KODIAK PETROLEUM ULC
GRANDVIEW (LITTLE CHICAGO) 2008 GRAVITY ON SEISMIC PROGRAM FINAL REPORT
Little Chicago, Northwest Territories
February 20 to February 22, 2008

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UNDER SEPARATE 11" X 17" COVER

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1. Bouguer Gravity
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INTRODUCTION

The following report describes the gravity survey conducted by *Excel Geophysics Inc.* (*Excel*) for *Kodiak Petroleum ULC* (*Kodiak*) during the winter of 2008. The area of exploration was in the Northwest Territories, Canada, on the west side of the Mackenzie River near Little Chicago NT, 145 km north of Fort Good Hope, NT. Gravity data were collected along three seismic lines, 101 to 103. The survey was conducted from February 20 to 22, 2008. Figure 1 shows the location of the program.

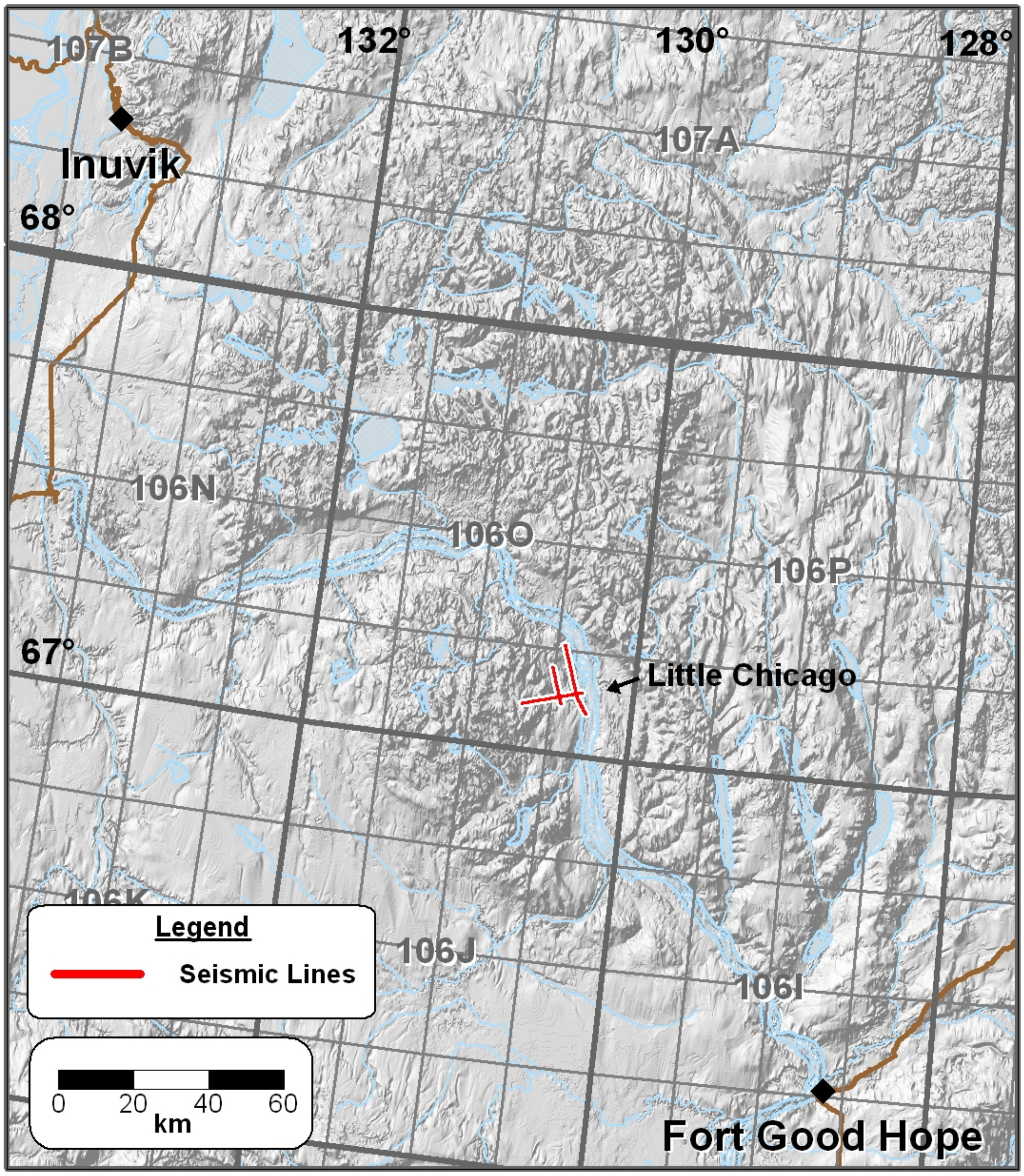

Figure 1. Little Chicago Survey Area

SAFETY

Each crewmember held current safety certifications in Emergency First Aid, WHMIS and H_2S awareness. An emergency response plan, containing contact numbers and emergency procedures, was distributed and explained to all staff members, and was posted in an accessible location. Safety meetings were held on a regular basis by the field staff to help identify any potential safety hazards.

Excel ensured that each member of the crew was equipped with appropriate outdoor wear, two-way radio, satellite phone, first-aid kit, and a safety vest. A medic was on site and monitoring radio calls for the duration of the project. *Excel* also followed safety procedures set forth by the site supervisor, Larry McEwen from *Kodiak*.

GRAVITY SURVEY PARAMETERS

The following two tables outline the main details of the gravity survey as well as the people involved with this project.

Table 1. Gravity Survey Parameters

Gravity Survey Parameters	
General Survey Locations	Little Chicago, Northwest Territories. Latitude: 67° 06.251' N Longitude: 130° 15.935' W
Survey Duration	February 20 to February 22, 2008
Gravity Station Spacing	240m
Gravity Stations Acquired	194 gravity stations
Terrain Corrections	to 40 km
Land Gravity Meters Used	LaCoste and Romberg G-232 LaCoste and Romberg G-472

Table 2. Project Personnel

Project Personnel		
***Kodiak* Project Manager**	Jim Trafford	
***Kodiak* Site Supervisor**	Larry McEwen	
Gravity Field Crew	Andrew Befus	James Beechey
Data Processor	Meghan Costello	Sheldon Kasper

GENERAL PROCEDURES

The Little Chicago Camp 2008 was located on the west side of the Mackenzie River. The survey was conducted using snowmobiles provided by *Kodiak*. *Excel*'s two-man crew operated out of the camp along with the surveyors, slashers, cat operators and drilling crew. *Excel* finished the gravity survey and was out of the camp by the time the seismic recording crew arrived on the project. The rooms in the camp were roughly 9' x 11' and housed two people. Each room had power and access to wireless internet. The camp also included an office with satellite phone, recreation room, and kitchen. Figure 2 shows the camp at Little Chicago.

Figure 2. Little Chicago Camp

Figure 3. A typical seismic line

GRAVITY SURVEY PROCEDURE

The gravity survey crew consisted of two *Excel* geophysical operators/data processors. James Beechey acted as the crew supervisor, and was on site for the duration of the project to coordinate all aspects of the operation including data quality control, environmental compliance and adherence to safety guidelines.

The area of exploration was surveyed using snowmobiles. LaCoste and Romberg gravity meters were used in this survey and were transported from station to station using backpacks. Gravity readings were taken using every twelfth receiver point (240 m) along the seismic lines. The survey elevation data for the seismic lines was provided by *MMM Geomatics* at the end of the project.

GRAVITY BASE STATIONS

The Grandview (Little Chicago) 2008 Gravity Survey was tied to a local gravity base from the Canadian Gravity Standardization Network (CGSN). This was accomplished by tying the survey to the Little Chicago Camp 2007 Control Base 3711 set up by *Excel* last year. During the 2007 survey, control base 3711 was tied to CGSN base 1992-9002, located in Normal Wells, NT, at the southeast corner inside the fire hall of the MOT multiple services building (shown in Figure 4). The main gravity base (control base 3891) used for the 2008 gravity survey was set up by *Excel* at Little Chicago Camp 2008. This base was tied to control base 3711 by taking a loop of gravity readings, first at control base 3891, then at control base 3711, and then back at control base 3891. Two gravity meters were used for the base tie. This tie in facilitated the integration of GSC regional data. Also, at the beginning and end of each day of the gravity survey, the base in and base out gravity readings were recorded at control base 3891. Table 3 shows the coordinates and gravity values for the bases used on this project.

Figure 4. CGSN Gravity Base 9002-1992 , Norman Wells, Northwest Territories

Figure 5. *Excel* Gravity Base 3711.

Table 3. Project Gravity Bases

Base Name	WGS84 Latitude	WGS84 Longitude	Observed Gravity (mGal)
CGSN 9002-1992; Norman Wells, NT	65° 16’ 42” N	126° 47’ 17” W	982229.001
Little Chicago Camp 2007 Control Base; 3711	67° 9’ 9.38697” N	130° 12’ 40.75995” W	982408.14
Little Chicago Camp 2008 Control Base; 3891	N/A	N/A	982409.84

GRAVITY DATA REDUCTION

The Lacoste and Romberg land gravity meter (G-series) is operated manually and is capable of reliable and repeatable gravity readings to an accuracy of 0.02 mGal by experienced operators. The operator must ensure that the meter is level and operated at the recommended regulated temperature during the reading.

The date, time, dial reading, inner terrain corrections and instrument height are recorded in a field notebook at each land gravity station. A gravity base is measured at the beginning and end of each day to correctly account for meter drift. Each evening the field data are entered into a portable notebook computer and corrected for sun/moon tidal effects, instrument height and instrument drift to obtain the observed gravity. Refer to

Little Chicago Observed Gravity Data 2008 (under separate cover) for the raw data, the observed gravity, and intermediate reduction values for each day.

GPS coordinates and elevation data for the survey were merged with the observed gravity for each station. See Table 4 for the formulae used to determine the intermediate corrections and Bouguer gravity values. The Bouguer gravity was calculated using variable density Bouguer and terrain corrections. The average elevation of the surveyed stations was approximately 145 m above sea level. Based on this value, an elevation datum of 145 m was chosen to minimize the effects of the Variable Density Bouguer Correction. Refer to *Little Chicago Bouguer Gravity Data 2008* (under separate cover) for the Bouguer values and all intermediate corrections.

Table 4. Gravity Correction Formulae

Gravity Corrections	Description
Latitude Correction	Standard latitude correction adopted by the International Association of Geodesy, 1967. G=978031.85 * (1+0.005278895 $\sin^2$(latitude) + 0.000023462 $\sin^4$(latitude))
Free Air Correction	(elevation (m) – datum (m)) * 0.3068 mGal/m [datum = 250m]
Bouguer Correction	(elevation (m) – datum (m))* density (g/cm^3) * (2.0 * pi * 0.006672) (note: density values vary depending on surface geology)
Terrain Corrections	Inner terrain corrections (2m to 175m) determined from field observations.
	Outer terrain corrections (175m to 40km) with variable densities computed with proprietary software.
Final Bouguer Values	Bouguer anomaly (mGal) = observed gravity – latitude correction + free air correction + Bouguer correction + terrain corrections

DATA QUALITY

Excel collected a total of 194 gravity stations. We found no reason to edit any of these stations from gridding. Overall, we have found the observed gravity values to be better than 0.01 mGal and the Bouguer gravity values to be better than 0.03 mGal. 23 repeat data points were collected during this survey, and the data from these repeats falls well within the accuracy of the gravity meters.

REFERENCES

Wheeler, J.O. and McFeely, P. (comp), 1991. Tectonic Assemblage Map of the Canadian Cordillera and adjacent parts of the United States of America. Geological Survey of Canada Map 1712A

APPENDIX A - UTM Zone 9 Coordinate System Parameters

The coordinate system used for mapping purposes is UTM Zone 9 (NAD83). Parameters for this coordinate system are shown in Table 5.

Table 5. UTM Zone 9 Mapping Parameters

Project Mapping System	
Datum	NAD 83
Ellipsoid	WGS 84
Latitude of Origin	Equator, 0^{o}
Central Meridian	129^{o} W
Grid Projection	UTM Zone 9
Scale Factor	0.9996
False Easting	500,000.0 m
False Northing	0.0 m

Ellipsoids:	WGS 84
Semi-major axis	6378137.0 m
Semi-minor axis	6356752.3 m

APPENDIX B - Data Listing

Observed Land Gravity Data

The *Observed Land Gravity Data Listing* (under separate cover) contains a listing of all land gravity data collected by the crew during the survey period. The data is presented in chronological order.

The LaCoste and Romberg G-series land gravity meter uses a zero length spring supporting a mass on a beam as is standard in all modern gravity meters. While the meter is level, a counter dial is turned to adjust the position of the beam until the force of gravity is balanced by the mechanical force of the zero length spring. A calibration table is used to convert the counter reading value to a value in mGal. While the zero length spring system is prone to drift during a day, this drift can be accurately identified and corrected by reoccupying a known gravity station one or more times during the day.

Each land gravity loop is separated by a blank row. For gravity stations collected along seismic lines, the line and shot point number is used for line and station values. The date, time, Greenwich Mean offset, and project location (latitude and longitude) are used to compute the sun/moon gravity tide correction.

The relative gravity is computed by summing all of the terms:

Relgrav = calibrated counter reading + Instrument Height (HI) correction
+ tide correction - drift

Gravity base values can be seen in Table 3.

Bouguer Gravity Data

The *Variable Density Bouguer Gravity Data Listing* (under separate cover) displays the observed gravity and coordinate data with intermediate corrections and variable density Bouguer gravity values. The table summarizes all of the collected data including the survey coordinates, elevation, and observed gravity at each station. Latitude and longitude values are given as well as UTM zone 9 coordinates in NAD 83. The elevations shown are orthometric height above mean sea level, as provided by *MMM Geomatics.* The intermediate corrections include the latitude, free air, variable density Bouguer and variable density terrain corrections. The variable density Bouguer gravity values were computed using density values determined from surface geology which range from 2.40 g/cm^3 to 2.77 g/cm^3. Terrain corrections were calculated for all stations using the most accurate digital elevation data available in the area. For this gravity survey, the digital elevation grid was created by integrating Canadian Digital Elevation Data, Level 1 (CDED1) and National Topographic Data Base (NTDB) data from the Centre for Topographic Information (CTI) at Natural Resources Canada.