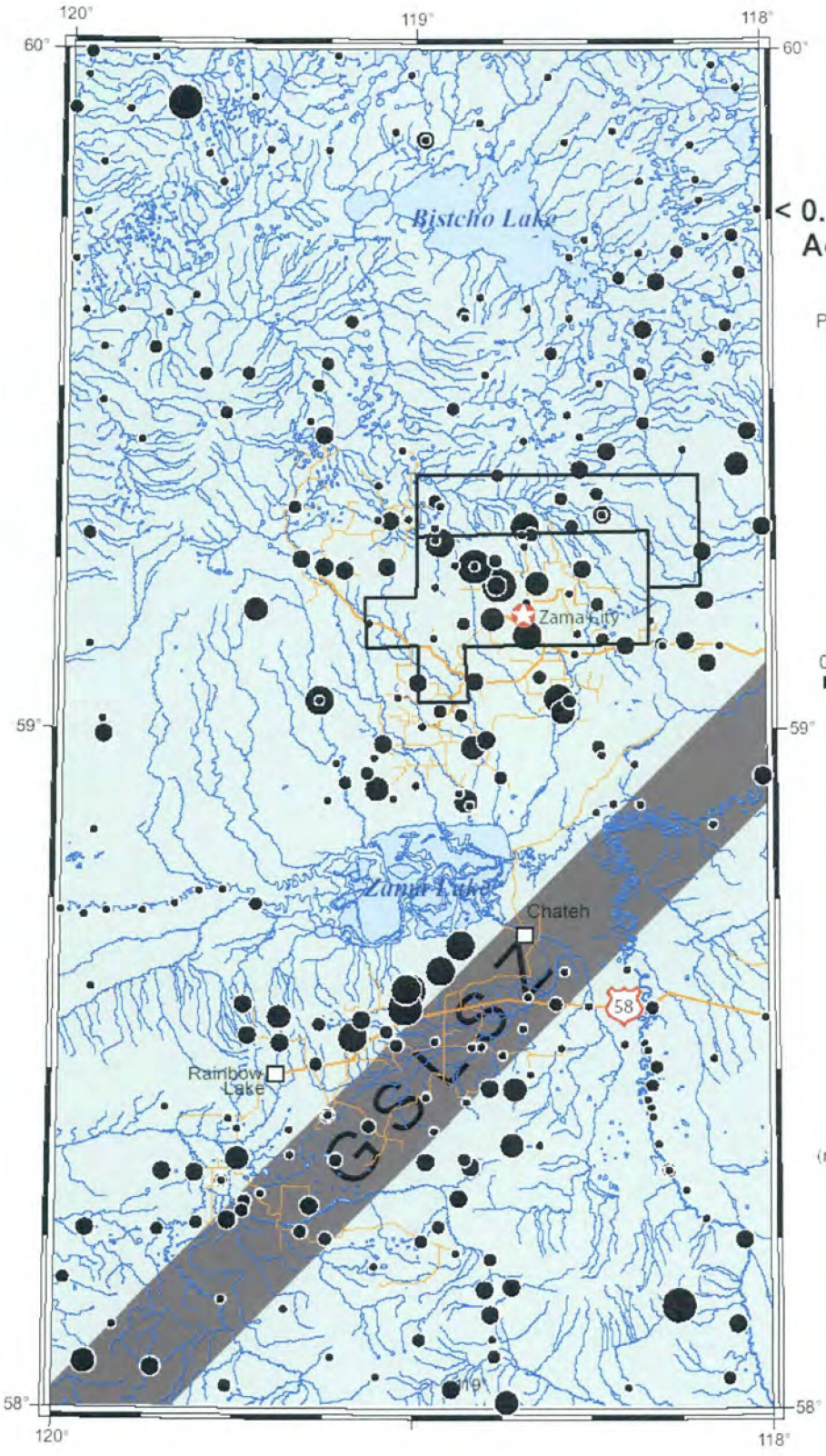
Lead concentrations in the silt and clay-sized fraction of the till samples range from 5.1 to 28.0 ppm with an average concentration of 15 ppm and a standard deviation of 2 ppm. Samples with trace amounts of galena in the heavy mineral picks do not contain high lead levels in the silt and clay-sized fraction. For example, sample 3205 with one galena grain yielded a lead concentration of 14 ppm which is close to the average lead concentration of 15 ppm in the rest of the till samples. Elevated lead concentrations (> 98$_{th}$ percentile) principally occur in a region extending from south of Zama Lake to approximately 30 km north of the hamlet of Zama City. There is some overlap between the region with high lead and zinc levels.



Zinc Content in Silt and Clay Size Fraction

Figure 8.

A08-217-8



(modified after Plouffe et al., 2006)

Lead Content in Silt and Clay Size Fraction

Figure 9.

Drawing A08-217-9

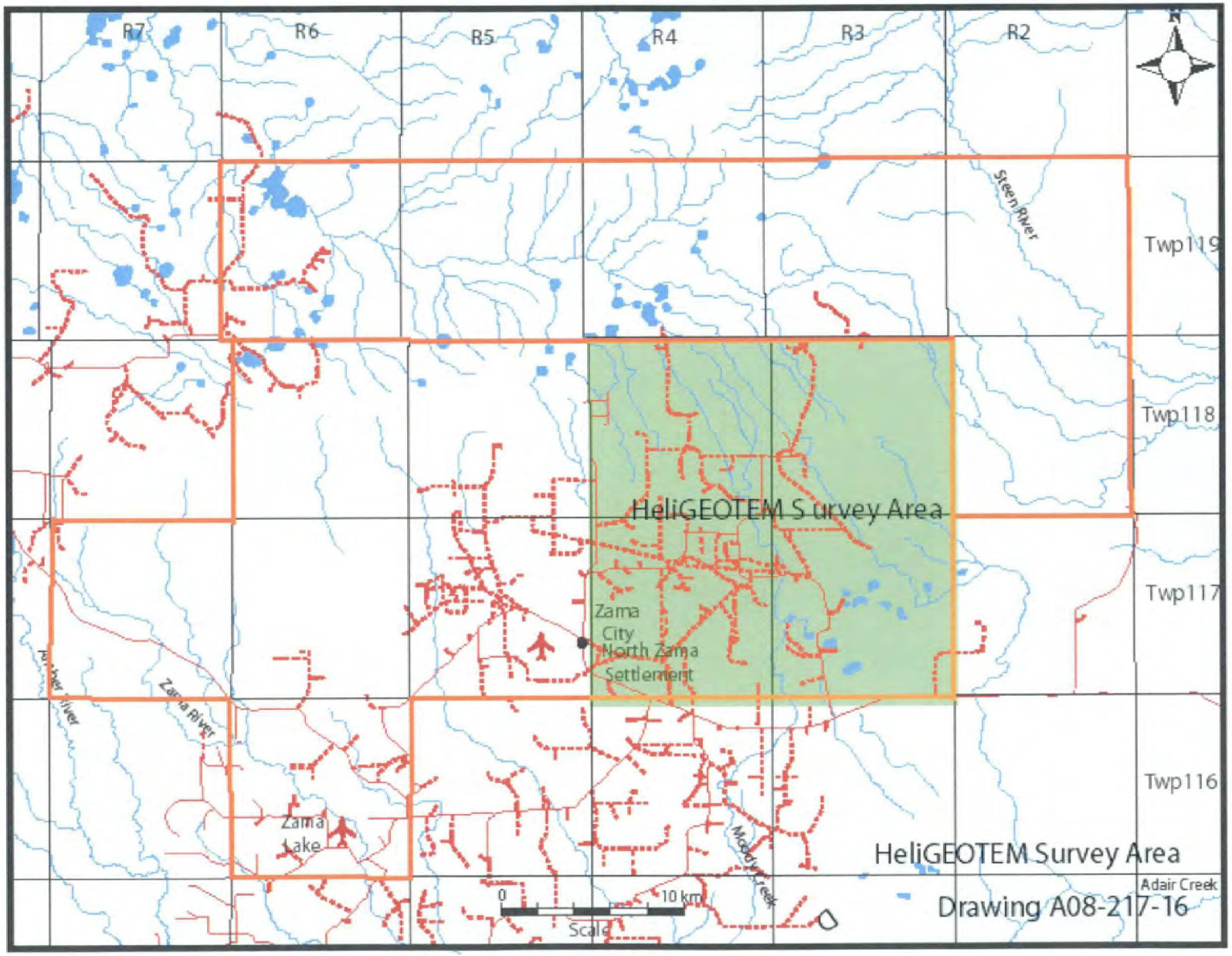
The absence of geochemical anomalies in the silt and clay-sized fraction of till samples that contain abundant sphalerite and galena in the medium sand-sized fraction might be related to the proximity of a bedrock source and the lack of glacial comminution of the sphalerite and galena into particles smaller than sand size. Sphalerite and galena in the host bedrock are most likely in the sand-sized range with no geochemical enrichment in fine-grained minerals. In addition, the un-oxidized nature and elevated carbonate content in some of the till samples (0 to 30% carbonate in the silt and clay-sized fraction) might have prevented the leaching of zinc and lead from the sulfide minerals and the scavenging of these metals by fine grained phyllosilicates, oxides, and hydroxides (Shilts, 1984). Understanding why this anomaly is only reflected in the mineralogy of the sand-sized fraction of tills and not in the geochemistry of the silt and clay-sized fraction will be the subject of future GSC/AGS research. These results indicate that a soil and glacial sediment geochemical survey alone, commonly used in exploration for sulfide deposits, would not yield satisfactory results within the study area. Any follow-up surveys will need to include heavy mineral analyses of glacial sediments collected from the "C" zone soil horizon as opposed to simply conducting drift geochemical analysis.

5.0.0 Star Uranium and Ivany Mining Exploration Program

Star Uranium collected a number of Heavy Mineral samples in the property (Hawkins. 2008). This work confirmed the GSC/AGS sampling results. Ivany Mining's initial program was planned to consist of further sampling on the property but poor weather condition in the late fall of 2007 prevented this because of poor road conditions due to an early snow fall. It was possible to conduct an orientation survey near the old Pine Point Mine site and collect regional sampling between Pine Point and Zama Lake. This sampling indicated that the grains recovered by the GSC/AGS were not derived from Pine Point (Hawkins, 2008). An airborne survey was flown in the spring of 2008 to detail the geophysical setting of the property.

5.1.0 HeliGEOTEM II Airborne Survey

Ivany completed in early 2008,) a helicopter GeoTEM survey over the eastern four permits of the property. Survey results are provided in Part "C" of this report. The area covered the HeliGEOTEM Survey is shown on Drawing A08-217-16, Survey results are fairly noisy given the industrial activity in the area.


R7
R6
R5
R4
R3
R2
N
Steen River
Twp119
Twp118
HeliGEOTEM Survey Area
Twp117
Zama City
North Zama Settlement
Zama River
Twp116
Zama Lake
Moody Creek
HeliGEOTEM Survey Area
Adair Creek
0
10 km
Scale
Drawing A08-217-16

6.0.0 Exploration Potential

The exploration potential of the Zama Lake Pb-Zn property lies in the recognition that the discovery of sphalerite, galena, barite grains in heavy mineral concentrates are being indicative of the metal bearing hydrothermal fluids ascending through a sedimentary package which hosts carbonates and shale where they could have deposited economic Pb-Zn deposits. Previous to this, sphalerite and galena occurrences were known in the Devonian carbonate rocks in oil wells in northern Alberta. High levels of metals were also found in saline formation waters in Devonian Keg River Formation. Both the federal (GSC) and provincial (AGS) geological surveys have been promoting the Pb-Zn conceptual potential of the Western Canadian Sedimentary Basin for several years (Rice, 2001; Hannigan, 2002; Hannigan et al., 2003). Previous analyses of Devonian formation waters in Northern Alberta show these waters to be Pb-rich and are thus not related to Pine Point because the deposit is Zn-rich. Recent analysis shows that Zn values are in an order of magnitude greater than Pb (Hannigan et al., 2003). Lead isotope dating of the Pine Point deposits is 290 Ma (290 million years ago or Late Pennsylvanian age). The metal-bearing fluids responsible for Pine Point are much older and likely different than modern formation waters. Modern formation waters are likely driven by a Laramide deformation event within the Cretaceous. This would make the whole sedimentary package prospective for Pb-Zn deposition.

The presence of the classical Pb – Zn – Mo anomalous geochemistry on a regional basis in the surficial environment in the clay silt fraction of till within the Zama Lake area indicates proximal source and not a far traveled transported anomaly. This potential has only recently been recognized. The structural setting of the Zama Lake Area along parallel structures to the MacDonald – Great Slave Fault northeast-southwest system and cross cutting northwest-southeast structures is similar in setting to the Pine Point Area. Most of these structures are basement features, which have been reactivated over time and penetrate nearly the full sedimentary package. These structures are likely one of the major controls localizing mineralization.

Exploration on the Zama Lake property consisting of till sampling, examination of indicator mineral concentrates and silt geochemistry indicates the likely proximal presence of Pb-Zn mineralization near surface. The best potential likely exists along structural breaks (faults), collapse structures, porous zones (tuffs), and proximal or up dip of petroleum zones. This potential likely exists beyond the carbonates at depth and into the shale. Further work is required to evaluate this grass-roots Pb-Zn property of merit.

6.1.0 Interpretation and Conclusions

Exploration on the Zama Lake property has resulted in the discovery of sphalerite and galena in the course sand fraction of basal till which is likely indicative of a proximal source of Pb-Zn mineralization. The anomalous sphalerite and galena were obtained from the bottom of the burrow pit at 3 – 4 m depth. The till was extremely well compacted. The surface is covered in most places on the property with a blanket of fine glaciolacustrine deposits. Little evidence of an ablation till is apparent.

An orientation study conducted by Ivany confirms the grains of sphalerite and galena are not derived from the Pine Point area (Hawkins, 2008). Till geochemistry (Hawkins, 2008) of the silt fraction also shows anomalous values in Pb, Zn and Mo. The potential of Pb-Zn has largely been unrecognized because of the lack of knowledge in the metallic mineral potential of Alberta. Results to date suggest a possible SEDEX type mineralization source of the down ice dispersal train containing highly concentrated sphalerite grains and galena grains. Further work is warranted to evaluate this grass roots Pb-Zn play.

6.1.0 Recommendations

A two-phase exploration is recommended to evaluate this Pb-Zn property in the Zama Lake Area of Northern Alberta. An extensive database of oil industry data exists for the area but most of it is focused at depths in excess of 1000 m within the Devonian carbonates. Sub-surface data should be compiled from select wells on the property to compile the shallow stratigraphy from well logs. Any structural information from the logs would also be valuable. Bedrock topography would also be important to avoid areas of deep overburden. This information can likely be acquired at a minimum cost.

The first batch of samples sent to SRC should be sent to ODM for re-processing to recover the metallic mineral indicators. Further, more extensive bulk till and silt geochemical sampling should be untaken at a higher density using ATV for better access into more remote and wetter areas where summer access does not exist. Coverage of silt geochemistry sampling should be expanded beyond that of addition bulk till sampling. Orientation studies should also be undertaken to define variation with depth and lateral variation within burrow pits near current anomalous areas. Increasing bulk till sample size should also be evaluated. Data from GSC / AGS multi-element sampling should be fully integrated into a single database.

Isotopic age dating of the sulfide indicator minerals recovered is warranted to date theage of the mineralization. The age date for mineralization at Pine Point is 290 million years ago. The age date for mineral at Zama Lake in the subsurface within Devonian carbonates is of a similar age. Mineralization near surface may relate to the Laramide Orogeny 47 ±10 Ma (million years ago). This Laramide Orogeny likely deforms rocks up and including Cretaceous age rock. If the age dates are much younger than the old lead dates for Pine Point, the potential for the play increases significantly. Several of the grains should have their isotopic composition determined.

Follow-up ground geophysics should likely initially consist of ground magnetometer, VLF-EM, HLEM and selected induced polarization (IP) surveys. The best suite of surveys should be determined given the local ground conditions and overburden thickness. It will likely be possible in some cases to use pre-existing grid lines from seismic surveys. Further airborne EM with magnetics in some areas may be warranted. The Phase I program would likely define some preliminary drill targets by late fall. Total cost for the Phase I program is estimated at $400,000.

The recommended Phase II program is largely a winter drilling program because of access issues. A suite of ground geophysics would delineate drill targets. Drilling would then be conducted on defined targets within 152.4 m (500 ft) of surface. Where possible, surface access would be gained by using pre-existing winter roads. Operations would likely be based out of one of Zama City's open camps. Special care would be required in areas of shallow natural gas. The special care procedures would not be cost prohibitive but include extra training of crews, spark arrestor on diesel engines and gas deflector on casings. The drilling component of the Phase II program budget is contingent on the delineation of suitable drill targets. A phase II budget of $1,000,000 is recommended. Total Budget for Phase I and Phase II as shown below in Table 6 is estimated at $1,400,000 and is warranted to test this grass roots Pb-Zn property in Northern Alberta.

Table 3 - Proposed Budget Zama Lake Property

Phase I - Summer Early Fall

Well Log Data Compilation	$ 25,000	
Heavy Mineral Sampling	$ 25,000	
Laboratory & Isotopic Analysis	$ 35,000	
Ground Geophysics (IP, EM and Mag)	$ 265,000	
Project Management and Reporting	$ 50,000	
Phase I Total =	**$ 400,000**	**$ 400,000**

Phase II Winter

Ground Geophysics (IP, EM and Mag)	$ 200,000	
Diamond Drilling (3000 m.)	$ 750,000	
Project Management and Reporting	$ 50,000	
Sub-total=	**$1,000,000**	**$1,000,000**
Project Total=		**$1,400,000**

Notes:

1. All cost centers are estimates of "all up" expenditures and include overhead but do not include GST.
2. "All up" costs include labour, taxes, camp support costs, fuel, surface transportation charges, equipment rental, assaying, field supplies, and field supervision.

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Appendix 1

MINERAL ASSESSMENT
EXPENDITURE BREAKDOWN BY TYPE OF WORK

☐ **Estimated Expenditure** (submitting with **Statement of Intent to File**)

☒ **Actual Expenditure** (**for Part B of Report**; Must match total filed in Part A)

Project Name: Zama Lake Pb-Zn Project

	AMOUNT
1. Prospecting	$
2. Geological Mapping & Petrography	$
3. Geophysical Surveys	
a. Airborne	$ **16,750**
b. Ground	$
4. Geochemical Surveys	$
5. Trenching and Stripping	$
6. Drilling	$
7. Assaying & whole rock analysis	$
8. Other Work:	$
SUBTOTAL	**$16,750**
9. Administration (up to 10% of subtotal)	$ 1,**675**
TOTAL	$**18,425**

Paul A. Hawkins [redacted]
SUBMITTED BY (Print Name)

15Jul2010
DATE

Paul A. Hawkins & Associates Ltd.

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CERTIFICATE of AUTHOR

I, Paul A. Hawkins, $B.Sc_{(Eng)}$., P. Eng., do hereby certify that:

1. I am Principal in the firm of: Paul A. Hawkins & Associates Ltd.
   72 Strathlorne Cr. SW.,
   Calgary, AB T3H 1M8
   APEGGA Permit to Practice Engineering #P04521

2. I graduated with a Bachelor of Science degree in Geological Engineering from the Queen's University in 1977.

3. I am a member of the Association of Professional Engineers, Geologists and Geophysicists of Alberta and the Association of Professional Engineers and Geoscientists of the Province of British Columbia and the Association of Professional Engineers of Ontario.

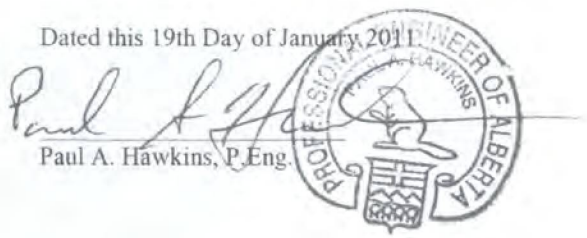
4. I have worked as a geological engineer for a total of 33 years since my graduation from university.

5. I have read the definition of "qualified person" set out in National Instrument 43-101 ("NI 43-101") and certify that by reason of my education, affiliation with a professional association (as defined in NI 43-101) and past relevant work experience,

6. I am responsible for the preparation or supervision of all sections of the report. I have visited property on a number of occasions with the most recent being May 2008.

7. I am retained on a fee for service basis only. I do not own any stock in either company, nor do I expect to receive any.

Dated this 19th Day of January, 2011



Paul A. Hawkins, P.Eng.

Interpretation of the Airborne HeliGEOTEM™ Survey Data

for

Ivany Mining Inc.

Zama Area, Alberta

by

Larch Consulting Ltd.

August 14, 2008

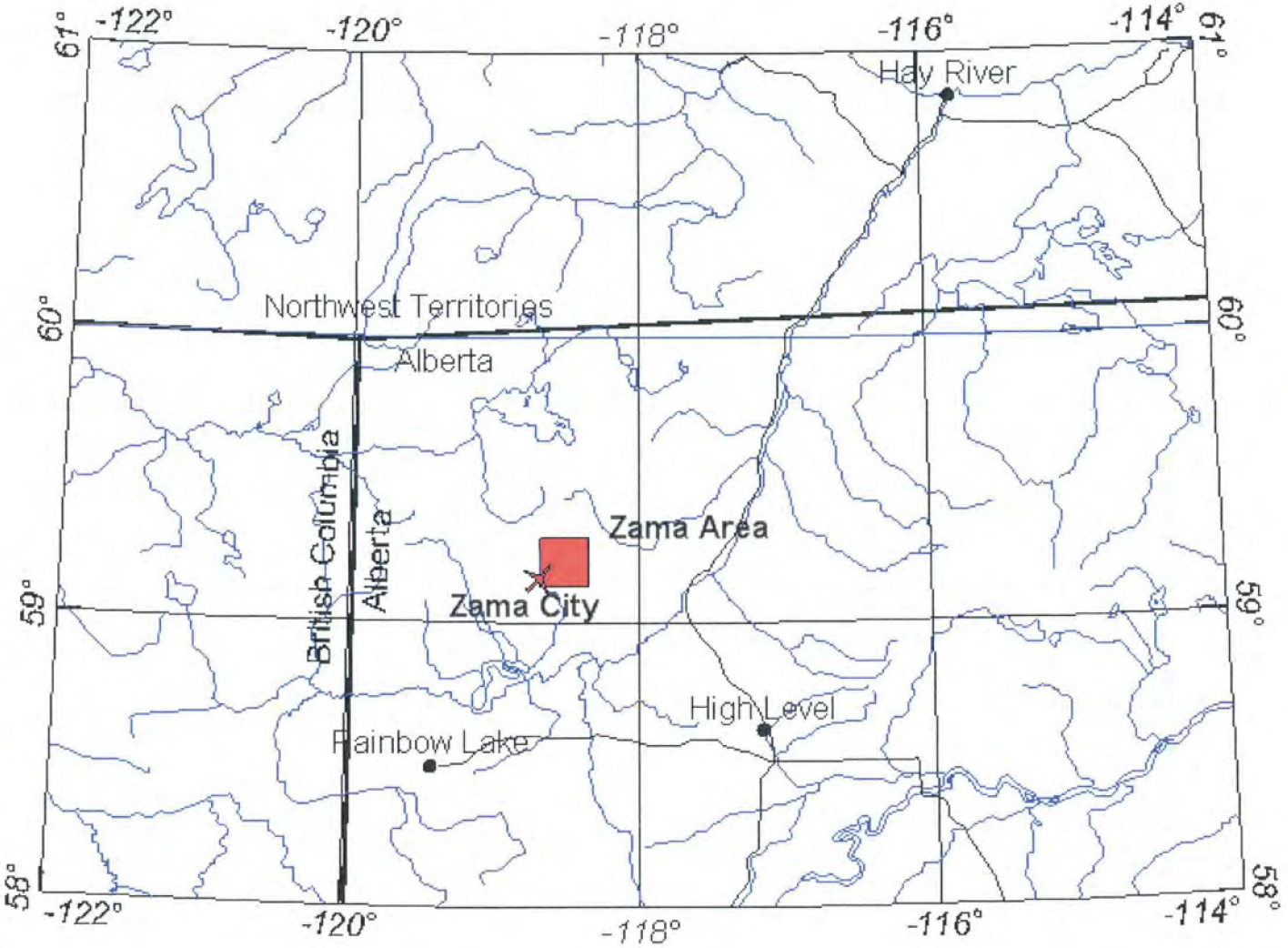
Final Report

INTRODUCTION

The HeliGEOTEM™ data, including both EM and the magnetic data, were obtained from FUGRO Airborne on a DVD and were loaded onto a Larch Consulting Ltd computer for analysis. Most data interpretation processing (filtering, gridding, etc.) was done using GEOSOFT™ and an inversion of the EM data was done using AIRBEO™ (a FUGRO data analysis routine obtained through participation in a multi-company research consortium with the government of Australia). The magnetic data were reduced to the pole and various derivative, band pass, matched and high pass filters were applied to the reduced to the pole total magnetic field data. These various data sets were used for interpretation and most of them are included here as shaded relief images. A four layer EM inversion was done and the results are presented here. In addition, the time decay profiles were interpreted to locate possible conductors. These results are also presented here. The 50m depth conductivity data provide by FUGRO was inverted to resistivity and are included here as a shaded relief image. All grids and map images can be provided to the client as maps, geo-referenced tiffs and grids (format requested by the client). The FUGRO projection was kept: NAD 83, UTM Zone 11N.

Oil well locations and pipelines were obtained from the GEOSCOUT™ data base. It is unknown how complete this data base may be. It is assumed to be fairly compete as of April 2008, the data the accessed file was created. The overlay of these data show where some of the short wavelength EM and magnetic anomalies may be attributed to the metal pipe in the wells or pipelines. The project is in a fairly active oil and gas production and exploration area. As such, there are a number of pipelines and wells in the survey area.

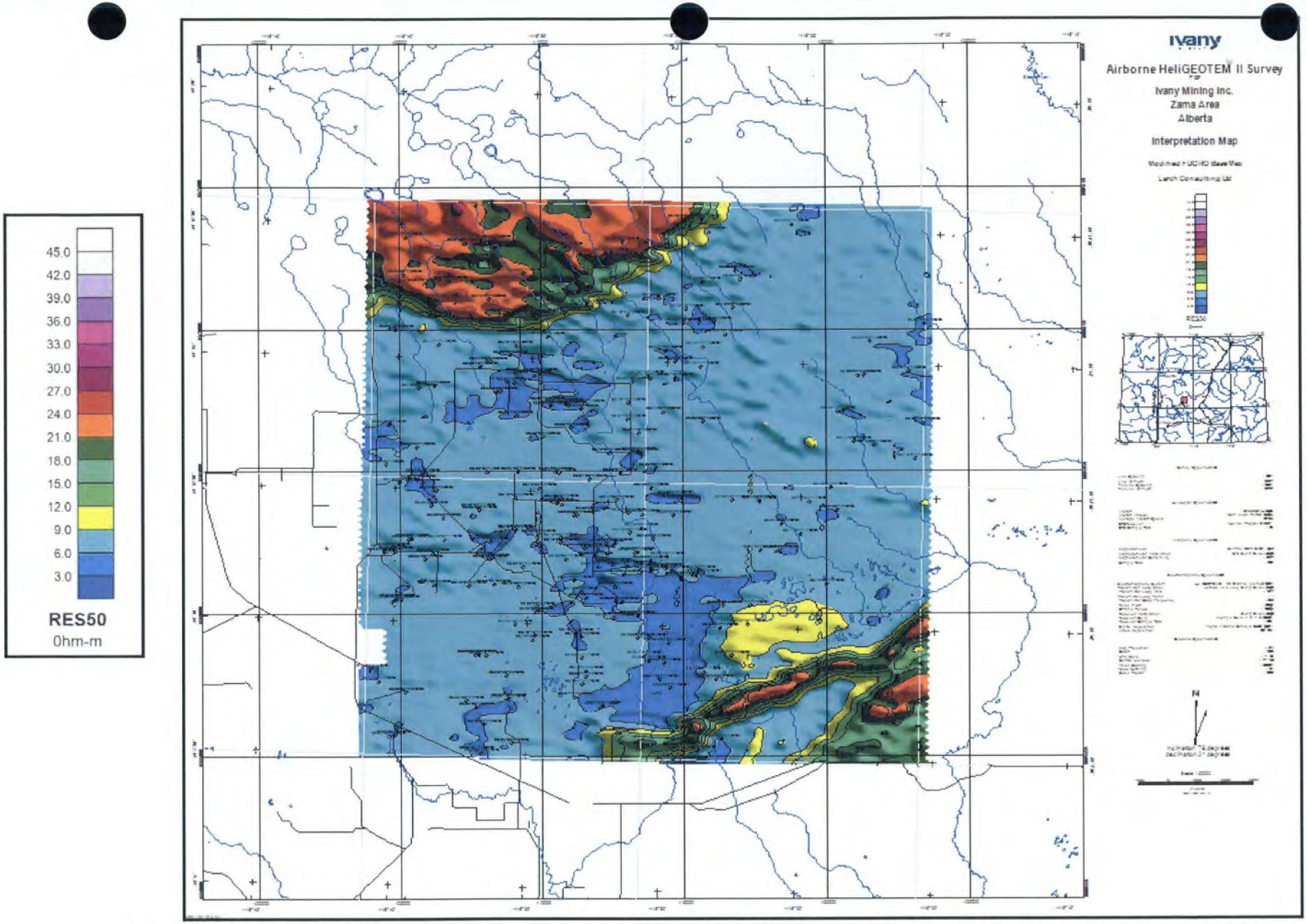
The flying and the data processing are described in a report written and submitted to the client from FUGRO. The report is dated June 2008. Their job number for the project is 08022.



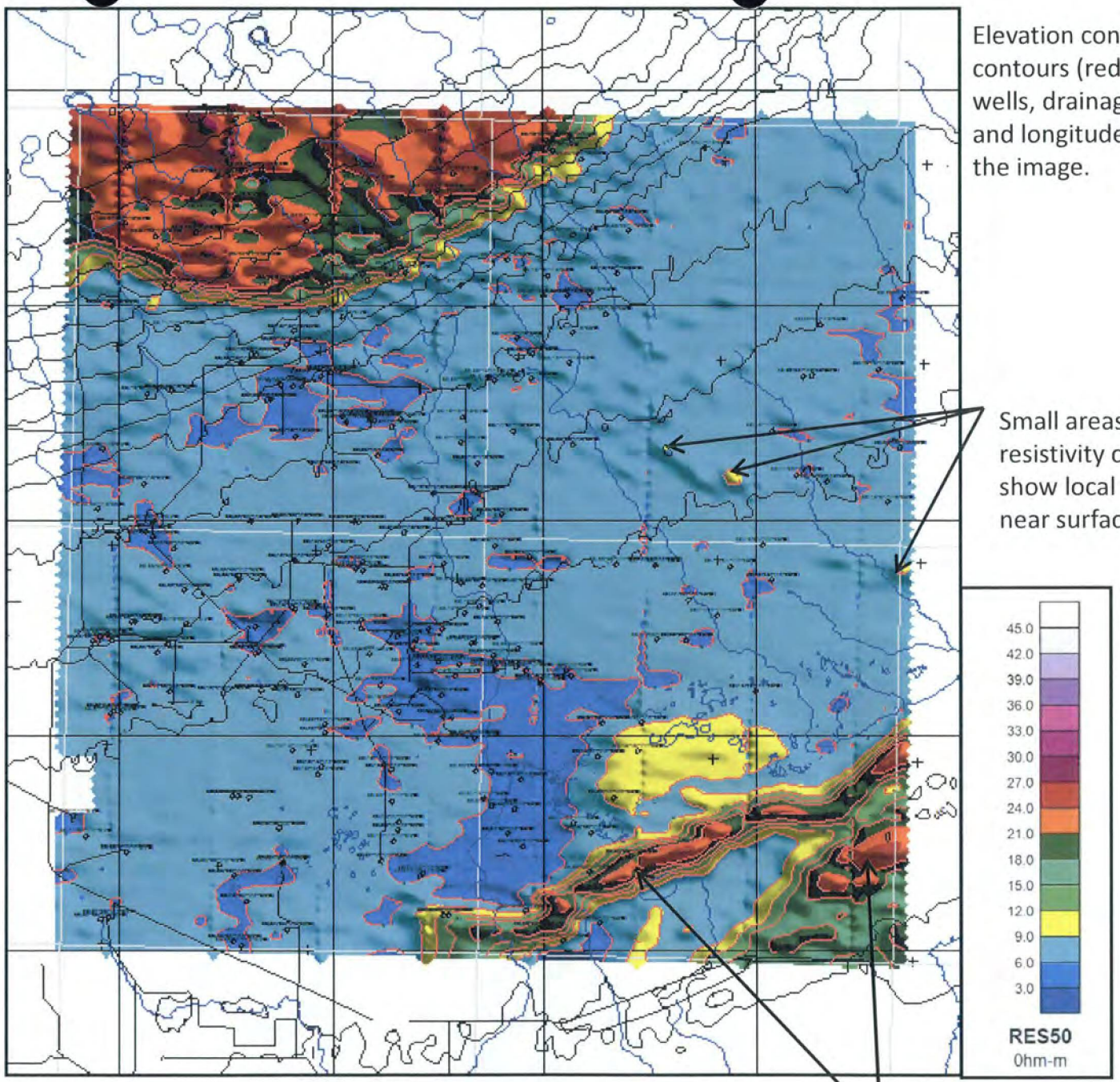
Above figure is copied from the FUGRO Logistics and Processing Report showing the project area

FUGRO Airborne's 50m conductivity data

FUGRO provided the client with CDI sections and a 50m depth horizon grid of conductivty data was extracted from these sections. The 50m depth slice of conductivity data were simply changed to resistivity (1/conductivity) and re-plotted with a colour palette that emphasizes the small dynamic range in the data. The colour palette, as will be evident in the following images, shows the possible shallow channels in the area. Shallow channels are now covered former river and stream channels. It is believed most are Quaternary, pre-Pleistocene features. Others may be Tertiary in age. One can imagine that prior to the ice age, the drainage system over Northern Alberta would have been well developed. The drainage system would have been highly altered and largely covered during the advance and retreats of the several ice ages. These channels may present drilling hazards to the oil and gas industry and may present shallow gas production opportunities.



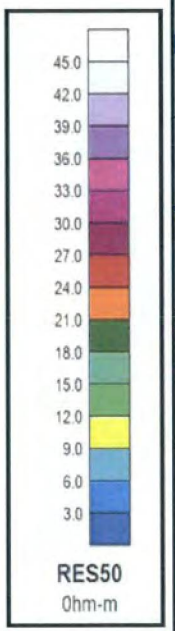
FUGRO 50m resistivity data with color palette as shown and 3 ohm-m contours. Oil well locations (all types, flowing, abandoned, etc.) are shown and named. Image and wells are on the base map created by FUGRO. Township and range grid, UTM grid, latitude and longitude lines, drainage are overlain on the image. Note that a large part of the area has relatively low resistivity at shallow depths. A interpreted channel feature can be seen in the south east corner of the survey area.



Elevation contours(black), 50m resistivity data contours (red), 50m resistivity data (color image), wells, drainage, township and range grid, latitude and longitude lines, and UTM grid all shown on the image.

Small areas of slightly higher resistivity; the resistivity contrast is quite small and may simply show local variations in the outcropping or very near surface formation.

Possible buried channel

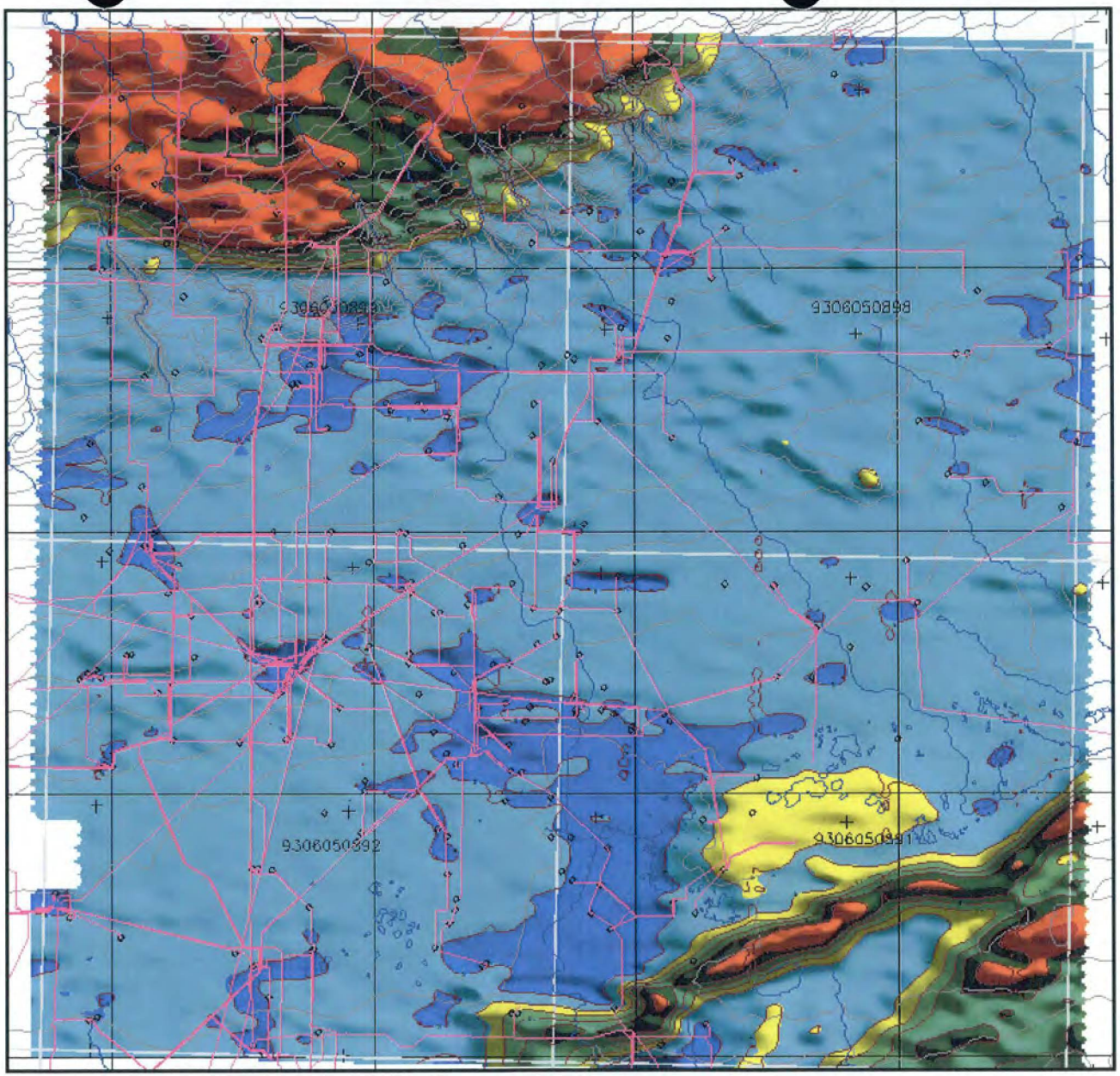


As will be indicated later this area of higher resistivity is in a higher relief area and is likely formation dependent.

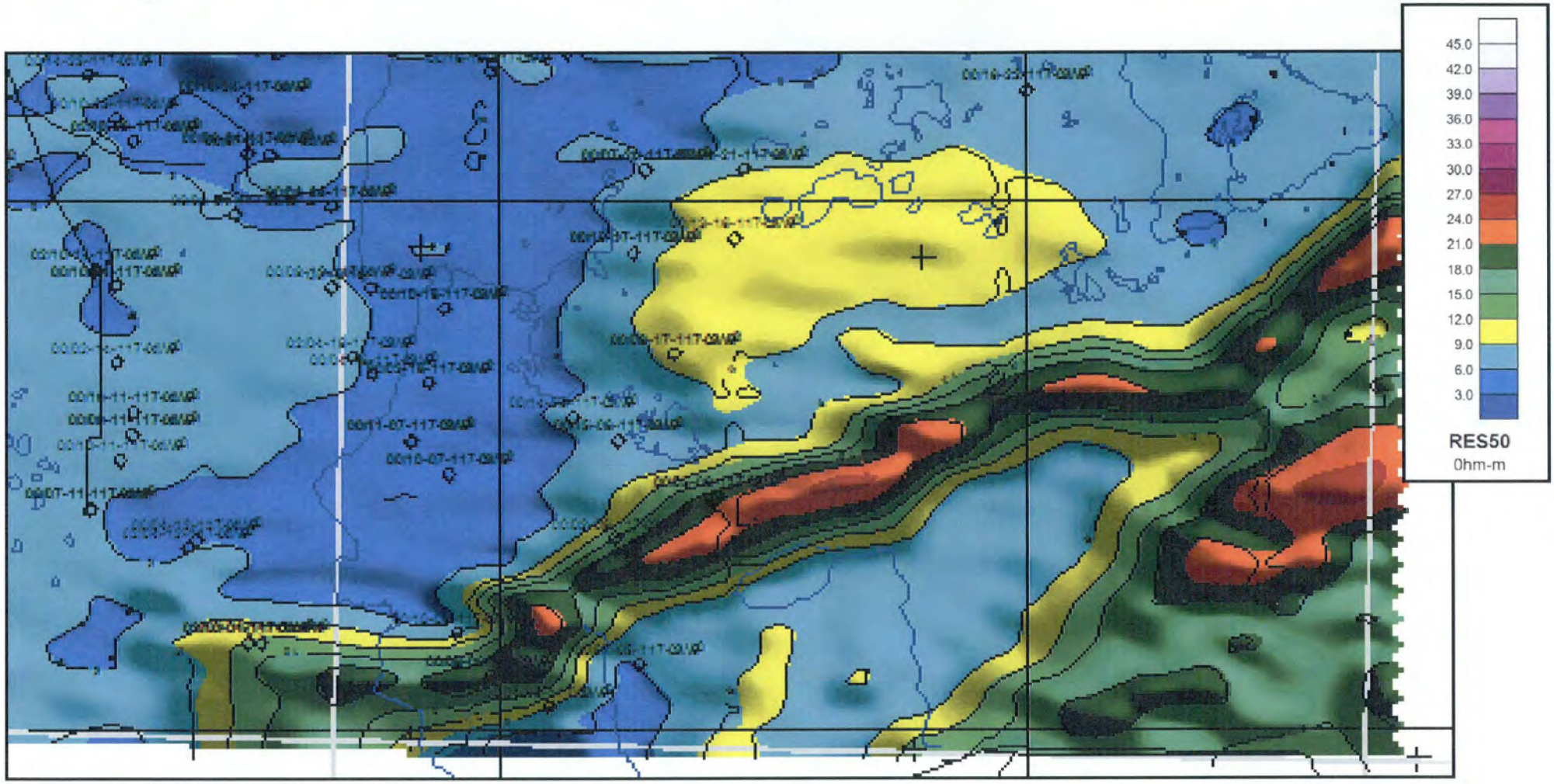
Local, slightly higher resistivity areas may not mean much since the difference is so small.

Higher resistivity patterns suggest they outline near surface buried channels. such channels may contain coarse aggregate, fresh water, gas or all of these materials.

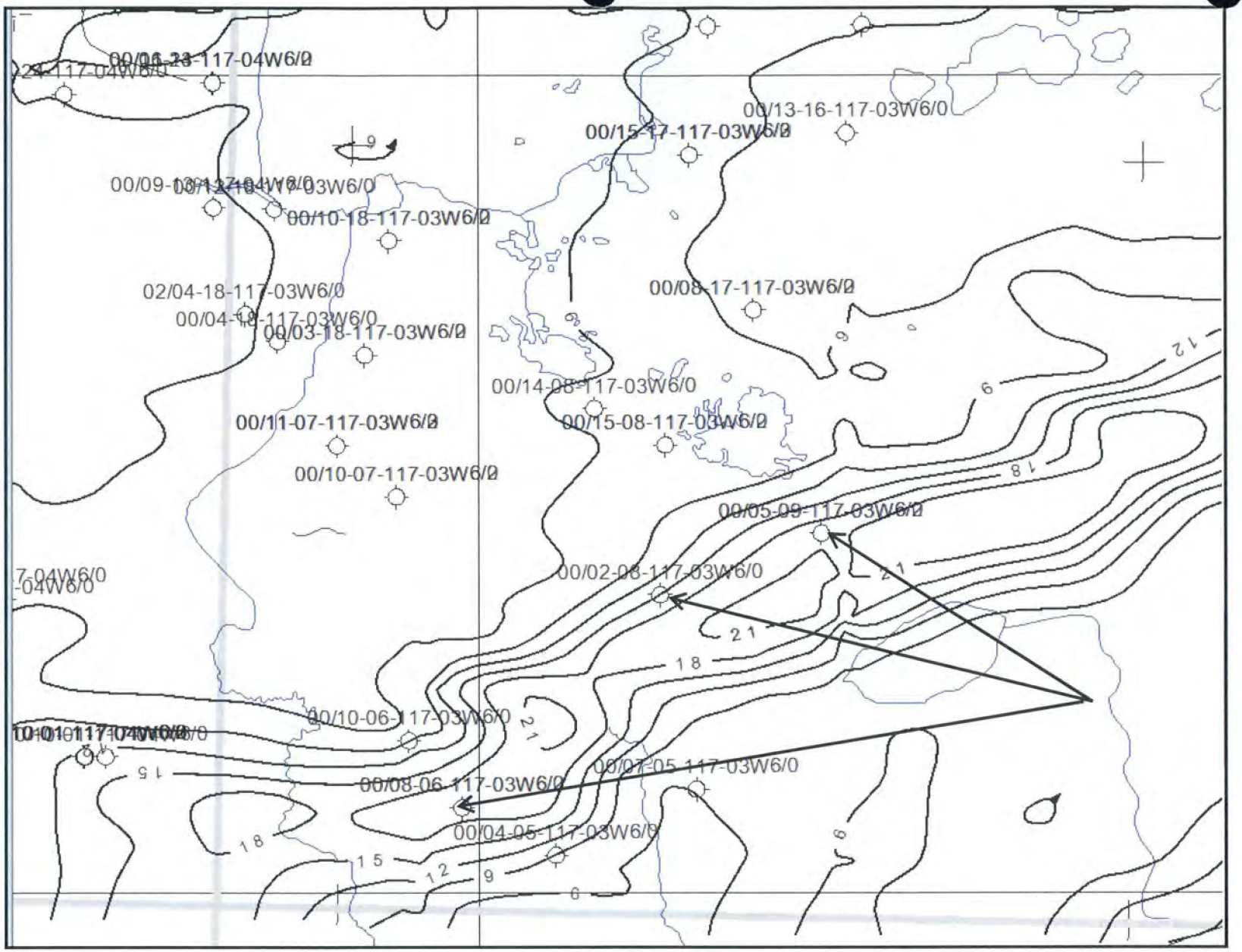
Zoomed to show the image of the survey area only.



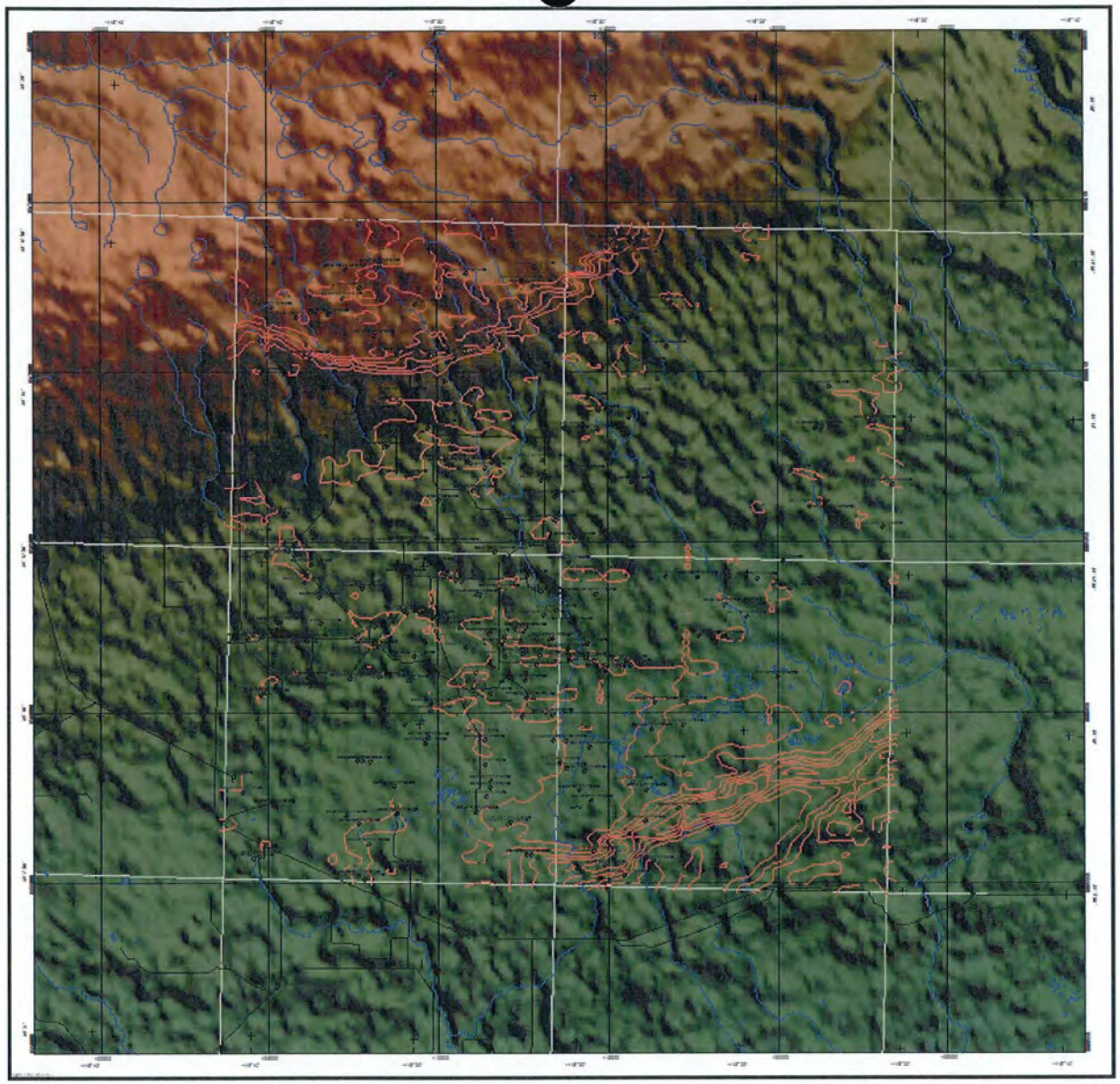
Same image as before but no with pipelines overlain. One can see that most of the wells are connected to a pipeline and in some areas there is a cluster of pipeline. One would expect the pipelines to show some response on the EM data and in some cases perhaps on the magnetic data. These responses will be noted in later images.



Zoomed portion of SE corner of map area is shown here. The resistive trends, as high as red (24-27 ohm-m), may be shallow channels. The more resistive areas **may be** zones with 1) greater amounts of sand/gravel, 2) greater amounts of fresh water, and 3) some concentration of gas. Note that no well penetrates the central, higher resistivity areas of the channel system. There are several wells along the channel that may intersect some channel features at very shallow depths. A review of the drillers' logs might reveal the stratigraphy intersected near the surface (see the next slide).



Resistivity contours and wells in SE corner of area over interpreted possible channel feature. It shows that three wells (arrows) may provide some information on the channel feature.



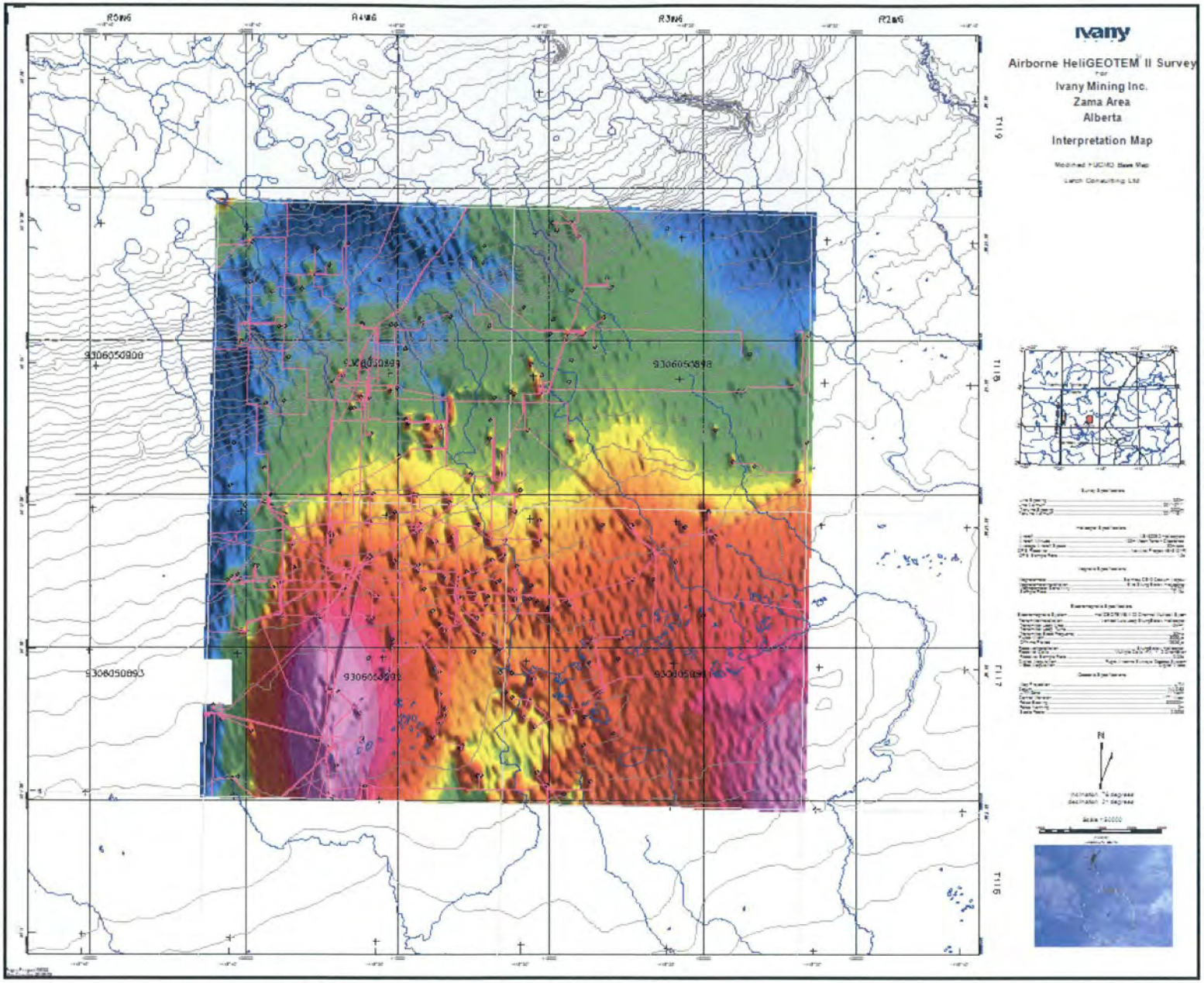
Color contours of the 50m resistivity and wells on the SRTM 90m elevation data. Note the interpreted channels in the SE are perpendicular to current drainage. Higher resistivity in the NW is on higher terrain and lies in a different material layer than the SE channel. The higher resistivity area in the NW correlates to some extent with the contours of the higher terrain but not completely. It may follow a particular formation within the higher terrain.

An examination of the magnetic data

The magnetic data were reduced to the pole, Inclination 78.5 degrees, declination 20.6 degrees. As stated earlier a number of derivative and filtered data sets were made from the reduced to the pole total magnetic field data. The following data sets were made:

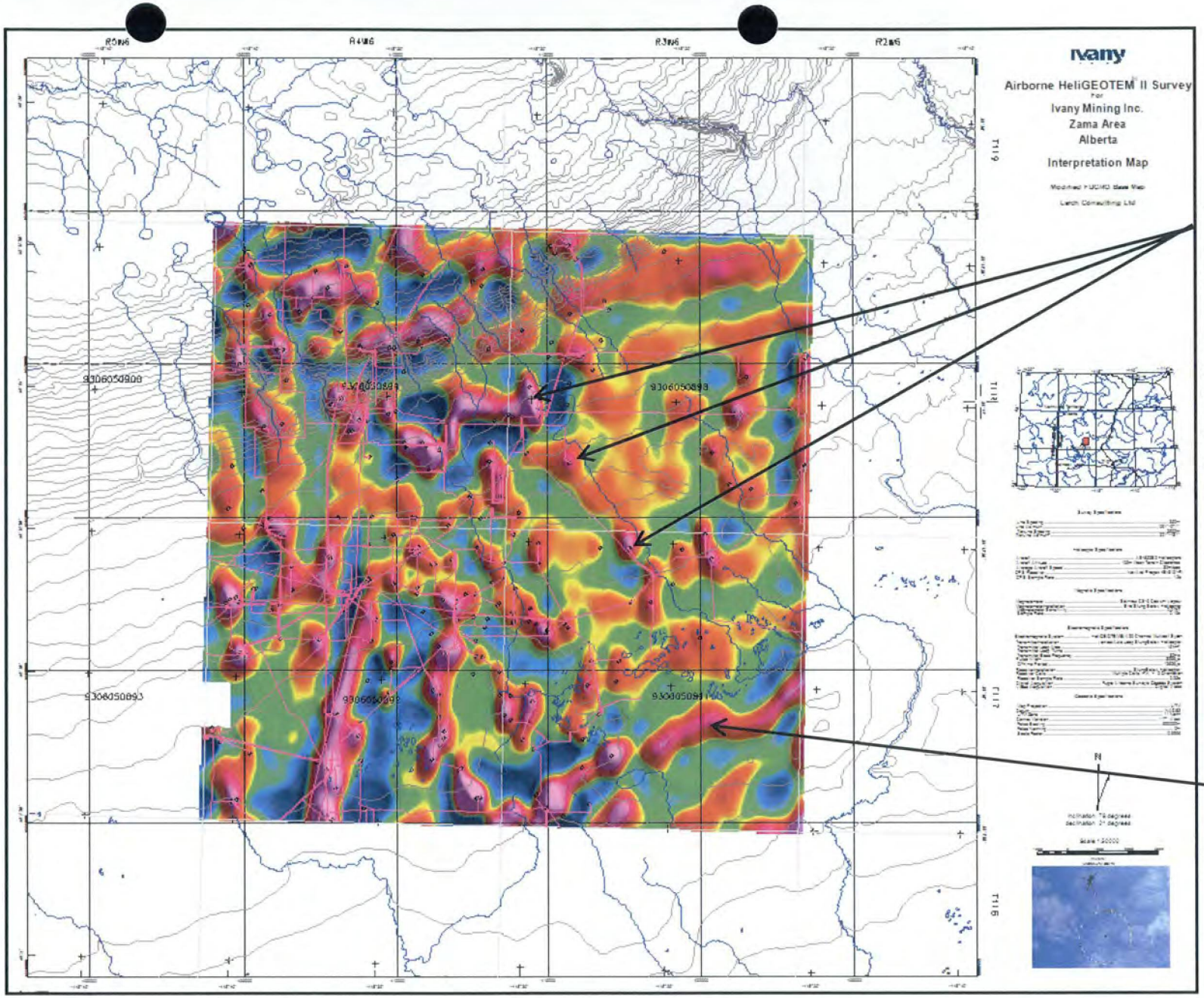
Total magnetic field, reduced to the pole (TF-rtp)
First vertical derivative (1VD)
Second vertical derivative (2VD)
Horizontal gradient (HG)
Total gradient (TG)
High pass filter, 2500m (HP1)
High pass filter, 5000m (HP2)
High pass filter, 8000m (HP3)
Band pass filter, 200 – 1500m (BP1)
Band pass filter, 500 – 2000m (BP2)
Matched filter, mf100m
Matched filter, mf200m
Matched filter, mf600m
Matched filter, mf3200m
Upward continued, UC100m
Upward continued, UC500m
Upward continued and first vertical derivative, UC100m-2VD
Upward continued and second vertical derivative, UC500m-2VD

Only a few of these products are shown here.



Total magnetic field, reduced to the pole

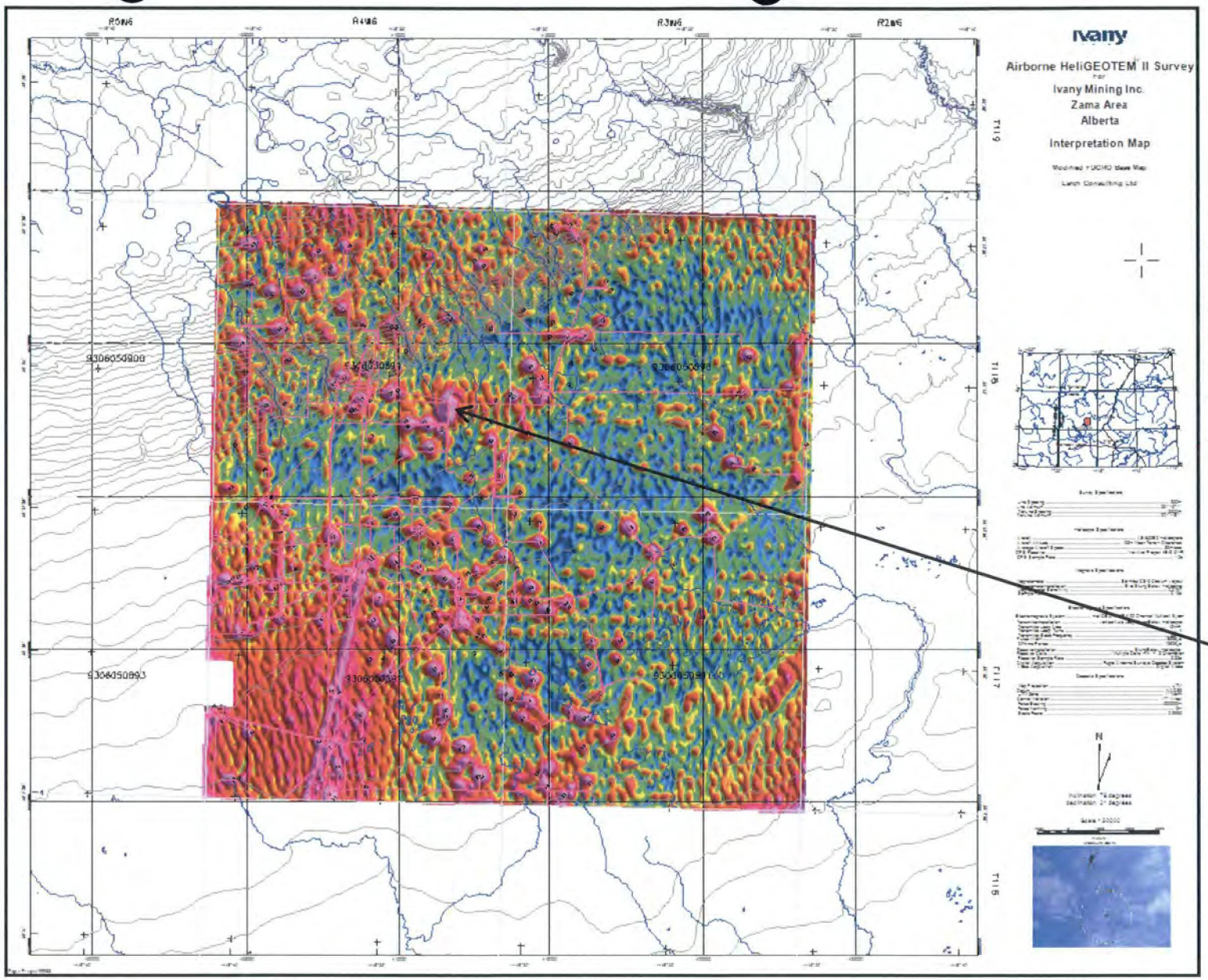
One can see that the wells produce small local magnetic highs and several pipelines, but not all pipelines have magnetic anomalies associated with them. The total magnetic field is processed into other grids for more detailed analysis and some of those products are presented in later images. The total magnetic field, including in this project area, is dominated by the long wavelength, high amplitude magnetic anomalies due to the Precambrian basement. Very weak to no anomalies arise from the sedimentary section. In this region of Alberta some surface to near surface anomalies arise due to magnetic material in channels and some of the Upper Cretaceous section.



600 meter matched filter (mf600 m)

This short wavelength magnetic filtered data set, 600m matched filter, shows many local magnetic anomalies. Three examples are indicated by the arrows. However, these three anomalies lie around known oil wells. Hence one could conclude that the anomalies are due to the metal pipe in the wells and likely other developments around the wells. There are a few other magnetic anomalies that do not correlate with wells that perhaps warrant some ground follow-up.

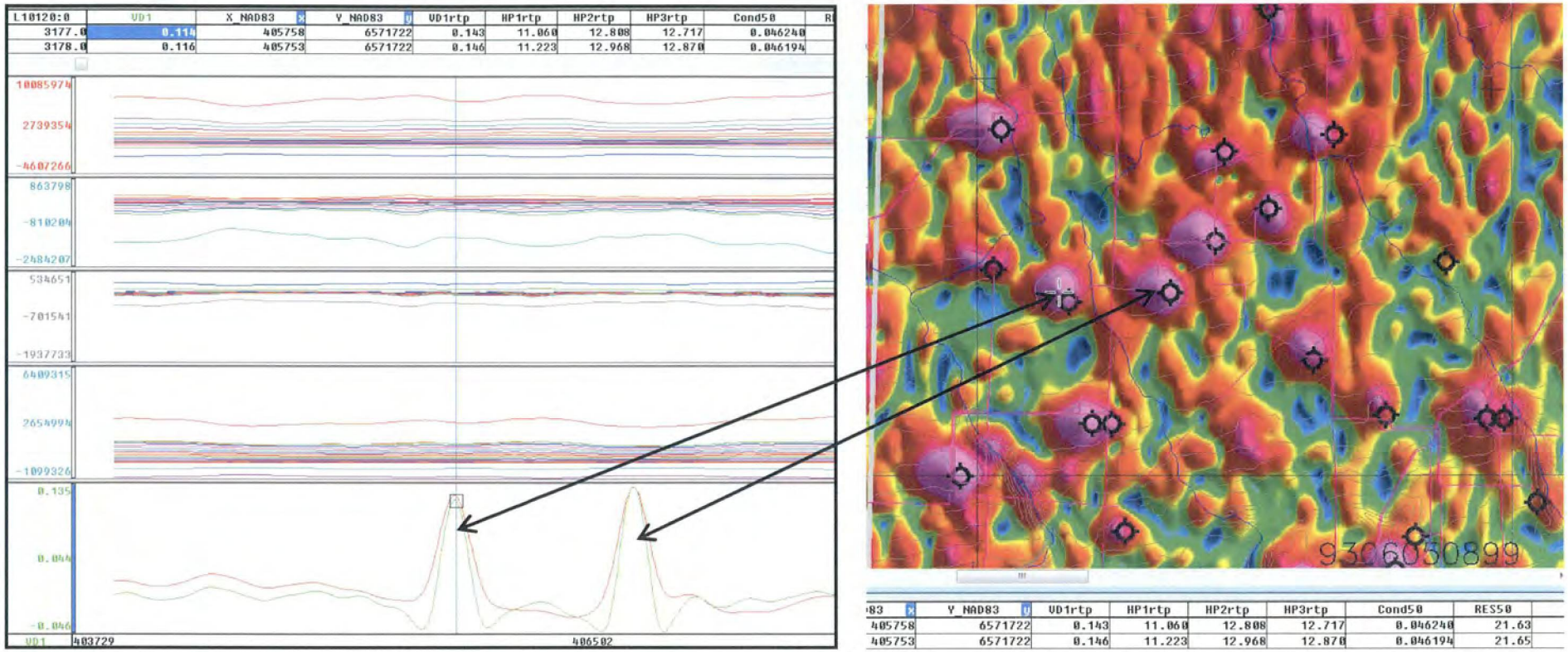
This magnetic anomaly trend is associated with the interpreted shallow channel.



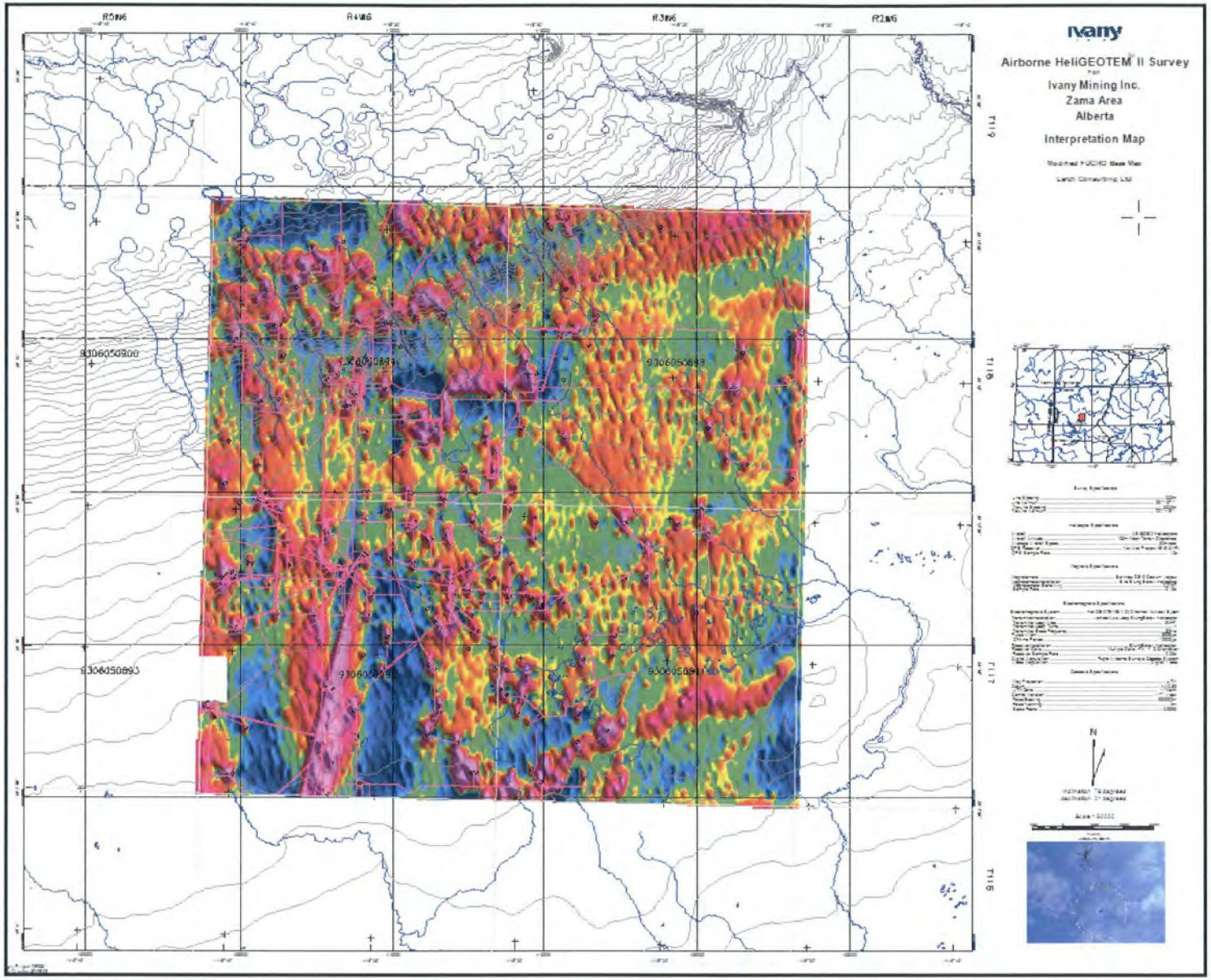
The TG accentuates the anomaly correlation to the wells and pipelines. It does not reveal many significant , short wavelength anomalies that might be due to geological sources. Even the channel anomaly is less evident.

This magnetic anomaly does not have a well associated with it but it still looks like a cultural anomaly.

Total Gradient (TG), or sometimes called the Analytic Signal (AS), typically shows anomalies directly over the magnetic sources. Note that it also removed most of the long wavelength amplitude anomalies due to the Precambrian.

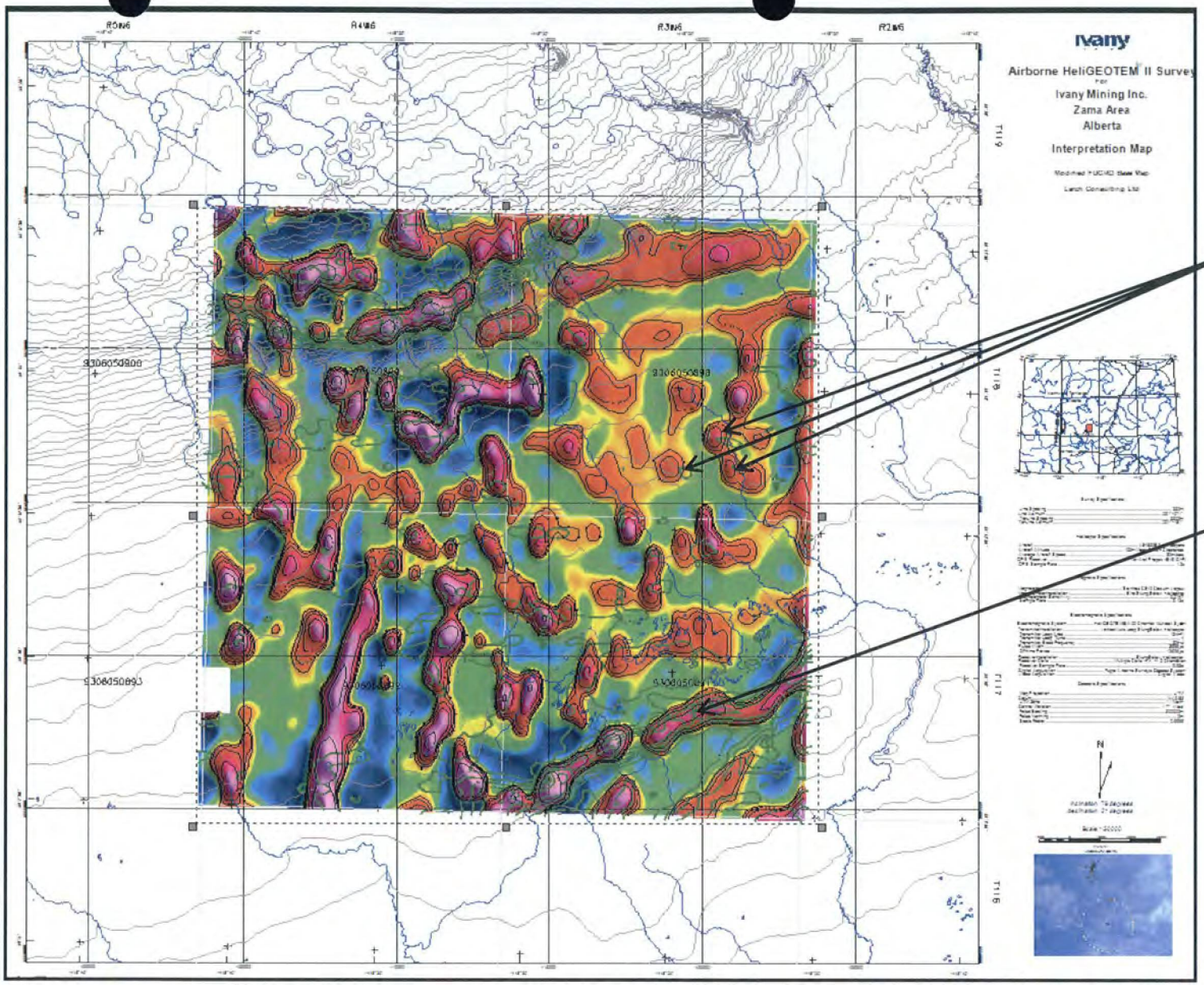


Two examples on line 12 of the magnetic anomaly that is associated with wells. The figure on the left shows the total field profile, red, and the first vertical derivative or the total magnetic field, green. The figure on the right shows the color shaded image of the total gradient of the total magnetic field. The client can view the left image using information provided by FUGRO. The channels in the upper panels are the EM data which will be discussed later.



HP2: High Pass filter, 5000m cut off wavelength

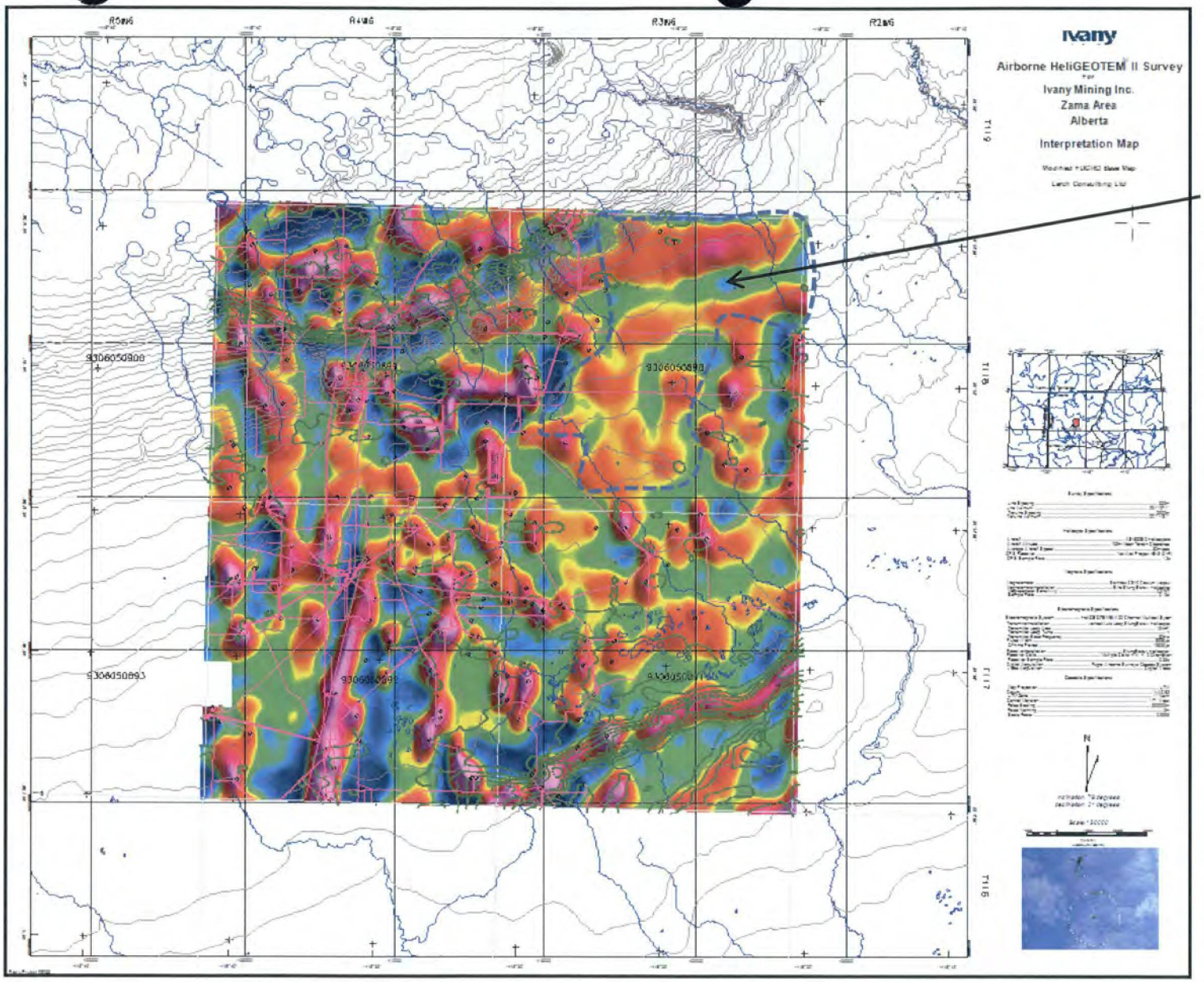
The high pass filter with cut-off wavelength of 5000m, shown here, emphasizes magnetic anomalies that may be in the shallow section. Note it does enhance the anomaly trend along the channel feature interpreted from the resistivity data. Well and pipeline anomalies remain but are not as evident as seen in the TG data.



Close coincidence of magnetic features and small resistivity "highs".

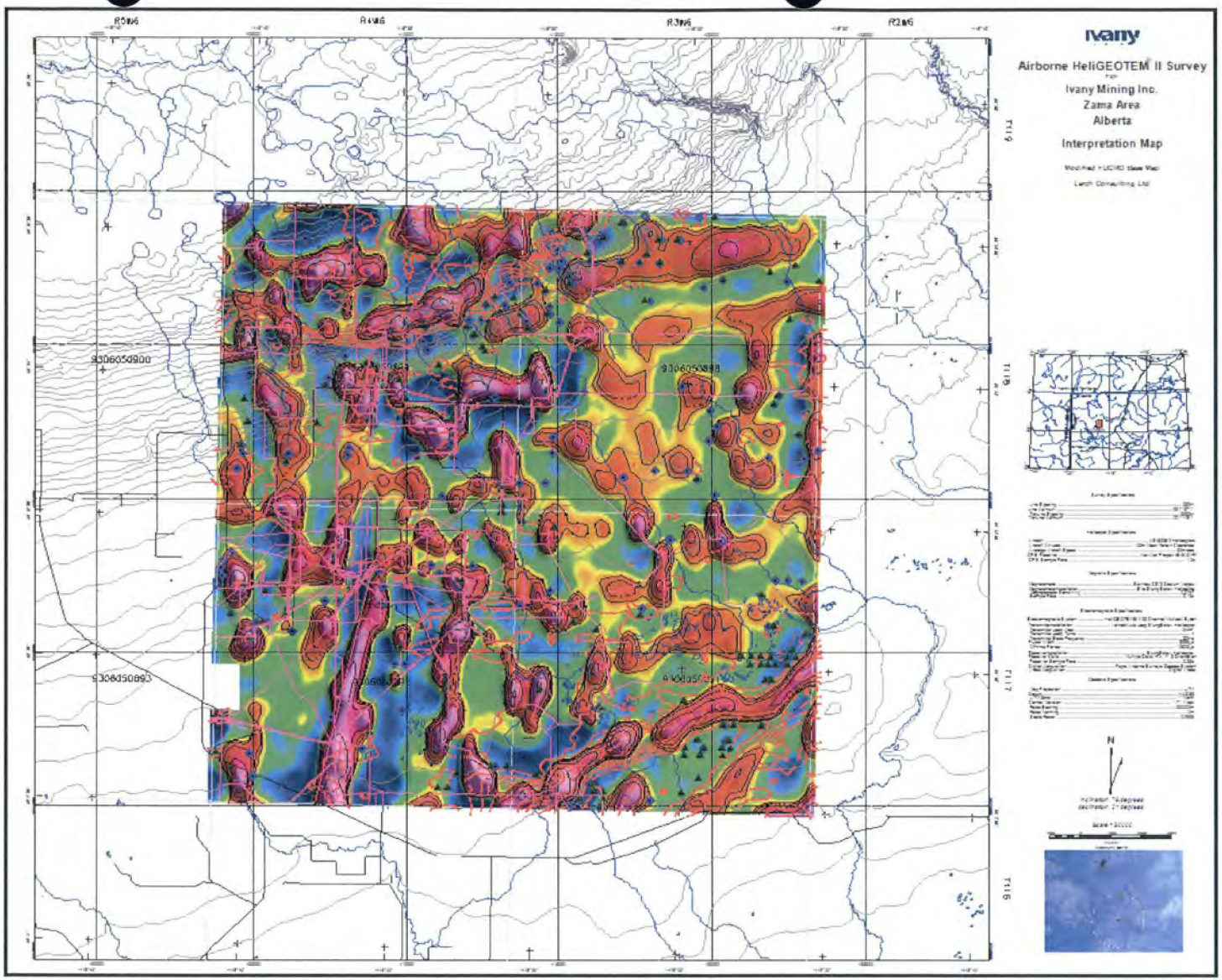
Strong correlation between resistivity and magnetic data along channel feature.

Res50m in dark green, 600m mf in color and black lines, elevation in thin grey lines



Magnetic anomalies in dashed area are not explained by culture. Note that many of the other small magnetic anomalies lie over wells, including two that were indicated on the previous image that are associated with the small resistivity "highs".

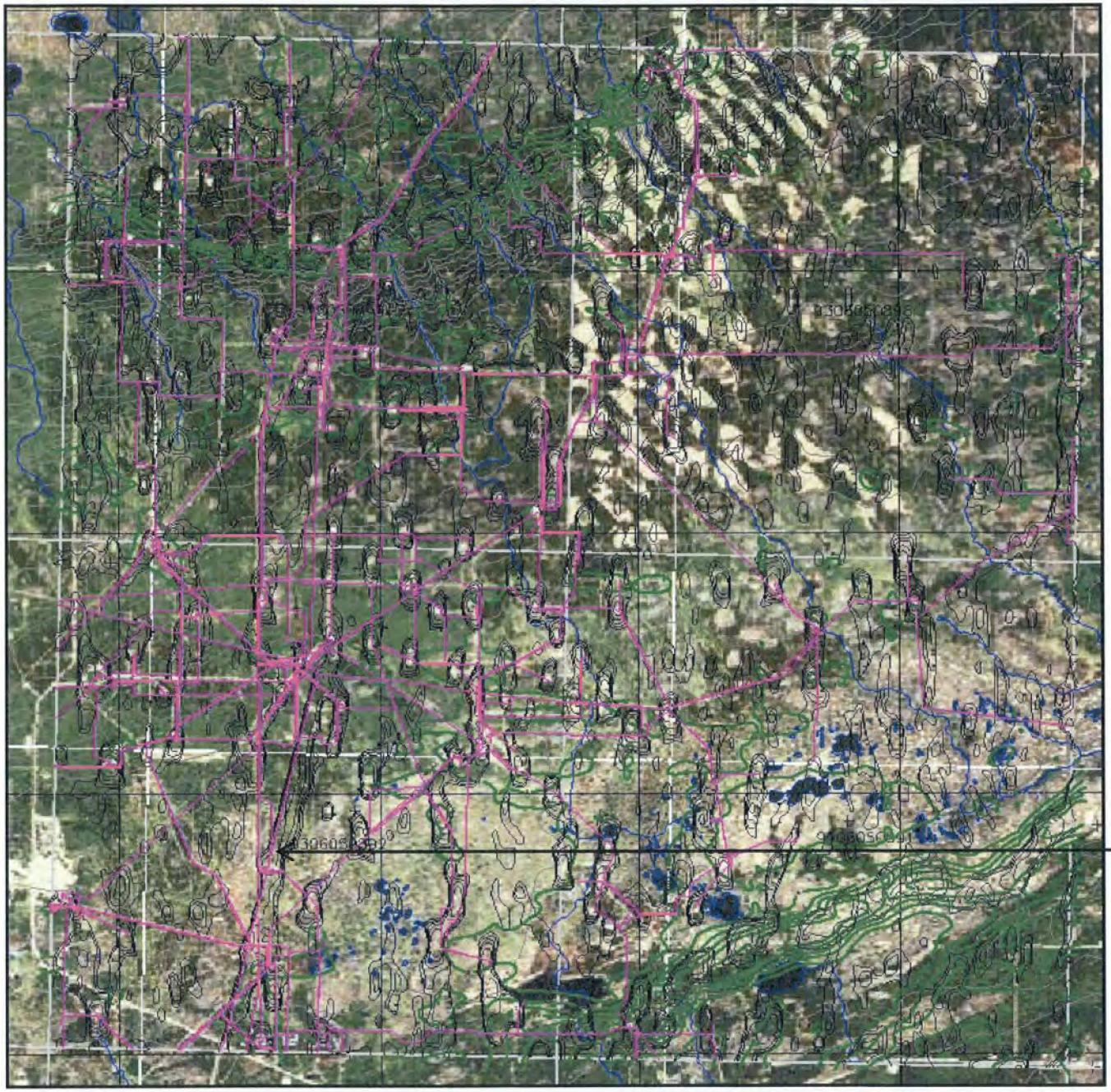
Repeat of previous figure with wells added.



600m mf with its own contours in black, RES50m contours in red, elevation contours in black, township and range grid, UTM and NTS grids, pipelines, roads, drainage, wells and EM anomalies are all shown on this image. One can evaluate all the data using these overlays: are anomalies associated with culture or could they be of geological interest? Some may required ground follow-up in order to improve their interpretation.

Satellite imagery

A basic satellite image was downloaded using Dapple™ in the GEOSOFT™ software. It is shown on the following page. These data, if obtained in full resolution, can be used to map structural lineaments. Here, it was used to examine if surface features might explain some of the shallow EM data.

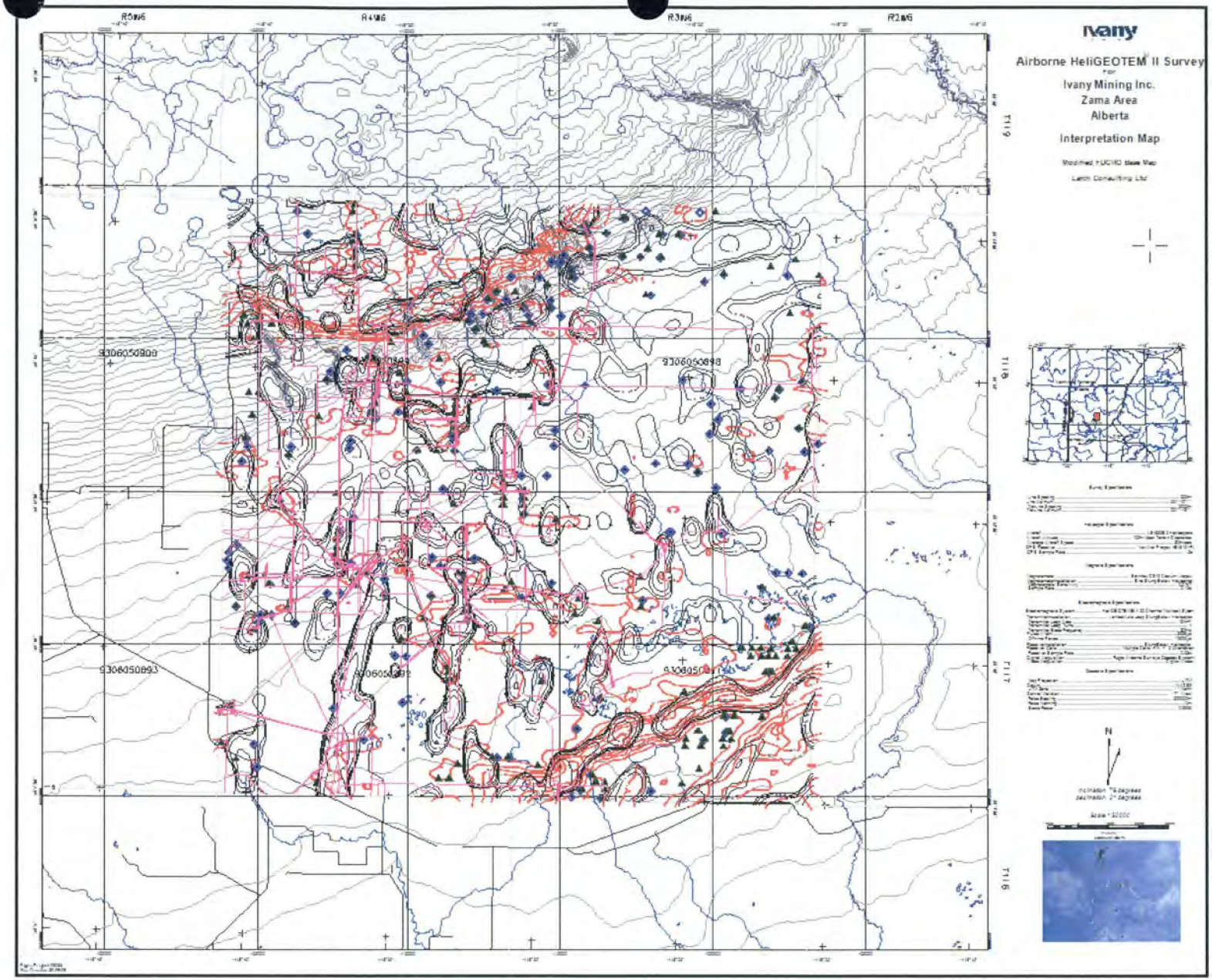


Pipelines (purple), Resistivity contours (green), 200m matched filter magnetic data (black), drainage (blue), elevation (grey) overlain on a satellite image downloaded from Dapple™ . The satellite image is not high quality but it does not indicate that neither the resistivity nor the magnetic data have any strong correspondence with surficial features.

This magnetic anomaly (approximately NNE-SSW strike) appears to follow the pipelines in the area.

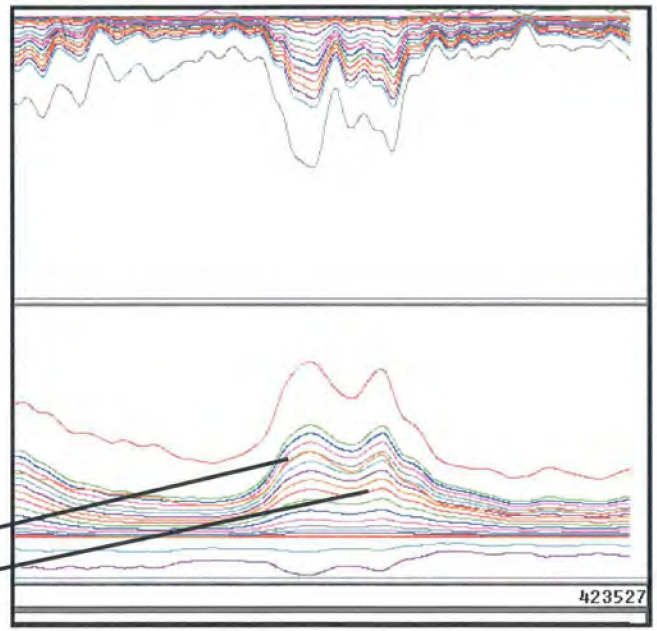
Anomaly Identification in the EM decay curves

The decay curves were reviewed and any decay that showed some indication of a conductor was mapped. One analysis was done using the dB/dt data and another was done using the B data. The first set of picks is shown with diamonds and the second set of picks is shown by triangles on the following images. No attempt was made to evaluate them as good or poor conductors. Some comment on this evaluation is made later for selected anomalies. No modeling has been done to determine quality or depth of conductors.



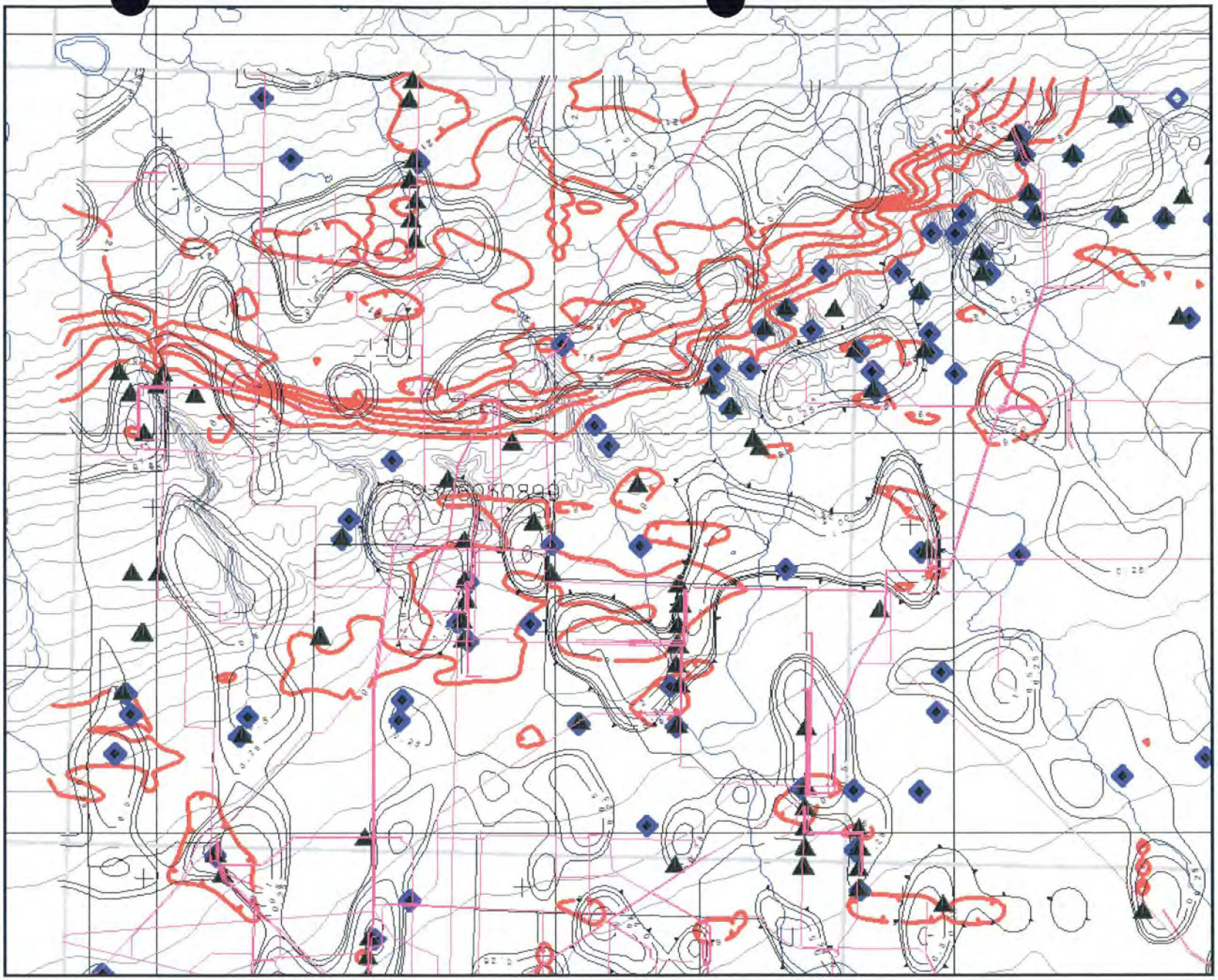
Here, the dB/dt anomaly locations (diamonds) are shown overlain on the 600m mf contours (black) and the 50m resistivity contours (red). Note many follow a topographic interval in the higher elevation area in the north west part of the survey area.

Black contours– 600m mf
Red conntours – 50m resistivity
Purple lines– pipelines
Purple Diamonds – dB/dt EM anomalies
Black Triangles – B EM anomalies

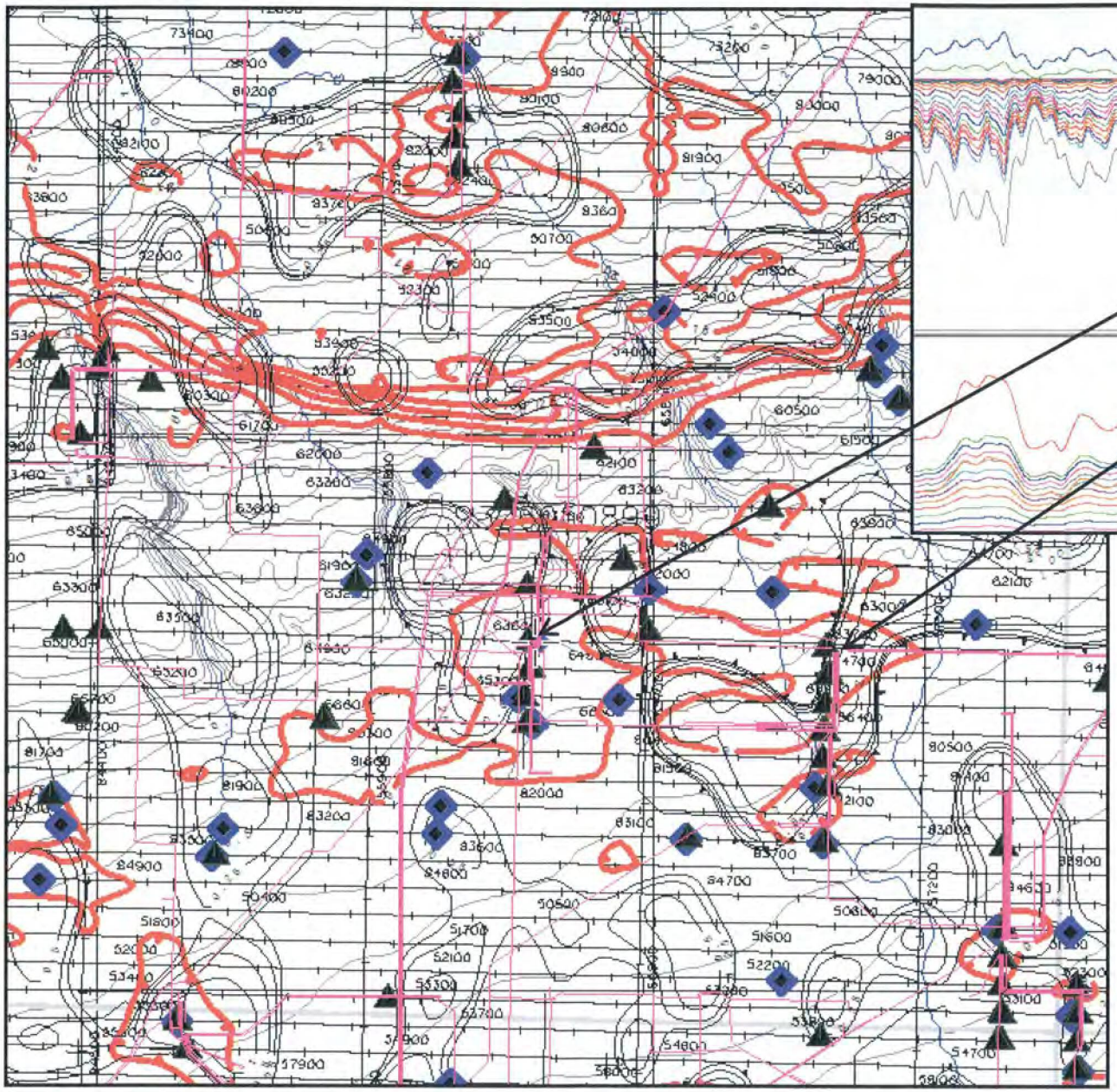


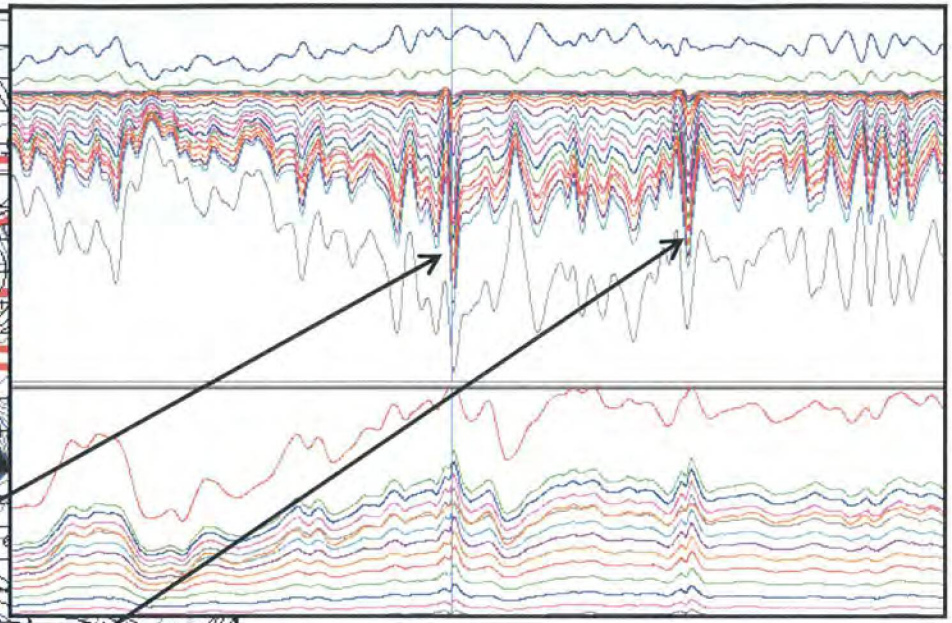
Line 69: B data

Zoomed SE part of map area. Both dB/dt and B anomaly locations are shown. Note the cluster in the conductive area between the interpreted, more resistive channel locations. The cluster and shape of the anomalies suggest they are probably due to conductive overburden.

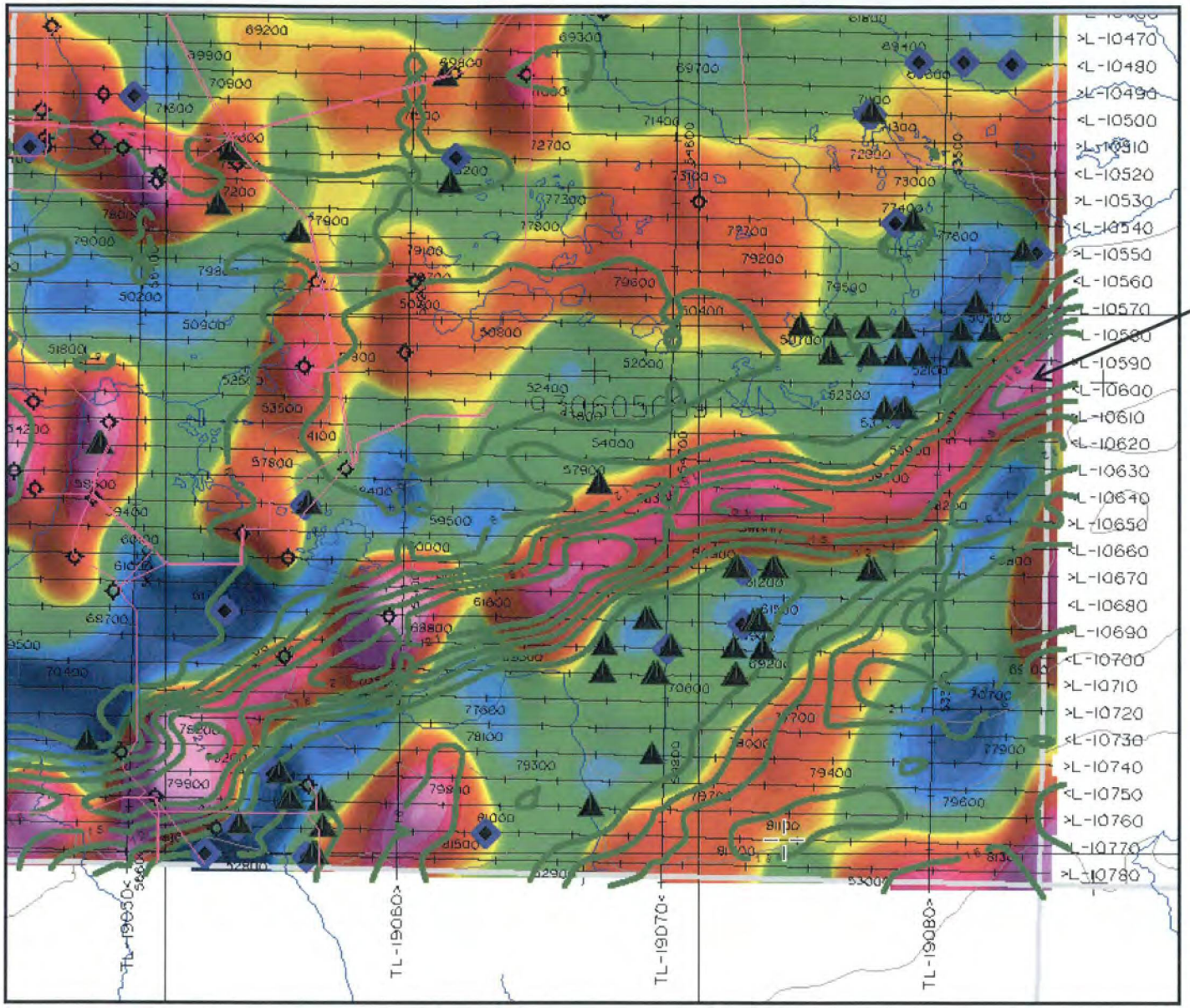


Many EM anomalies have a strong correlation to pipelines



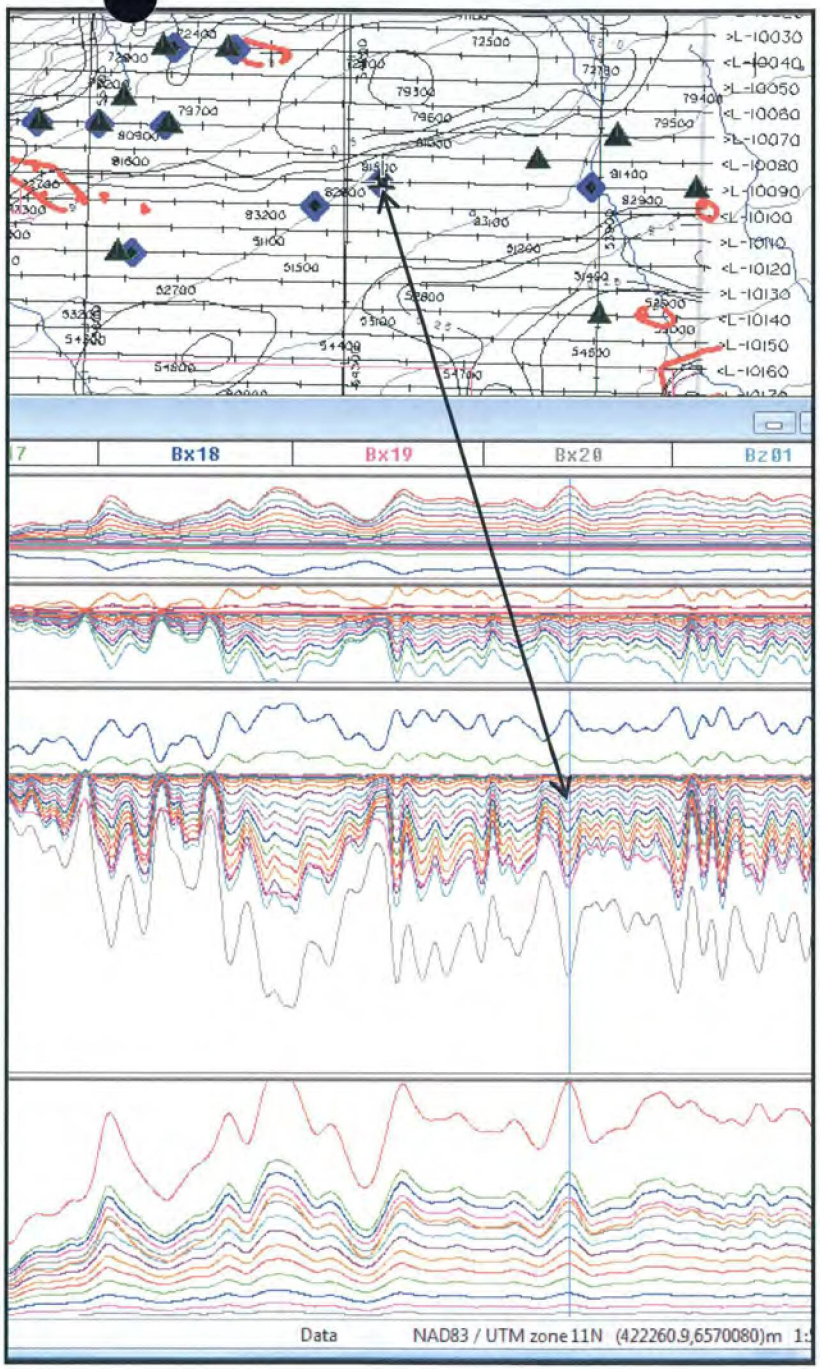


Here are two examples of the decay curve anomalies and their location on the survey area map. These two anomalies are over known pipelines. Other similar correlations can be seen in the map area shown here.

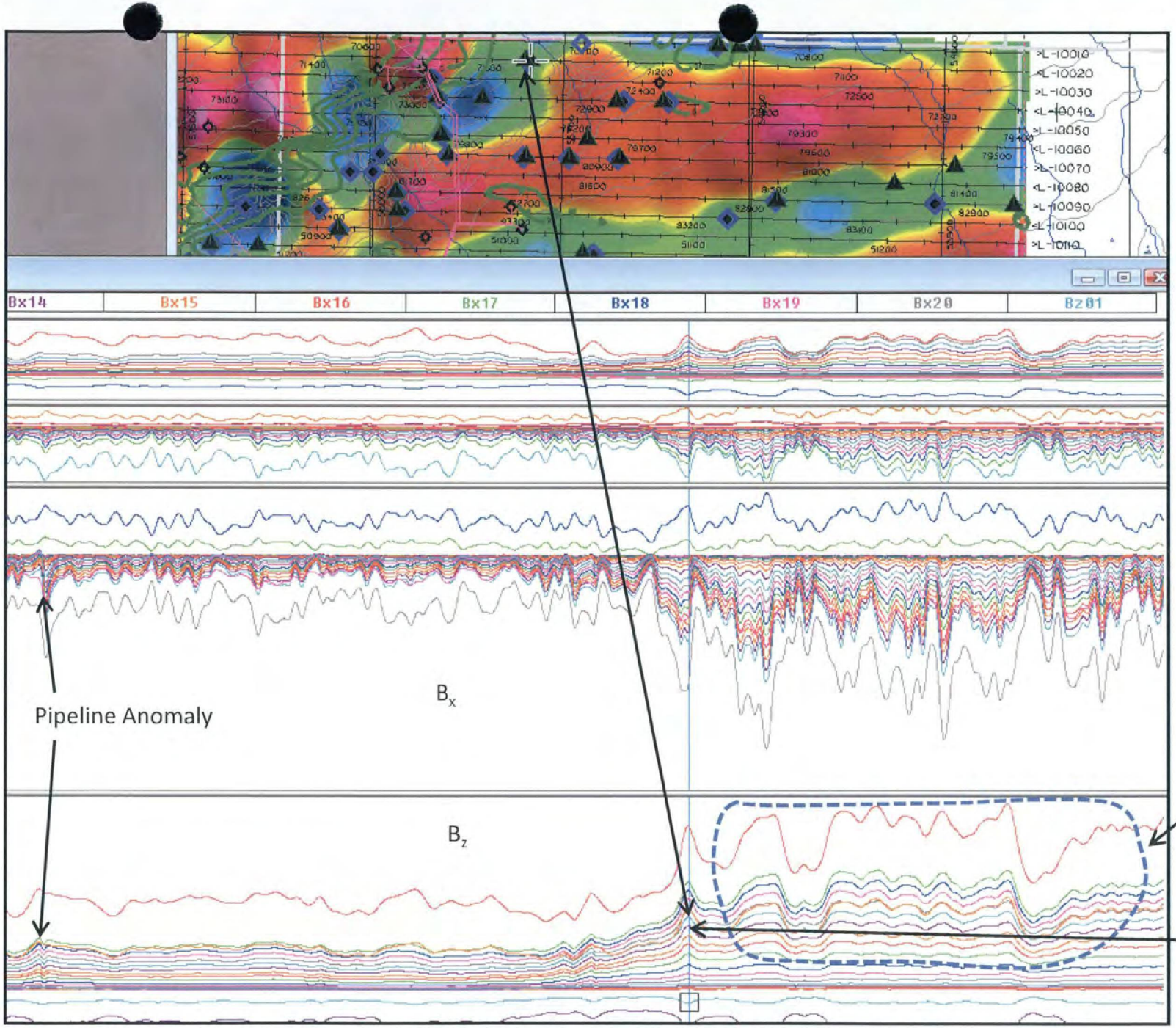


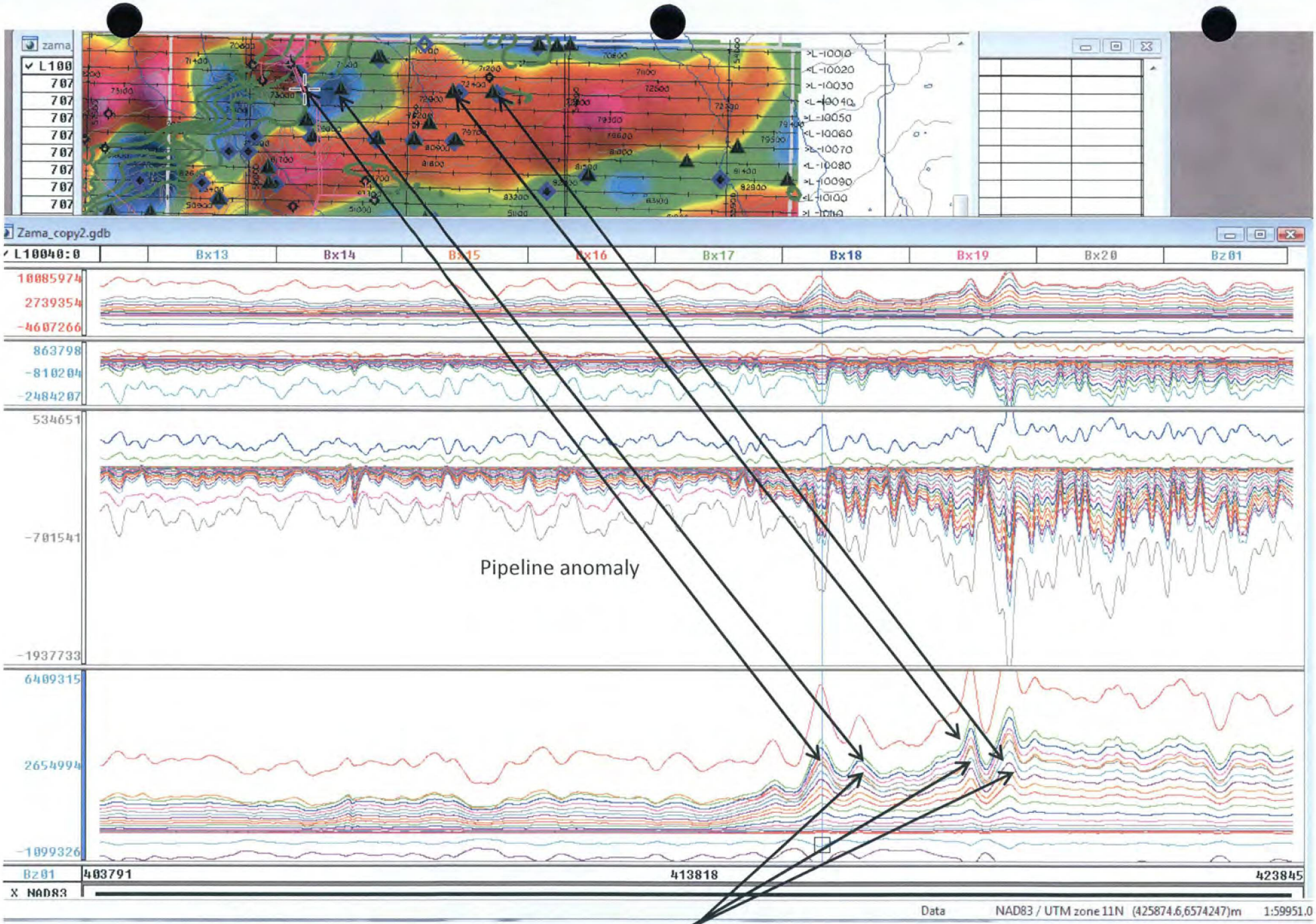
Note again the very good correlation between the magnetic and resistivity data along the interpreted shallow channel

Zoomed image of south east part of survey area with the 600m mf magnetic data shown in color and the RES 50m data shown in green contours.

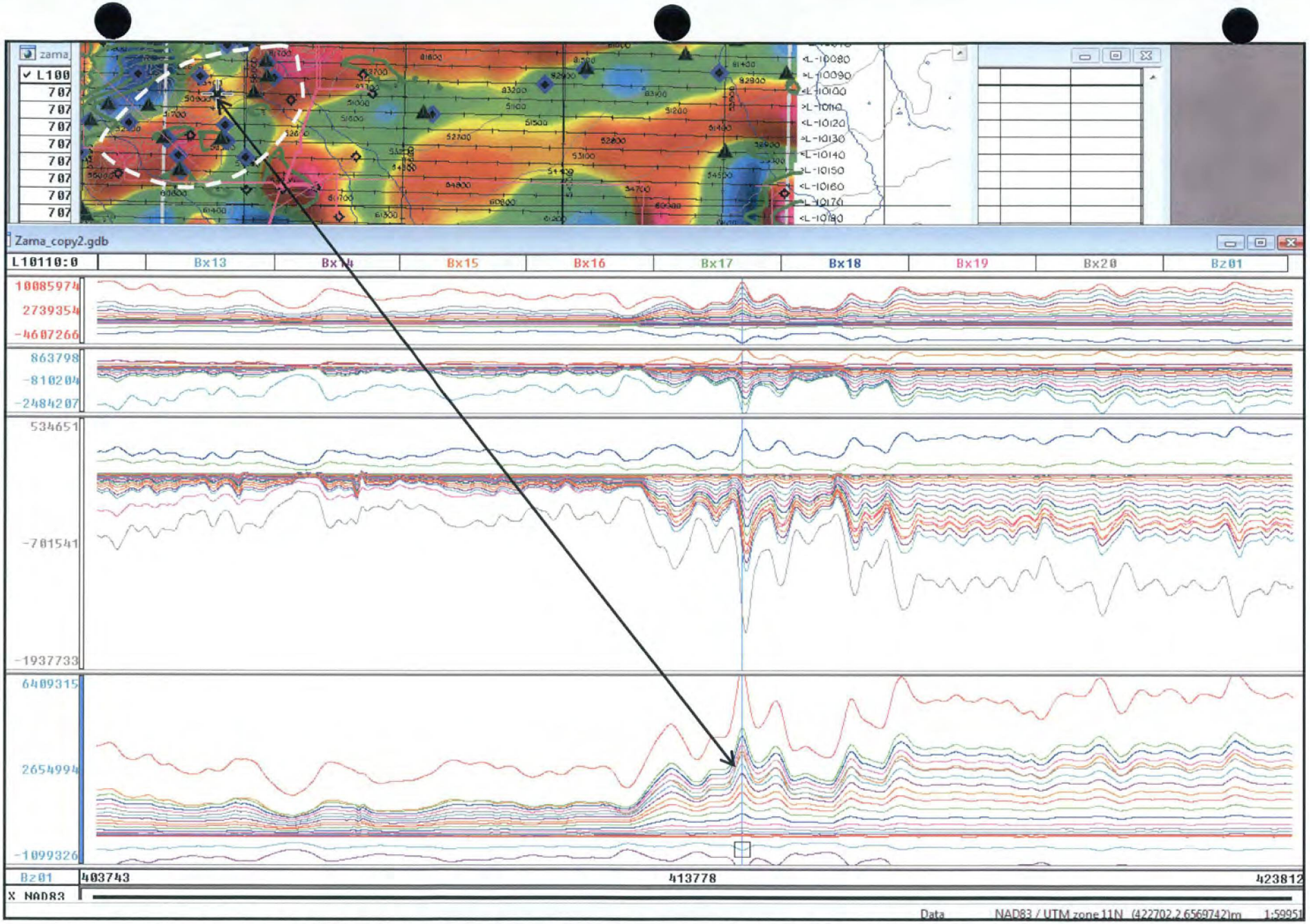


Modest EM conductor, does not appear associated with any culture. May be of some exploration interest.


Bx14
Bx15
Bx16
Bx17
Bx18
Bx19
Bx20
Bz01
Pipeline Anomaly
B_x
B_z
Area of what looks like overburden anomalies
Has the decay pattern of a bedrock conductor that may need evaluation on the ground



Three anomalies are similar in character to the pipeline anomaly makes them suspicious despite no pipelines indicated in the database. However, the anomalies are associated with a magnetic anomaly and it does increase their interest.



Similar anomalies on adjacent lines; here another example on line 10. The cluster of anomalies in the dashed white area on the map view all have similar characteristics and do not appear associated with any pipeline as available in GEOSCOUT`s™ database.

Discussion

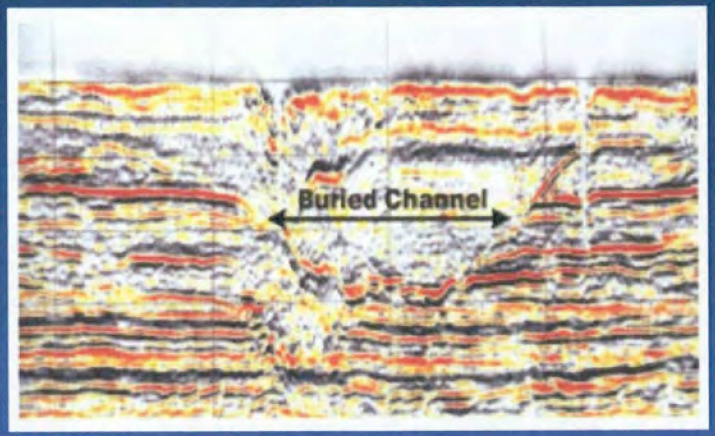
The airborne data appear to be quite good. The magnetic data map what are likely both Precambrian magnetic sources and some very shallow to surface magnetic sources. The surface sources include culture such as wells and pipelines; shallow sources include what appears to be a shallow channel. The following figures, pages 34 and 35, show images from the Alberta Geological survey of seismic data and a road cut that clearly define two shallow features that can create magnetic anomalies if part or all of the features contain material having a magnetic susceptibility. Two models on page 36 illustrate the magnetic anomalies one might expect over two kinds of channel models. Both model types are found in the Western Canada Sedimentary Basin. The upper magnetic channel model appears to be the one found in this study area.

In this study there appears to be a shallow channel striking NE-SW across the SE corner of the survey area. It has been discussed in the body of this report. It may have exploration potential for shallow gas. It will depend on a number of factors, including porosity, seal, trap and migration. It potential size has not been estimated. Also, the channel may extend in either direction off the HeliGeotem survey area. Other magnetic data does suggest this possibility. However, the magnetic data does not reveal if the resistive character of the channel also continues away from the EM survey area. The inversion study done on the EM data suggests the third layer of the channel is the most resistive. Also, some higher resistivity values continue into the surface layer which may indicate that, at least for part of the channel, the seal may not be good if one is prospecting for shallow gas. There are several wells that penetrate the channel but they do not appear to penetrate the most resistive areas of the channel. It could be useful to review the drilling records for these wells to see if any shallow information is available to evaluate the channel. It would require more regional evaluation as well. It is possible that along strike a current drainage channel cuts down through the older channel breaching any possible seal in the buried channel.

Several EM anomalies were identified as possible "bedrock" conductors that could merit ground follow-up. Modeling might provide a better evaluation of their prospectivity.

The magnetic data do not outline any major anomaly that could be interpreted in terms of a mineral prospect. There are a few very small anomalies that could be assessed by drilling or other ground geophysics. There is not a coincidence of any of these anomalies with the EM anomalies but some lie close.

Seismic line showing outline of buried channel (~1500 m wide x 150 m deep)



(Fennell et al., 2001 2nd Joint IAH and CGS Groundwater Conference)

Slide 25
November 6, 2003
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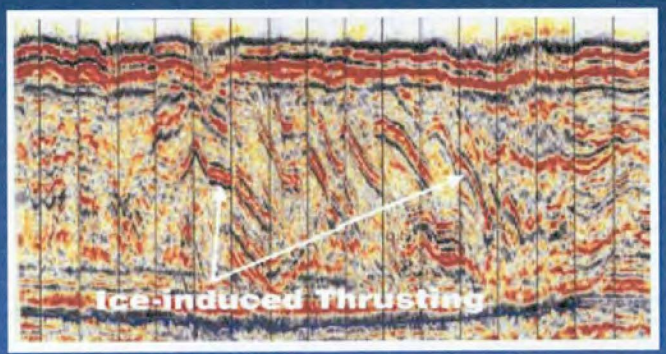
Seismic line showing imbricate thrusting from glaciotectonism



~150 m

(Fennell et al., 2001 2nd Joint IAH and CGS Groundwater Conference)

Slide 34
November 6, 2003
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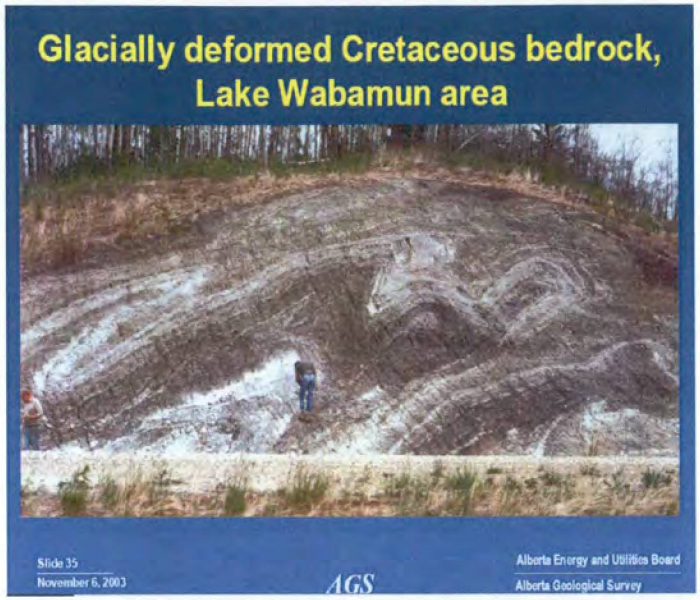
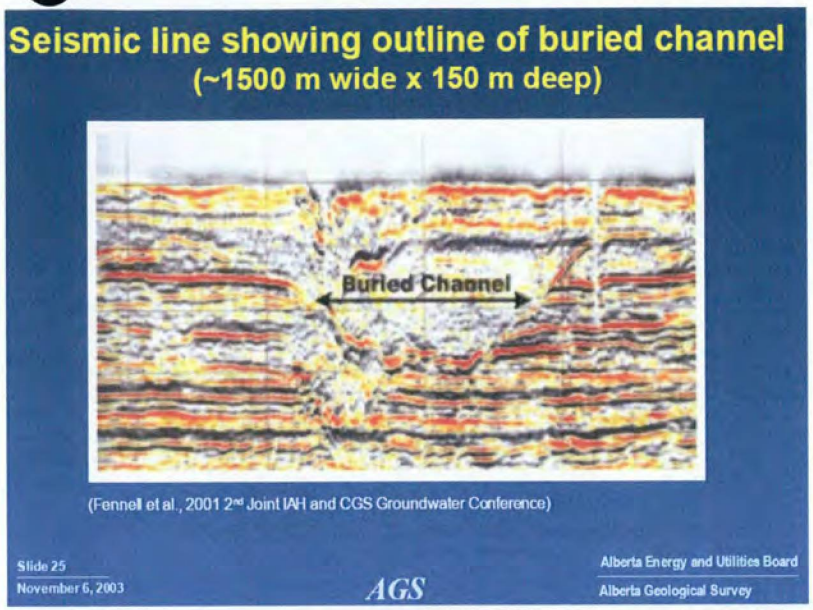
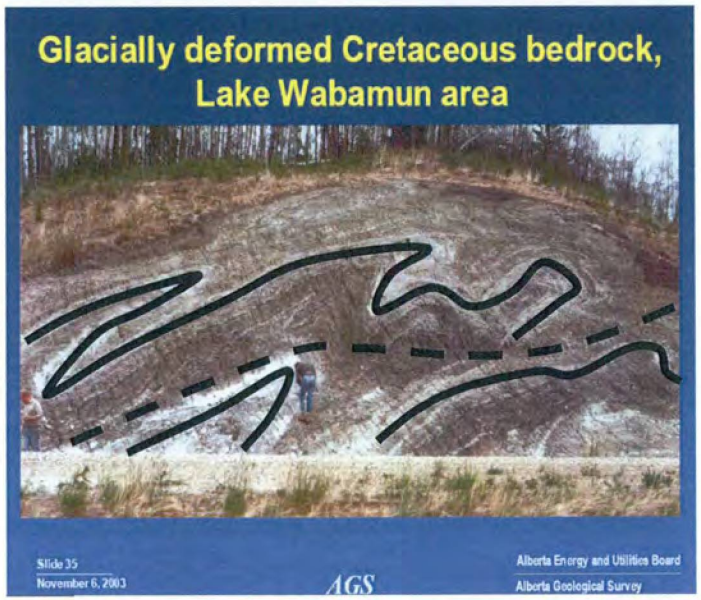
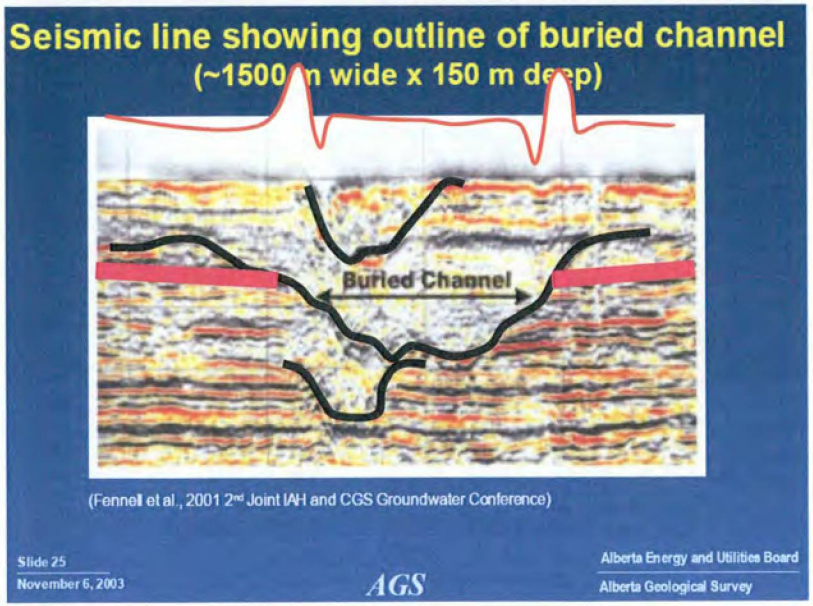
Examples of two shallow features that can affect either or both EM and magnetic data (Alberta Geological Survey). The top image of shallow seismic data shows a buried channel and the lower figure shows ice induced thrusts in the near surface layer rocks. No depth is indicated on the channel example but the these channels can be up to 400 meters deep. Interpretations of each image is shown on the next page.



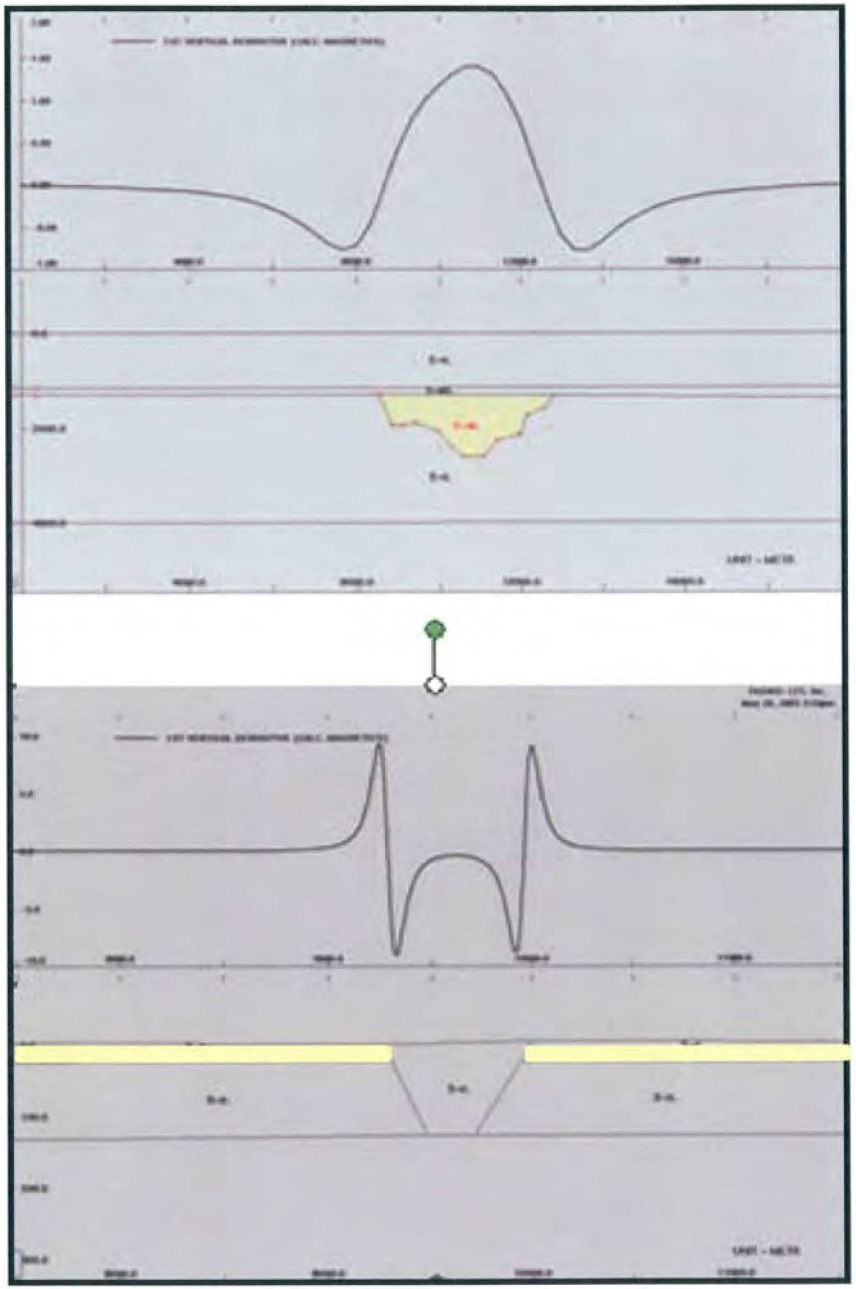






Note the ice thrusts do not outcrop. Note also the depth to the base of the thrust, about 150m.

A sketch to illustrate how a buried channel can cut a magnetic horizon and produce magnetic anomalies. A second case, and the one in this project, is the channel has magnetic material in it and produces a peak over the channel.



Two channel models: top figure is of a magnetic channel and the bottom figure is of a non-magnetic channel that cuts through a magnetic horizon (yellow color marks the magnetic unit in each model). The 1VD of the total magnetic field is shown for each one. Note how each model has a very distinct magnetic anomaly signature. Both these channel types are very common in the western Canada sedimentary basin and some areas are explored for shallow gas resources. In other areas they are mapped for water resources and coarse aggregate and to identify drilling hazards. (figure from Larch Consulting Ltd. course notes).

The channel anomaly in this study appears to be similar to the top model. The interpretation of the channel is reasonable; however, interpretation of the material in the channel is less certain. The higher resistivity along parts of the channel, as seen in the EM data, would suggest that there could be coarser material in the channel and that it may contain a more resistive substance in the porosity such as fresh water or gas.