BRITISH COLUMBIA
Ministry of Energy and Mines
Oil and Gas Division
Resource Development and
Geoscience Branch

Surficial Geology Studies in Northeast British Columbia: Quaternary Mapping and Diamonds

Victor M. Levson, Travis Ferbey, Ben Kerr, Tim Johnsen, Jaqueline Blackwell and Sheila Jonnes

Shallow Gas & Diamond Opportunities in Northern Alberta and British Columbia 2003 - 2007

THE OIL AND GAS DIVISION'S RESOURCE DEVELOPMENT AND GEOSCIENCE BRANCH GOALS:

- Identify, stimulate, and facilitate emerging oil and gas resource development opportunities in the Province
- Provide energy related geoscience research in the fields of petroleum and Quaternary geology
- Provide project management expertise to achieve economically, environmentally, and socially sound development of oil and gas resources

PROGRAM GOALS

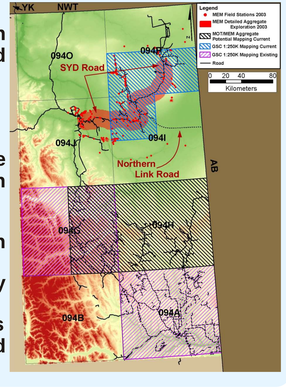
1. Identify aggregate resources in areas of new oil and gas road development:

- Sierra-Yoyo-Desan Road area
- Industry road proposal areas
- Northern Link Road area

2. Conduct reconnaissance evaluation of diamond potential in NE BC

3. Investigate gas potential in Quaternary/Tertiary paleovalleys

- complete bedrock topography maps for 94I and P
- construct geologic cross sections across identified paleochannels



AGGREGATE ECONOMICS

- In 2001, SYD Resource Road generated $358 million in land sales, etc; ~2 million m^3 of aggregate needed for upgrade
- Thurber (2000) suggested NE BC reserves largely depleted
- Lowering aggregate costs just $1/$m^3$ = $2 million savings to BC

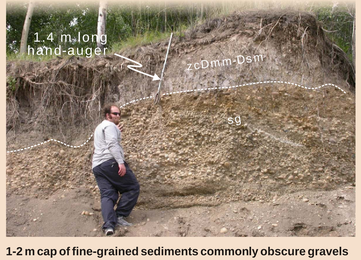
ECONOMIC IMPORTANCE OF EARLY PLIESTOCENE AND LATE TERTIARY PALEOCHANNELS

- Reservoirs for natural gas at shallow depths
- Aquifers – agriculture, drinking water, steam injection, CBM discharge sites, contamination issues
- High quality aggregate

AGGREGATE MAPPING CHALLENGES

- subdued topography, extensive muskeg, general scarcity of glaciofluvial landforms, vegetation not always a good indicator of subsurface material

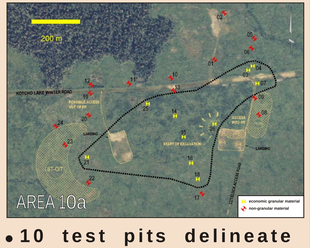
Relatively rare example of esker; note lack of pine and aspen (i.e. dry-site species).



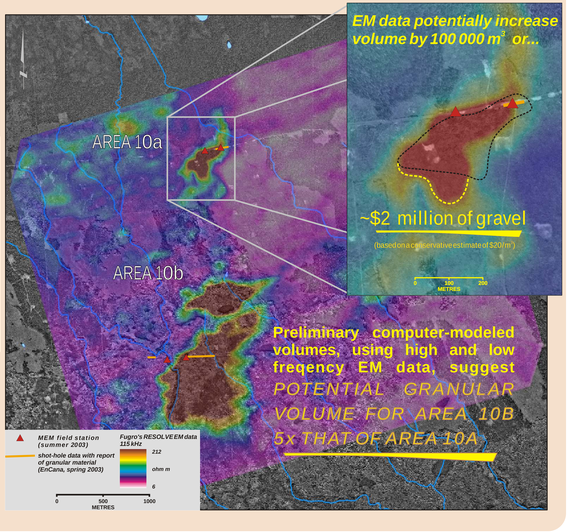
1-2 m cap of fine-grained sediments commonly obscure gravels

MAPPING BURIED AGGREGATES USING FIELD, SEISMIC SHOT-HOLE, AND HIGH RESOLUTION AIRBORNE EM DATA

- EnCana seismic shot-hole data suggested granular material in two locations (Area 10a and 10b), 1-2 m below silts/clays
- In airphotos area is flat and featureless



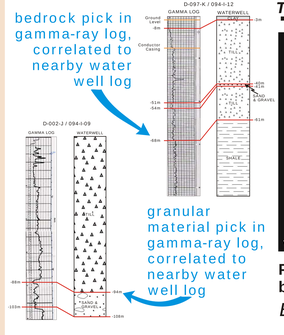
- 10 test pits delineate preliminary gravel volume of 400 000 m^3 in Area 10a (figure above)
- Fall 2003, high resolution, airborne EM (Fugro's RESOLVE) flown over Area 10a and 10b (figure to right)



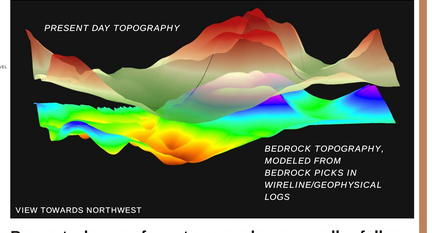
MAPPING BEDROCK TOPOGRAPHY AND PALEOCHANNELS - Quaternary gas targets

- Reservoir for Quaternary-Tertiary gas, <300 m below surface (1 field in Alberta has yielded 4 bcf):
  - At present, no east-draining rivers in BC, north of Peace River
  - Possible paleochannels in 94I, H and/or P
- 825 oil/gas wireline/geophysical logs used to map surface of Late Cretaceous shales and sandstones
- Lithologic descriptions from water well logs used to verify interpretations

WIRELINE/GEOPHYSICAL AND WATERWELL LOGS



TOPOGRAPHY - 94I and P



Present day surface topography generally follows bedrock topography.

Bedrock low 94I/NE... paleochannel?

DIAMOND POTENTIAL OF NE BC

- Sedimentary cover in NE BC is underlain by Precambrian basement rocks (possible Slave Craton equivalents?); diamond potential largely unknown
- Reconnaissance sampling of glaciofluvial systems has been conducted to evaluate kimberlite potential
- Bulk samples were collected and concentrates were produced using heavy liquids
- Preliminary results show that kimberlite indicator minerals are present at a few sites; microprobe analyses are currently in progress

CONCLUSIONS

- Identification of 4 main aggregate sites with a total resource of ~5 million m^3 gravel
- Discovery of buried (blind) gravels has been successful using a variety of data, e.g. wireline/geophysical, waterwell, seismic shot-hole, rathole, remote sensing, high resolution airborne EM and aeromag data.
- Kimberlite indicator minerals have been detected at a number of sites in NE BC. Microprobe analyses are in progress to confirm a kimberlite source
- There are good shallow gas targets in Quaternary paleochannels in NE BC. Prospective areas occur in lowlands east of the Rockies where Tertiary drainages were disrupted by Quaternary glaciations.

ACKNOWLEDGMENTS

Encana Corporation is gratefuly acknowledged for the use of their seismic shot-hole data.