

A DIGITAL GEOSCIENCE ATLAS ON CD-ROM OF THE BUCHANS – ROBERT'S ARM BELT

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ABSTRACT

As part of a multidisciplinary project to encourage further mineral exploration in the Buchans – Robert's Arm volcanic belt, central Newfoundland, a systematic compilation of geoscientific data has been undertaken. The task of compiling diverse types of information (topographical, geological, geochemical, geophysical) from a variety of sources and at differing levels of detail is feasible only using Geographic Information Systems (GIS) and related techniques.

From a thorough review of relevant geofiles archived with the Newfoundland Geological Survey, a series of digital indexes was created of the data available for the belt. Geoscientific data from new surveys under this multidisciplinary project, earlier government surveys and selected non-confidential assessment files were captured digitally, and systematically documented.

The indexes, data and documentation have been designed around the desk-top mapping system ArcView™ (version 1.0), and together comprise a digital atlas. The self-contained atlas on CD-ROM provides a comprehensive collection of geoscience information for the belt that can be manipulated and interrogated incisively with only limited computer skills, providing a comprehensive framework to give context to new data acquired in further exploration work. The data can also be imported to true GIS for more sophisticated modelling and interpretation.

INTRODUCTION

The Buchans – Robert's Arm belt contains a sequence of volcanic rocks that extends from Buchans in central Newfoundland to Pilley's Island in Notre Dame Bay (Plate 1). The belt is highly prospective for high-grade polymetallic base-metal deposits, and has been the locus of a great deal of exploration and geoscientific work by mineral exploration companies and the federal and provincial geological surveys. The results of this work are archived as hard copy and microfiche in the geofiles of the Newfoundland Geological Survey. In addition, new data have been collected under field projects in 1994 and 1995 that are also part of the multidisciplinary project to encourage further mineral exploration along the belt.

Information from these sources for the belt was indexed and a systematic compilation of geoscientific data has been undertaken. The task of compiling diverse types of infor-

mation (topographical, geological, geochemical, geophysical) from a variety of sources and at differing levels of detail is feasible only using Geographic Information Systems (GIS) and related techniques.

The indexes, data and documentation have been designed in digital format around the desk-top mapping system ArcView™ (version 1.0), and together comprise a digital atlas. The organized digital databases can be manipulated and interpreted systematically using GIS, providing a comprehensive framework to give context to new data acquired in further exploration work. As a self-contained atlas on CD-ROM, the compilation is easy to use and accessible to those without access to GIS.

The digital atlas covers NTS sheets 2E/5, 2E/12, 12H/1, 12H/8, 12A/15 and 12A/16. In addition to the viewing software ArcView™ version 1.0 and its documentation (which have been made available by Environmental Systems

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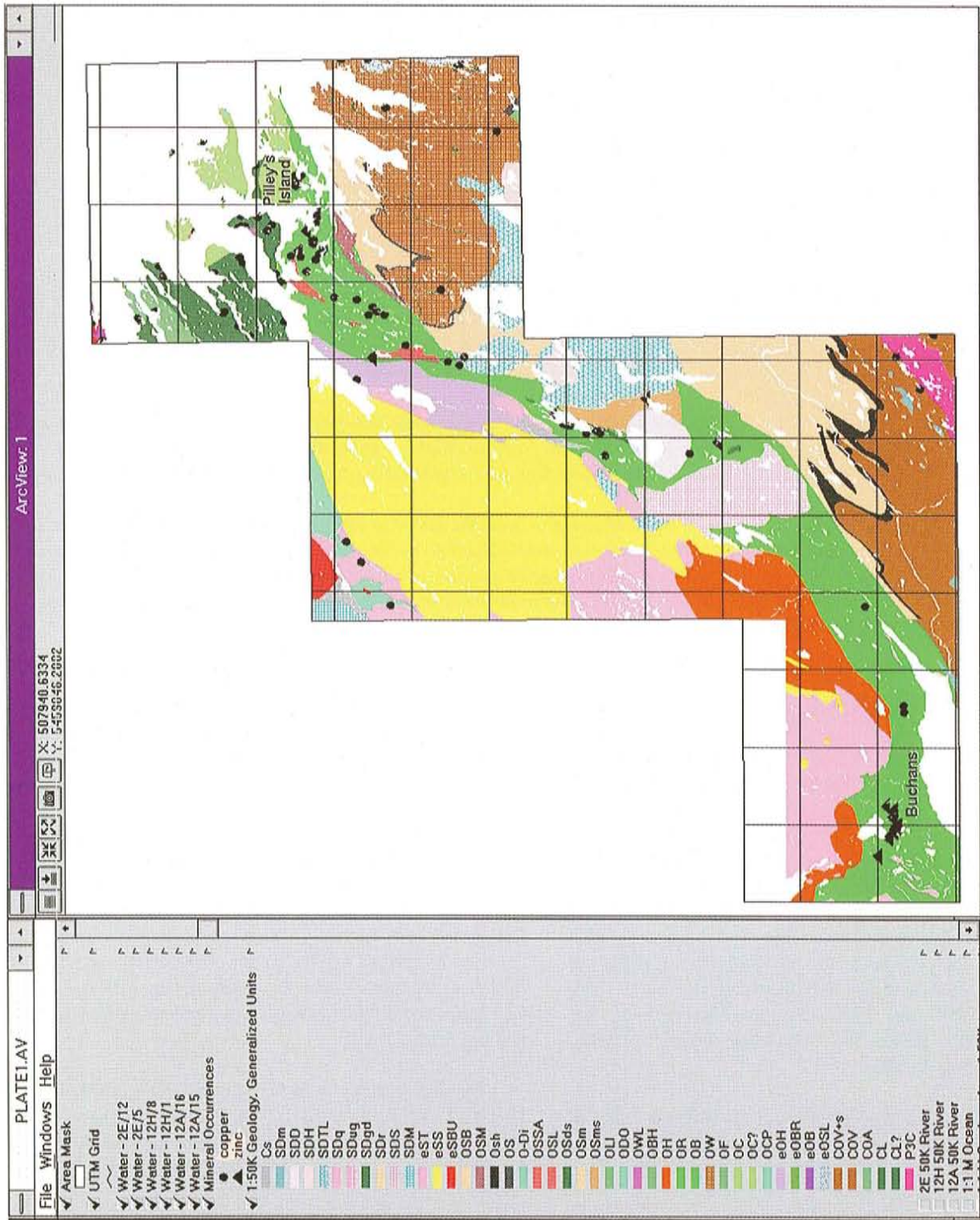


Plate 1. Atlas display of the Buchans - Robert's Arm project area, illustrating its geological elements and significant copper and zinc deposits. This geology map uses the highest (or most general) stratigraphic division (usually group), the variable g-dom table (see Table 3 and Colman-Sadd et al., this volume). The grid is 10 by 10 km.

Research Institute Incorporated (1992) at no charge), the atlas has three components:

- 1) the geoscientific data chosen for inclusion in digital format;
- 2) indexes to assessment files, government surveys, diamond drilling and airborne geophysical surveys available for the belt; and
- 3) documentation for the digital data and indexes.

Both the data and indexes are prepared in ways that facilitate their manipulation and interpretation with ArcView™. The documentation for the data is in the form of Windows™ help files that can be linked with one another and with the documentation supplied with the ArcView™ software.

In the digital atlas, information is linked to one of three classes of spatial entity, i.e., points, lines and polygons. An ArcView™ coverage comprises a set of one of these classes of spatial entity that is geographically registered to a simple database file of information. In a point coverage, for example, each point has a corresponding entry in the database file of information about that point (Plate 2). Individual coverages can be overlaid and displayed at any scale as long as they are co-registered.

In ArcView™, the database can be used to select which points (or lines, or polygons) are displayed, or the screen display can be used to select records from the database from their spatial location. ArcView™ provides a variety of ways to display points, lines and polygons through symbol, line-type and polygon-fill-type libraries and colour palettes. Polygon coverages can be displayed both as polygons or as lines (outlines). Raster images can also be displayed as backdrops to point, line and polygon coverages.

Although individual databases cannot be linked directly through ArcView™, forethought in their design can permit the user to cross-reference information within them. In this atlas, attention has been paid to creating links that are likely to be of general use.

The data are contained within four main directories, the indexes in a fifth and the help files in a sixth, as illustrated in Figure 1. The data are further organized in logical, hierarchical structures within these main directories, which are described and illustrated below.

DATA

TOPOGRAPHIC DATA

The primary directory contains 3 major sub-directories; 50K, 1MA and GRID (Figure 2).

DIRECTORY	CONTENTS
+---TOPO	Topographic information
+---GEOLOGY	Geological information
+---GEOCHEM	Geochemical data
+---GEOPHYS	Geophysical survey data
+---INDEXES	Bibliographic and drillhole indexes
\---HELP	Documentation help files

Figure 1. Primary directory structure of the Buchans – Robert's Arm Digital Atlas.

DIRECTORIES	TYPE OF COVERAGE
TOPO	
+---50K	
+---LAKES	Polygon
+---STREAMS	Line
\---ROADS	Line
+---1M	
+---WATER	Polygon
\---GRID	
+---UTM_NFLD	Line
+---NTS_NFLD	Line
\---MASK	Polygon

Figure 2. Sub-directories in the primary directory TOPO, Buchans – Robert's Arm Digital Atlas.

Digital topographic data at two levels of detail are included (Table 1); a general one from 1:1 000 000-scale topographic maps for the whole island (sub-directory 1M), and more detailed information from 1:50 000-scale NTS maps (sub-directory 50K). The digital data were obtained from the Surveys and Mapping Division, Newfoundland Department of Natural Resources. The type of coverage for each layer is listed in Figure 2.

The directory GRID contains computed Universal Transverse Mercator (Zone 21) and NTS grids in sub-directories UTM_NFLD and NTS_NFLD, respectively. The UTM grid is useful in providing a scale for screen images. Sub-directory MASK contains a polygon to frame the project area.

GEOLOGICAL DATA

The geological information in the compilation is organized into three sub-directories MODS, BEDROCK and SURFICAL (Figure 3), containing, respectively, mineral occurrence data, bedrock geology and surficial geology.

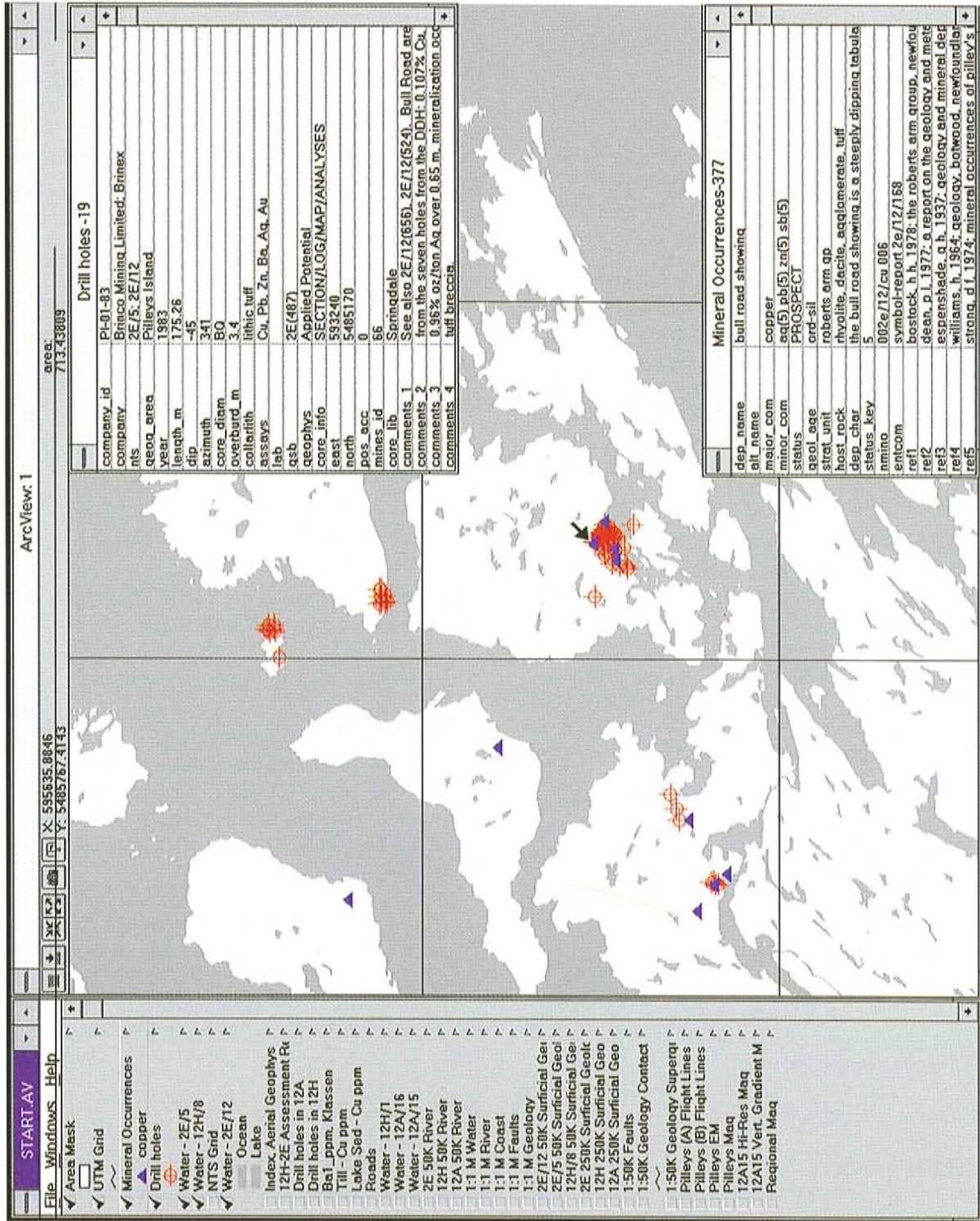


Plate 2. Location of diamond-drilling sites and mineral occurrences in part of the Robert's Arm area. Windows contain examples of information from the drill and MODS databases; the grid is 10 by 10 km.

Table 1. Key to variables in the topographic data layers, Buchans – Robert's Arm Digital Atlas

COVERAGE	VARIABLE	DESCRIPTION
IM\WATER	Water_type	OCEAN (salt) LAKE (fresh)
50K\ROADS	Length	Length (m) of road segment
	Road_code	National Topographic database codes, (NTDB explicit codes) 999 less than 2 lanes, all season, undivided, loose 1003 more than 2 lanes, all season, undivided, hard 1004 cart track 1005 dry weather, undivided, loose 1006 undivided, unclassified 1011 street, hard 1012 street, loose 1016 2 lanes, all season, undivided, hard 1022 2 lanes or more, all season, undivided, loose
	Road_type	PAVED, GRAVEL, CART TRACK
50K\LAKES	Area	area (m ²) of waterbody or digitized polygon thereof
	Perimeter	perimeter (m) of waterbody or digitized polygon thereof
	Water_type	1 - Ocean (salt) 2 - Lake (fresh) 3 - Island
50K\STREAMS	Length	Length (m) of stream segment

DIRECTORIES	TYPE OF COVERAGE	STRUCTURE and FIELD95. The first two coverages comprise a composite geological map, prepared from 10 existing maps of the area (listed in Colman-Sadd <i>et al.</i> , 1995, and illustrated in Plate 3), using methods developed by Colman-Sadd <i>et al.</i> (<i>this volume</i>). In ArcView™, the geology of the area can be displayed at various levels of stratigraphic detail within a consistent labelling and legend structure, or as lithofacies maps based on the legend of the 1:1 000 000-scale geological map of Newfoundland (Colman-Sadd <i>et al.</i> , 1990). The geological units displayed in Plate 1 are using the most generalized level of subdivision, whereas Plate 4 illustrates the most detailed level of subdivision possible. Colours for individual units in Plate 1 were carefully selected to conform to a lithostratigraphic colour code, whereas in Plate 4 the colours for units were arbitrarily assigned by ArcView™. These colours can be changed by the user.
GEOLOGY		
+---MODS	Point	
+---BEDROCK		
+---ROCKUNIT	Polygon	
+---FAULTS	Line	
+---STRUCTURE	Point	
\---FIELD95	Point	
+---SURFICAL		
+---250K	Polygon	
+---50K	Polygon	
+---STRIAE	Point	

Figure 3. Sub-directories in the primary directory GEOLOGY, Buchans – Robert's Arm Digital Atlas.

Mineral occurrence data were extracted from the MODS/PC database (Stapleton and Parsons, 1993), simplified, updated and reformatted for inclusion as a point coverage for display in ArcView™. The variables in this coverage are listed with brief descriptions in Table 2, and an example of their use is illustrated in Plate 2.

Bedrock geology information is contained in the sub-directory BEDROCK as four coverages: ROCKUNIT, FAULTS

Individual units or sets of units can be selected for display, allowing the map to be customized to emphasize a particular theme, e.g., Plate 5. Table 3 contains the list of variables for the geological polygons. Complete legend information and a description of the compilation method is contained in Windows™ help files that can be opened with the ArcView™ display.

The sub-directories FIELD95 and STRUCTURE contain general field observations and structural measurements,

Table 2. Key to variables in the mineral occurrence dataset, Buchans – Robert's Arm Digital Atlas

VARIABLE	DESCRIPTION
Dep_name	Usual name for occurrence
Alt_name	Alternative name for occurrence
Major_com	Major economic commodity in occurrence
Minor_com	Secondary commodities in occurrence
Status	Development status
Geology	Bedrock geology (see Table 3 for coding scheme)
Geol_age	Age of deposit
Strat_unit	Stratigraphic unit of host rocks
Host_rock	Lithology of host rocks
Dep_char	Brief description of occurrence (including assays where available)
Status_key	Development status as numerical code 1 - current producer 2 - developed prospect 3 - past producer (dormant) 4 - past producer (exhausted) 5 - prospect 6 - showing 7 - indication
MODS_ID	MODS/PC unique ID (also National Mineral Inventory Number)
Entcom	Information on nature and source of occurrence location
Ref1	Information sources; First reference
Ref2	Information sources; Second reference
Ref3	Information sources; Third reference
Ref4	Information sources; Fourth reference
Ref5	Information sources; Fifth reference

respectively, from geological mapping during the 1995 season (Kerr, *this volume*). These point data represent basic outcrop descriptions, including rock type, colour, bedding, grain size, alteration, mineralization, oxidation and details of any samples collected. Where applicable, the data also include structural observations such as strike/dip, foliations and orientations of elements such as dykes, veins and faults. Due to the nature of mapping and local geology, many geographic locations are represented by multiple records, representing different rock types and (in some cases) multiple structural measurements. Where appropriate, the field data are linked to an associated lithogeochemical database (GEOCHEM\ROCK\ROCK95) by geochemical sample numbers.

Although ArcView™ cannot display all of this geological data in standard map-type format, it represents valuable reference material for users in specific areas. Field names were selected to be as intuitive as possible, and a complete listing of fields and their contents is contained as an associated "help file". Users should note that these data do not represent *every* outcrop visited by the field crew, but only those that were entered as "field stations". (At this scale of mapping, it is clearly impractical to designate every single outcrop encountered as a field station.) Also, some descriptive and interpretative information that is not readily amenable to

a database format has been omitted, although it may be added in a future release. A polygon-type database was not created from this work, as the distribution of lithological units is essentially the same as that shown by Bostock (1988), which has been incorporated into the "composite" geology coverage. However, the interpretation of unit groupings and relationships differs from those outlined previously (see Kerr, *this volume*, for details).

Surficial Geology. The sub-directory SURFICAL contains this information at two levels of detail (Plate 6): a general coverage in sub-directory 250K taken from the 1:250 000-scale digital compilations by Liverman and Taylor (1994a,b and c) and, in sub-directory 50K, a more detailed coverage of the northern half of the belt digitized from 1:50 000-scale mapping in NTS map areas 12H/8 (Liverman *et al.*, 1991), and 2E/5 and 2E/12 (Liverman *et al.*, 1995b).

The general coverage contains only a simple legend for the dominant surficial material in each polygon (e.g., till veneer, bog, alluvium etc.). The database for the more detailed coverage contains, in addition to the simple descriptor of the dominant surficial material for each polygon (dom_class), a more complete descriptor (full_clasts) that includes information on subordinate landform classes (Table

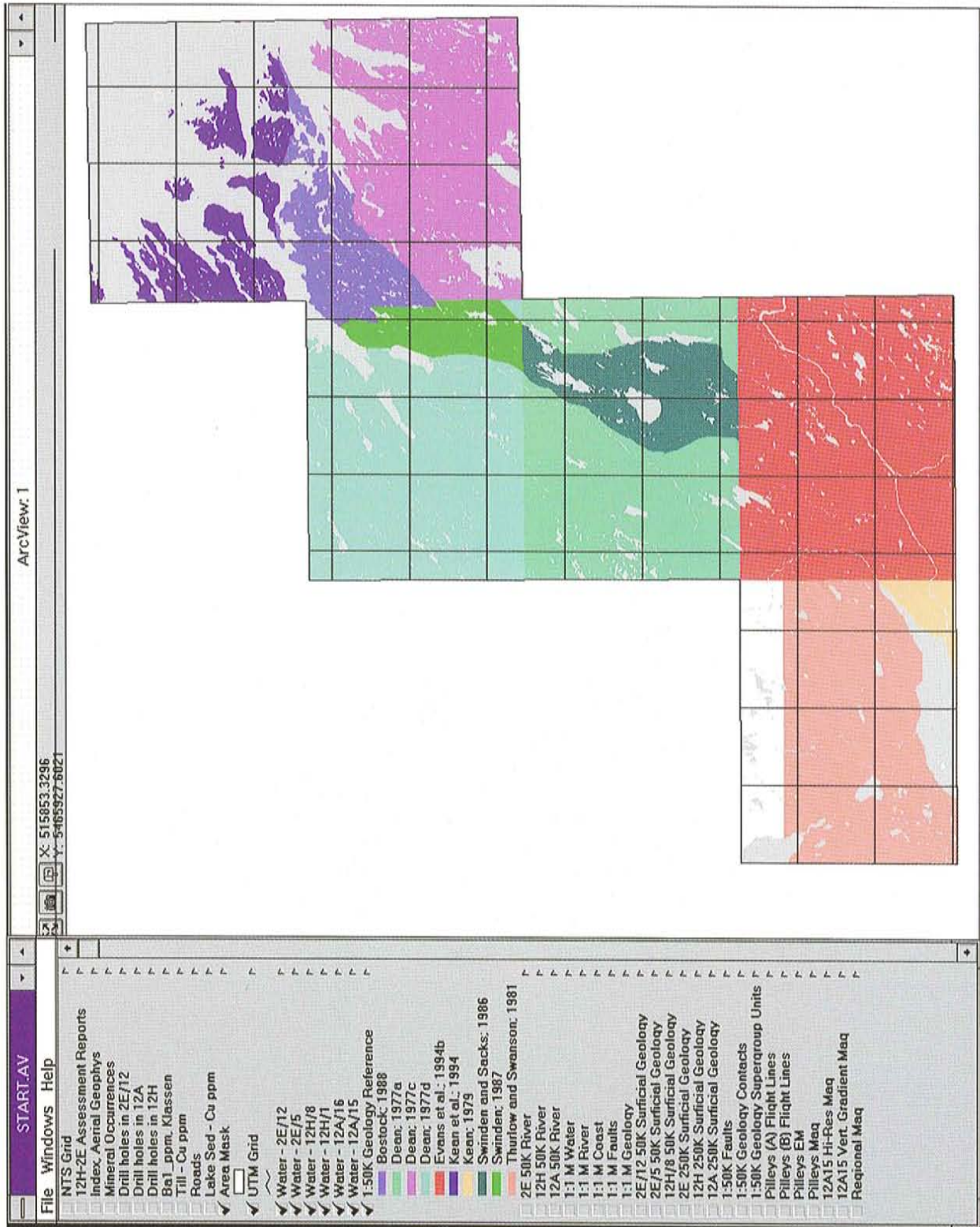


Plate 3. Sources of information for the composite geological map in the digital atlas of the Buchans - Robert's Arm area; the grid is 10 by 10 km.

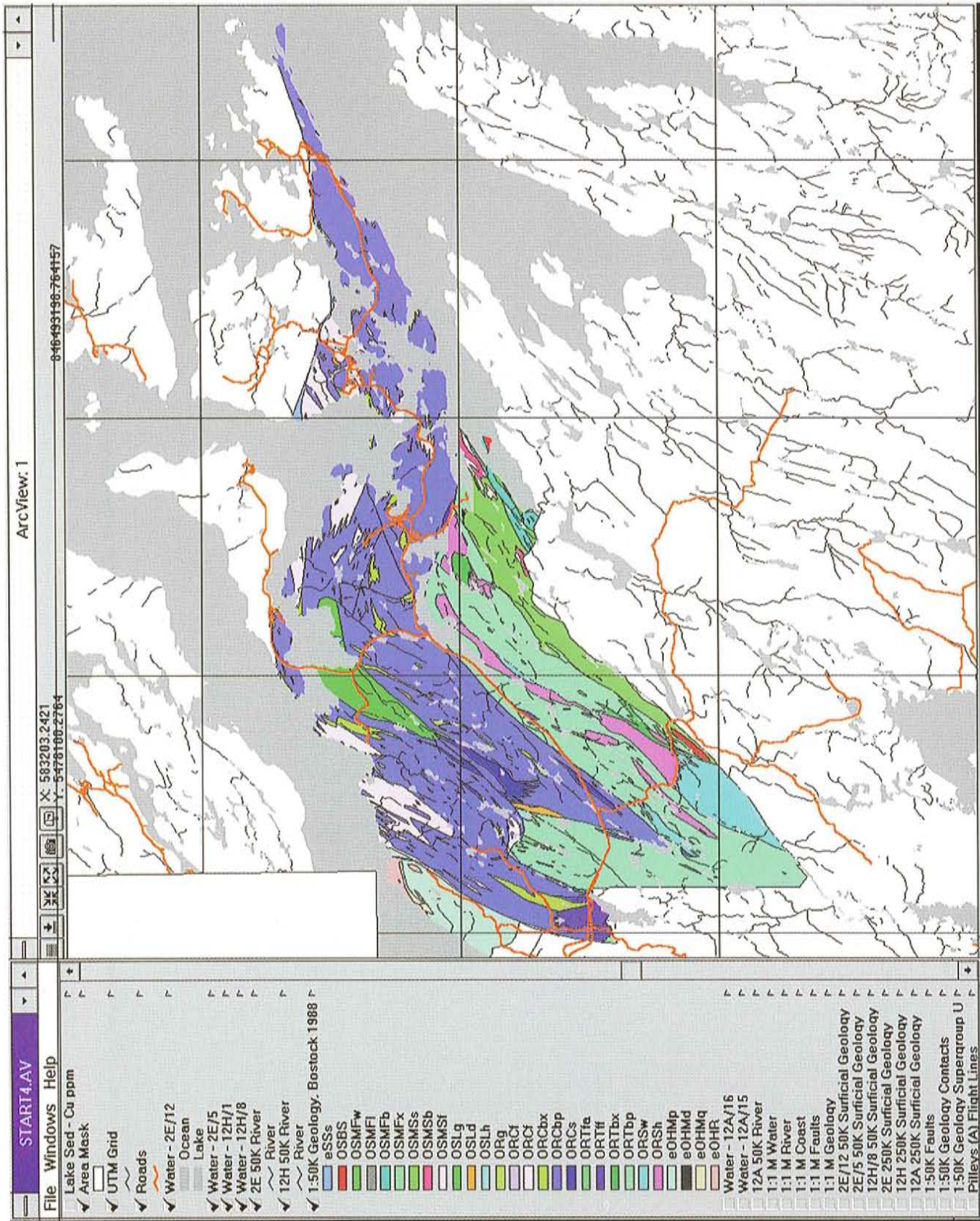


Plate 4. Geology of the Robert's Arm Group showing full detail (from Bostock, 1988). Also displayed are the drainage (waterbodies and streams) and roads, from 1:50 000-scale topographic maps, and a 10 by 10 km grid for scale.

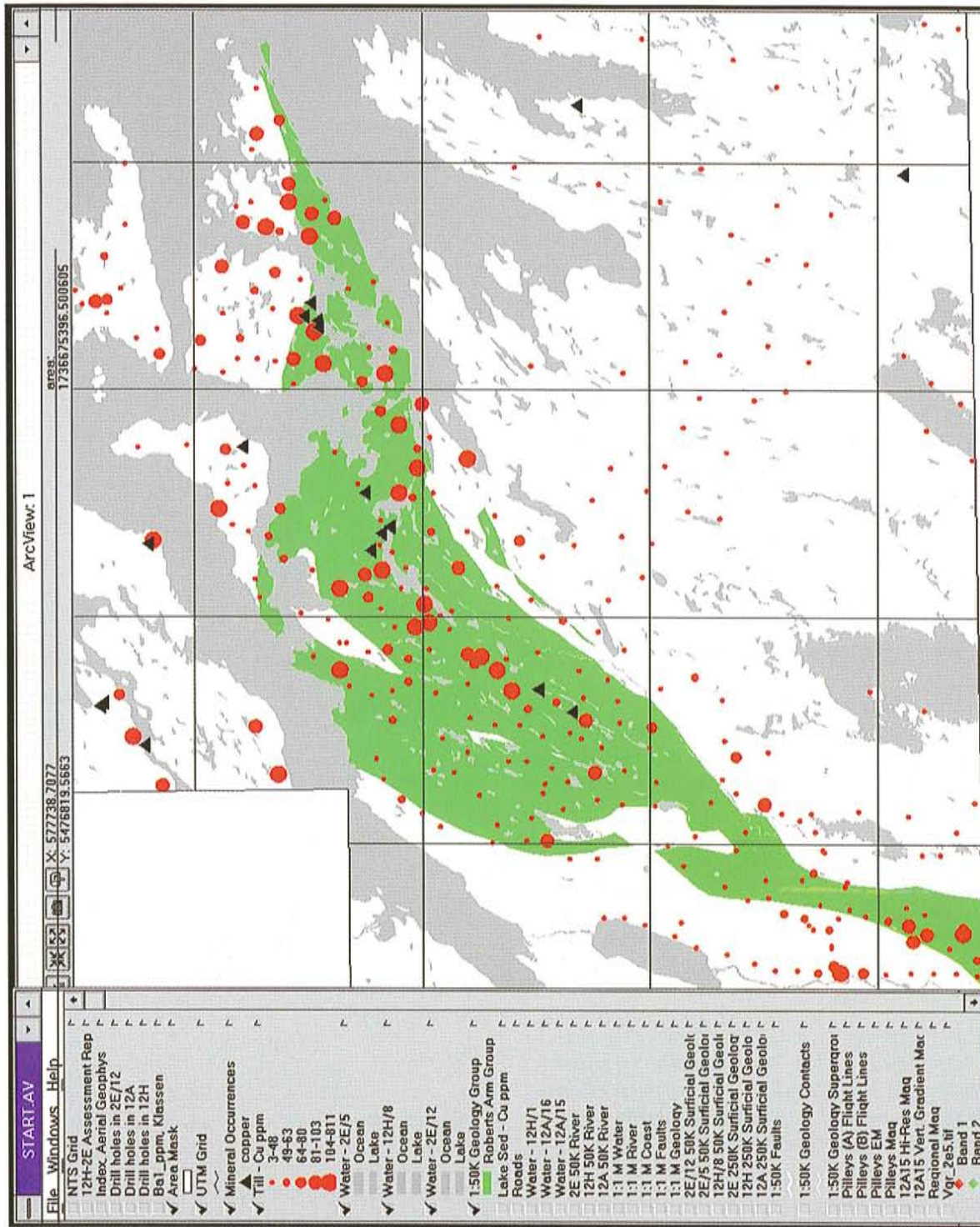


Plate 5. Copper in $< 63 \mu\text{m}$ fraction of till in the Robert's Arm – Gullbridge area in relation to the Roberts Arm Group (in green), and significant copper deposits (from MODS/PC). Till data from Klassen (1994) have been adjusted to be directly comparable with those from Liverman et al. (1995a); the grid is 10 by 10 km.

Table 3. Variables included in the bedrock geology database for the "composite" geology map of the Buchans - Robert's Arm belt; full details are contained in a help file in the atlas

1. g_unitname	Unit name
2. g_domLabl	Label of dominant unit (top rank)
3. g_polyLabl	Full polygon label (top rank)
4. g_agerange	Age range of unit (top rank)
5. g_agebase	Age of base of unit (top rank)
6. g_agetop	Age of top of unit (top rank)
7. d_domLabl	Label of dominant unit
8. d_polyLabl	Full polygon label
9. d_rocktype	Summary rock type
10. d_agerange	Age range of unit
11. d_agebase	Age of base of unit
12. d_agetop	Age of top of unit
13. Supergroup	Supergroup
14. Group	Group
15. Formation	Formation
16. Member	Member
17. Sub1-unit	Sub1-unit
18. Sub2-unit	Sub2-unit
19. Sub3-unit	Sub3-unit
20. M_labl	1:1 million label (based on Colman-Sadd <i>et al.</i> , 1990)
21. M-zonesubz	Zone +/- Subzone
22. Map_ID	Map ID
23. Map_ref	Map reference
24. g_ordnum	Dom. unit ordering number (top rank)
25. d_ordnum	Dom. unit ordering number
26. m_ordnum	1:1 million order number
27. mz_ordnum	Tectonic Zone ordering number

to determine the distribution of all surficial units where marine sediments may occur as dominant or subordinate sediment types (Plate 7), which may have a bearing on the interpretation of the geochemical data from soil samples collected within them.

Ice-flow information for the area has been taken into ArcView™ from the striation database for Newfoundland (Taylor *et al.*, 1994). The fields in the striation database are listed in Table 5.

GEOCHEMICAL DATA

Geochemical mapping is available for the area based on two media; lake sediment and till. These data are included in the sub-directories LAKESEDS and TILL respectively. There is also a considerable body of lithochemical data for the volcanic rocks in the belt, and these are in the sub-directory ROCK.

Lake sediment data for the area have been windowed from the digital geochemical atlas of Newfoundland (Davenport *et al.*, 1995). The variables in the database associated with this point coverage are listed in Table 6.

DIRECTORIES	TYPE OF COVERAGE
+---GEOCHEM	
+---LAKESEDS	Point
+---TILL	
	+---KLASSEN Point
	+---LIVERMAN Point
	\---COMBINED Point
\---ROCK	Point
	+---VOLCANO Point
	\---ROCK95 Point

Figure 4. Sub-directories in the primary directory GEOCHEM, Buchans – Robert's Arm Digital Atlas.

Till geochemical data are from two sources. Klassen (1994) carried out surveys in NTS map areas 12H/1, 12A/15 and 12A/16, and these results are in the sub-directory KLASSEN. The variables in this geochemical database are listed and described in Tables 7 and 8.

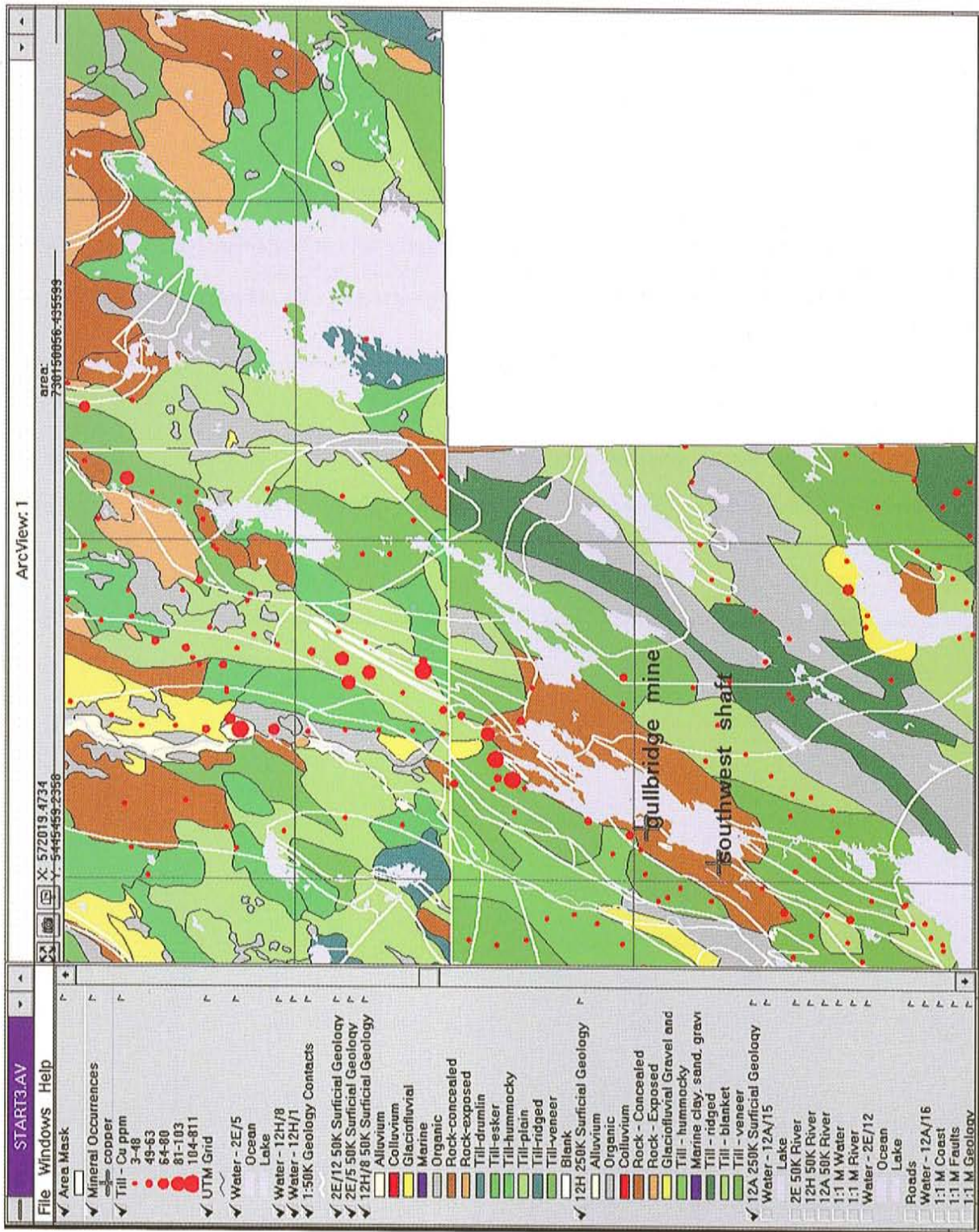


Plate 6. Major units of surficial deposits from 1:50 000-scale mapping, upper part, (Liverman et al., 1991; 1995a and b) and the 1:250 000-scale compilation of Liverman and Taylor (1994a, b and c), lower part. Also displayed are the distribution of Cu in till as a proportional-size symbol plot (data from Klassen, 1994; Liverman et al., 1995a and b), significant deposits of copper (from MODS/PC), bedrock geology in outline (white), waterbodies from 1:50 000-scale topographic maps, and a 10 by 10 km UTM grid for scale.

Table 4. Key to landform classification variables in the dataset for the 1:50 000-scale surficial geology coverage, Buchans – Robert's Arm Digital Atlas

LANDFORM CLASSIFICATION

Each mapped polygon is assigned a landform classification consisting of up to three genetic categories and modifiers that designate the types of deposits within it. Each category within a landform classification is listed in order of dominance, and is separated from the other categories by a slash (e.g., Tv/R). Categories occupying less than 5 percent of a polygon are ignored.

Three variations of the landform classification are used.

1. A landform descriptor containing three genetic categories, each separated by a single slash (e.g., O/Tv/R), indicates relative percentages of these categories to be 60-85/15-35/5-15, respectively.
2. Landform descriptors containing two genetic categories separated by a double slash or single slash (e.g., Tv//R, or Tv/R) indicate relative percentages of these categories to be 85-95//5-15 or 60-85/15-40, respectively.
3. A landform descriptor containing two genetic categories separated by a hyphen (e.g., Tv-R), indicates approximately equal percentages of each.

LANDFORM CLASSIFICATION MATRIX

Genetic Category - Depositional Environment

	Alluvial	Colluvial	Aeolian	Glacio-fluvial	Lacu-strine	Marine	Glacial	Organic	Rock	Anthropo-genic
	(A)	(C)	(E)	(G)	(L)	(M)	(T)	(O)	(R)	(X)
Modifier - Morphology										
apron (a)		Ca								
concealed vegetation (c)		Cc							Rc	
drumlinoid (d)							Td			
eroded and dissected (e)		Ce	Ee	Ge	Le	Me	Te			
fan (f)		Cf		Gf						
hummock (h)			Eh	Gh			Th			
kettle (k)				Gk			Tk			
lineated (l)			El				Tl	Ol	Rl	
plain (p)	Ap									
ridge (r)			Er	Gr	Lr	Mr	Tr	Or	Rr	
terrace (t)	At			Gt	Lt	Mt	Tt		Rt	
veneer (v)	Av	Cv	Ev	Gv	Lv	Mv	Tv	Ov		
blanket (b)							Tb			
weathered (w)									Rw	
complex (x)				Gx	Lx	Mx	Tx		Rx	

Liverman *et al.* (1995a) conducted similar surveys in NTS map areas 2E/5, 2E/12 and 12H/8, and undertook some additional sampling in NTS map areas 12A/15 and 12A/16 (Liverman *et al.*, 1996) to fill in gaps in Klassen's coverage over rocks of the Buchans Group. Liverman's data are in the sub-directory LIVERMAN, and the variables in this

geochemical database are listed and described in Tables 9 and 10.

Although the same sample medium (the < 63 µm fraction of till) was employed by Klassen and Liverman, different analytical methods were used. Cross-analysis of a suite of 36

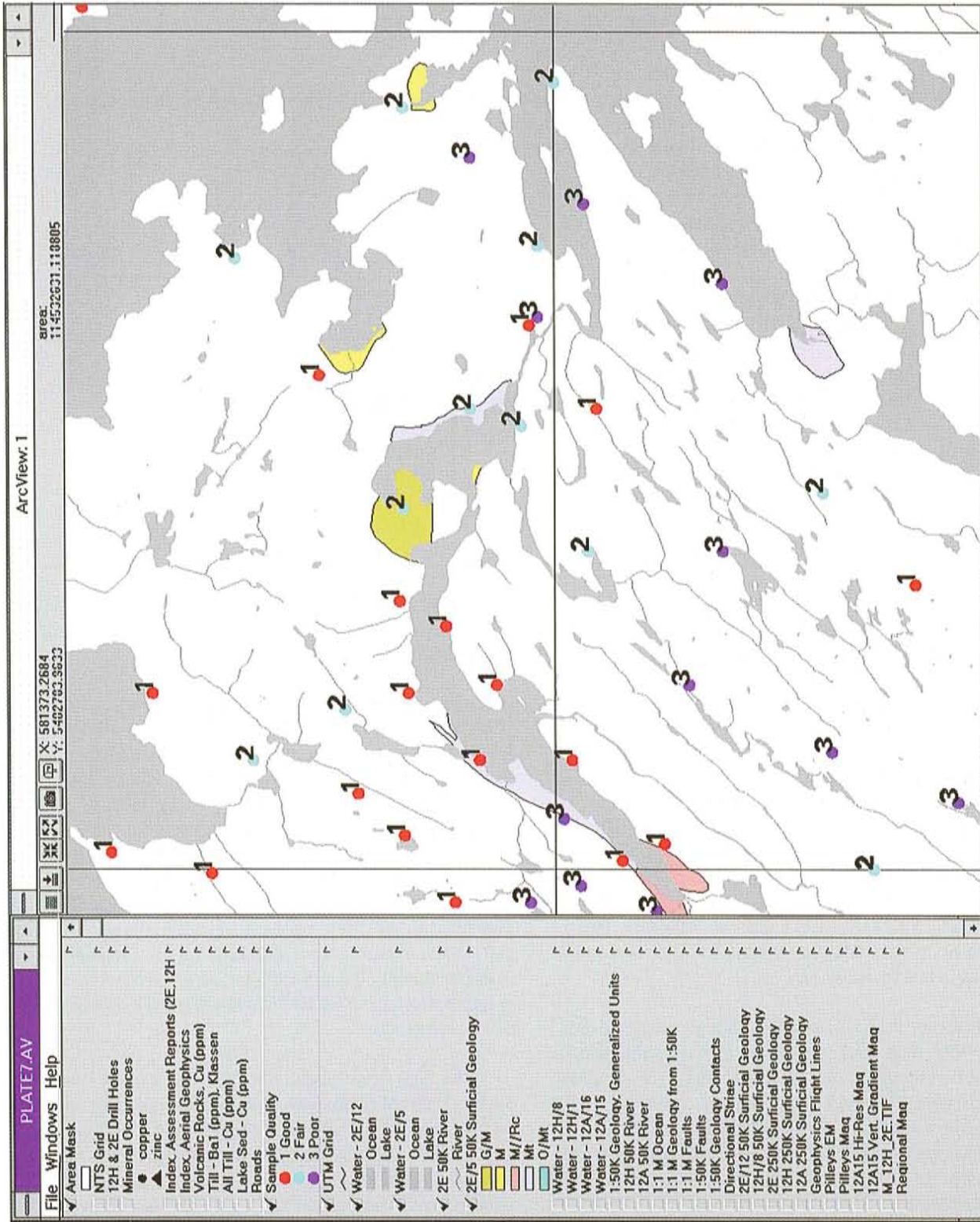


Plate 7. Distribution of Quaternary marine sediments in the Crescent Lake area. Units were selected if either their dominant or subordinate sediment type was labelled marine. Also shown are till sample sites (Liverman et al., 1995a and b) classified by sample quality, drainage and a 10 by 10 km UTM grid for scale.

Table 5. Key to variables in the striation database, Buchans – Robert's Arm Digital Atlas

VARIABLE	DESCRIPTION
Sense	Sense of movement: 1 - indicated, 0 -not indicated
Direction	Stria(e) orientation, degrees
Dir_conf	Confidence level in direction: L - low; M - medium; H - high
Rel_age	Where two or more ice-flows recognized, 1 is oldest, and subsequent flows are numbered 2, 3 etc.
Age_conf	Confidence level in age relationship: L - low; M - medium; H - high
Detail	Density of observations; 1 summary subset; 2 - additional detail
Elev	Elevation (m) of site above sea level
NTS	1:50 000 scale topographic map sheet
Observer	Original observer of stria(e) ¹
Year	Year of original observation
Site	Site number
East	UTM easting (m), zone 21
North	UTM northing (m), zone 21

¹ BGS	B.G. Sparks	ERN	E.R. Neale
CMT	C.M. Tucker	GEK	G.E. Kirby
DGL	D.G. Liverman	JJH	J.J. Hayes
DGV	D.G. Vanderveer	JK	J. Kalliokoski
DMB	D.M. Baird	LFS	L.F. St. Croix
DMT	D.M. Taylor	RAK	R.A. Klassen
DRG	D.R. Grant	RJR	R.J. Ricketts
DWA	D.W. Alley	SVV	S.V. Vatcher

of Klassen's samples at the Newfoundland Geological Survey's geochemical laboratory in St. John's has established that the two sets of data are well correlated for most ore-elements. For elements where the degree of fit of the linear regression equations between the laboratories was better than 50 percent, these equations have been used to level Klassen's results to Liverman's, and compile the two datasets into a single coverage (sub-directory COMBINED). For most users, this merged till-geochemical dataset will prove most useful in providing consistent till geochemistry for the belt, as illustrated in Plates 5 and 6.

Lithochemical data for volcanic rocks were extracted from the Volcanic Rock Geochemical Database (Saunders, 1995). The variables in the database associated with this point coverage are listed in Table 11.

Sub-directory ROCK95 contains lithochemical data from the 1995 field program (Kerr, *this volume*), which incorporated systematic coastal, road, and cross-country sampling of volcanic rocks. The data are contained within simple flat-file databases, and include coordinate information, details of rock type, and a comprehensive suite of major and trace elements. As in the case of field data, many geographic locations are represented by two or more records, representing different rock types. The data can be linked to the field data from the 1995 program using the variable FIELDNUM, and details of fields and their contents are provided in an

associated help file. Users should note that the data only became available in early 1996, and no interpretation has yet been possible.

Airborne geophysical data in the directory GEOPHYS (Figure 5) were divided into those commissioned by government (sub-directory GOVT), and those by the mineral exploration industry (sub-directory INDUSTRY). In general, government-sponsored airborne surveys tend to provide information uniformly distributed over larger areas, often province-wide or national in scope. Industry-sponsored surveys tend to provide more detailed information, but extend only over specific project areas or land holdings (Plate 8). Whereas results from adjacent industry surveys are often difficult to merge due to differing survey parameters and instrumentation, the government surveys provide a good regional coverage to which the more detailed industry surveys can be referenced.

The data from government surveys include magnetic, VLF – EM and radiometric data. Total-field-magnetic data (sub-directory REG_MAG) were recorded at 305 m altitude along east – west-oriented flight lines spaced at 800 m during several phases of a national magnetic mapping program initiated by the Geological Survey of Canada. These data for the whole of Newfoundland were gridded to a 200 m resolution (Kilfoil and Bruce, 1990), from which a smaller grid has been created to provide a complete "regional"

Table 6. Variables included in lake sediment database, Buchans – Robert's Arm Digital Atlas; key to abbreviations for analytical methods; AAS - Atomic Absorption Spectrophotometry; INAA - Instrumental Neutron Activation Analysis

VARIABLE	DESCRIPTION	VARIABLE	DESCRIPTION
1. Sample ID	Unique sample ID	28. Sb1_ppm	Antimony, ppm, by INAA
2. nts	NTS sheet (1:50 000)	29. Sc1_ppm	Scandium, ppm, by INAA
3. Ag6_ppm	Silver, ppm, by AAS	30. Se1_ppm	Selenium, ppm, by INAA
4. As1_ppm	Arsenic, ppm, by INAA	31. Sm1_ppm	Samarium, ppm, by INAA
5. Au1_ppb	Gold, ppb, by INAA	32. Ta1_ppm	Tantalum, ppm, by INAA
6. Ba1_ppm	Barium, ppm, by INAA	33. Tb1_ppm	Terbium, ppm, by INAA
7. Br1_ppm	Bromine, ppm, by INAA	34. Th1_ppm	Thorium, ppm, by INAA
8. Ce1_ppm	Cerium, ppm, by INAA	35. U1_ppm	Uranium, ppm, by INAA
9. Co1_ppm	Cobalt, ppm, by INAA	36. U8_ppm	Uranium, ppm, by DNA
10. Co3_ppm	Cobalt, ppm, by AAS	37. W1_ppm	Tungsten, ppm, by INAA
11. Cr1_ppm	Chromium, ppm, by INAA	38. Yb1_ppm	Ytterbium, ppm, by INAA
12. Cs1_ppm	Cesium, ppm, by INAA	39. Zn1_ppm	Zinc, ppm, by INAA
13. Cu3_ppm	Copper, ppm, by AAS	40. Zn3_ppm	Zinc, ppm, by AAS
14. Eu1_ppm	Europium, ppm, by INAA	41. LOI_pct	Loss-on-ignition, %, Gravimetric analysis
15. F9_ppm	Fluorine, ppm, by Potentiometric analysis	42. INAAWT_g	sample weight (g) used for INAA analysis
16. Fe1_pct	Iron, %, by INAA	43. Lakarea_ha	Lake area, ha
17. Fe3_pct	Iron, %, by AAS	44. Sampdpth_m	Lake depth, m, at sample site
18. Hf1_ppm	Hafnium, ppm, by INAA	45. Year	Year of sample collection
19. La1_ppm	Lanthanum, ppm, by INAA	46. Vegetation	Vegetation type surrounding lake
20. Mn3_ppm	Manganese, ppm, by AAS	47. Sampcolour	Sediment colour
21. Mo1_ppm	Molybdenum, ppm, by INAA	48. Sampcompo	Sediment composition
22. Mo5_ppm	Molybdenum, ppm, by AAS	49. Contaminat	Site contamination
23. Na1_pct	Sodium, %, by INAA	50. Utmeast	UTM easting, m (all zone 21)
24. Ni1_ppm	Nickel, ppm, by INAA	51. Utmnorth	UTM northing, m (all zone 21)
25. Ni3_ppm	Nickel, ppm, by AAS	52. Geology	Solid geology
26. Pb3_ppm	Lead, ppm, by AAS	53. Surficial	Surficial geology (1:250K)
27. Rb1_ppm	Rubidium, ppm, by INAA		

DIRECTORIES

\+---GEOPHYS

+---GOVT

+---REG_MAG	Images (tif)
+---GAMMA	Images (tif)
\---HI_RES	Images (tif)
+---MAG	Image (tif)
+---V_GRAD	Image (tif)

+---INDUSTRY

+---FL_LINES	Line
+---MAG_IMG	
+---PILLEYS	Image (tif)
+---SEAL_BAY	Image (tif)
+---NEW_BAY	Image (tif)
\---DAWES_P	Image (tif)
\---EM_ANOM	
+---COMBINED	Point
+---TWIN_L	Point
+---DAWES_P	Point
\---ROBS_ARM	Point

TYPE OF COVERAGE

coverage for the project area. Two colour shaded-relief images (illuminated from the northwest and northeast) generated from the regional magnetic data are included.

Gradiometer, high-resolution magnetometer and VLF – EM data (directory HI_RES) are from surveys flown for the Geological Survey of Canada (1985, 1988) with a 300-m-line spacing, and cover the whole project area. Total-field magnetic and vertical gradient data have been gridded to a 60 m resolution. Shaded-relief images that can be read in ArcView™, and overlaid with other data (Plate 9) were generated from the gridded magnetic, vertical gradient and VLF – EM data.

Radiometric surveys with a 1-km-line spacing were also flown by the Geological Survey of Canada (1989) over the Baie Verte Peninsula, including NTS map areas 2E/5, 2E/12 and 12H/8. The radiometric, total-field magnetic and VLF – EM data from these surveys have been included as images in the compilation (Plate 10) in the subdirectory GAMMA.

From industry surveys, the locations of active electromagnetic (EM) anomalies and total-field aeromagnetic

Figure 5. Sub-directories in the primary directory GEOPHYS, Buchans – Robert's Arm Digital Atlas.

Table 7. Variables included in till geochemical database from Klassen (1994) in the Buchans – Robert's Arm Digital Atlas; key to abbreviations for analytical methods; ICP - Inductively Coupled Plasma Emission Spectrophotometry; INAA - Instrumental Neutron Activation Analysis

VARIABLE	DESCRIPTION	VARIABLE	DESCRIPTION
1. Sampleno	Unique sample ID	35. Nd1_ppm	Neodymium, ppm, by INAA
2. Ag22_ppm	Silver, ppm, by ICP	36. Ni1_ppm	Nickel, ppm, by INAA
3. Al22_pct	Aluminium, %, by ICP	37. Ni22_ppm	Nickel, ppm, by ICP
4. As1_ppm	Arsenic, ppm, by INAA	38. Pb22_ppm	Lead, ppm, by ICP
5. As22_ppm	Arsenic, ppm, by ICP	39. Rb1_ppm	Rubidium, ppm, by INAA
6. Au1_ppb	Gold, ppb, by INAA	40. Sb1_ppm	Antimony, ppm, by INAA
7. Ba1_ppm	Barium, ppm, by INAA	41. Sc1_ppm	Scandium, ppm, by INAA
8. Ba22_ppm	Barium, ppm, by ICP	42. Sc22_ppm	Scandium, ppm, by ICP
9. Bi22_ppm	Bismuth, ppm, by ICP	43. Se1_ppm	Selenium, ppm, by INAA
10. Br1_ppm	Bromine, ppm, by INAA	44. Sm1_ppm	Samarium, ppm, by INAA
11. Ca1_pct	Calcium, %, by INAA	45. Sn1_ppm	Tin, ppm, by INAA
12. Ca22_pct	Calcium, %, by ICP	42. Sr22_ppm	Strontium, ppm, by ICP
13. Cd22_ppm	Cadmium, ppm, by ICP	43. Ta1_ppm	Tantalum, ppm, by INAA
14. Ce1_ppm	Cerium, ppm, by INAA	44. Tb1_ppm	Terbium, ppm, by INAA
15. Co1_ppm	Cobalt, ppm, by INAA	45. Th1_ppm	Thorium, ppm, by INAA
16. Co22_ppm	Cobalt, ppm, by ICP	46. Ti22_ppm	Titanium, ppm, by ICP
17. Cr1_ppm	Chromium, ppm, by INAA	47. U1_ppm	Uranium, ppm, by INAA
18. Cr22_ppm	Chromium, ppm, by ICP	48. V22_ppm	Vanadium, ppm, by ICP
19. Cs1_ppm	Cesium, ppm, by INAA	49. W1_ppm	Tungsten, ppm, by INAA
20. Cu22_ppm	Copper, ppm, by ICP	50. Yb1_ppm	Ytterbium, ppm, by INAA
21. Eu1_ppm	Europium, ppm, by INAA	51. Zn1_ppm	Zinc, ppm, by INAA
22. Fe1_pct	Iron, %, by INAA	52. Zn22_ppm	Zinc, ppm, by ICP
23. Fe22_pct	Iron, %, by ICP	53. NTS	NTS sheet (1:50 000)
24. Hf1_ppm	Hafnium, ppm, by INAA	54. SOILHORZ	Soil horizon ¹
25. K22_pct	Potassium, %, by ICP	55. SOILDPTH	Minimum depth below surface, (m)
26. La1_ppm	Lanthanum, ppm, by INAA	56. UTMEAST	UTM easting, (m), zone 21
27. La22_ppm	Lanthanum, ppm, by ICP	57. UTMNORTH	UTM northing, (m), zone 21
28. Lu1_ppm	Lutetium, ppm, by INAA	58. YEAR	Year of sample collection
29. Mg22_pct	Magnesium, %, by ICP	59. MUNSCOL	Munsell soil colour
30. Mn22_ppm	Manganese, ppm, by ICP	60. SAMPTYPE	Sample type; till or drift ¹
31. Mo1_ppm	Molybdenum, ppm, by INAA	61. TEXTURE	Sediment texture ¹
32. Mo22_ppm	Molybdenum, ppm, by ICP	62. FIELDCOL	Field colour (wet)
33. Na1_pct	Sodium, %, by INAA	63. Geology	Bedrock geology
34. Na22_pct	Sodium, %, by ICP		

¹ see Table 8 for coding scheme from Klassen (1994).

data have been digitized from maps and plots submitted with mineral assessment reports (cf. Kilfoil and Bruce, 1994) for six industry-sponsored airborne geophysical surveys within, or adjacent to, the Buchans – Robert's Arm belt. The results are included in this compilation in the INDUSTRY sub-directory.

Sub-directory FL_LINES contains a line coverage of flight-line paths for the four (of six) airborne surveys for which total field magnetic data were digitized from contour maps. The flight-line database contains four fields: Length - length in metres of each flight profile; Line_ID - the flight-

line number assigned during survey; Surv_Area - identifies the industry survey; Block - distinguishes phases of a particular survey. Flight-line spacing and orientation vary from survey to survey as well as among phases of each survey.

Total-field magnetic contour plots were digitized (Plate 8) only for surveys for which this information was found to be more detailed than that provided by the high-resolution gradiometric surveys (in HI_RES). However, in general, the industry aeromagnetic data provides little more information than the total-field data from the Geological Survey of

Table 8. Coding scheme for descriptive variables included in till geochemical database taken from Klassen (1994), Buchans – Robert's Arm Digital Atlas

VARIABLE	DESCRIPTION
SOILHORZ	Soil horizon. Soil descriptions are qualitative, based on the Canadian System of Soil Classification (1978). Most soils in central Newfoundland are podzolic. B: Mineral sediment enriched in organic matter, sesquioxides or clay. Characterized by hues associated with oxides and hydroxides of iron and manganese, and darker than underlying soil horizon. C: Mineral sediment comparatively unaffected by pedogenic processes. Modifiers: m horizon slightly altered, evidenced by slight, uniform oxidation colour relative to overlying sediment; g gleyed, evidenced by mottling associated with periodic reduction, and characteristic of poorly drained sites; f horizon enriched in amorphous Al and Fe combined with organic matter, evidenced by strong red and brown hues.
SAMPTYPE	Sample type: Till: Sediment either deposited directly from glacier ice, or released from ice by melting; includes sediment subject to re-sedimentation by debris flow and other mass-movement processes without significant water sorting. Drift: Glacial sediments that contain evidence for limited water sorting. Characteristically high angularity of clasts and poor sorting indicate minimal transport and modification by meltwater.
TEXTURE	Primary texture: D Diamict G Gravel S Sand Textural modifier: st silty s sandy g gravelly f fine-grained m medium-grained p poorly sorted c coarse

Canada's high-resolution aeromagnetic surveys. Sub-directory MAG_IMG contains colour, shaded-relief images generated from the gridded total-magnetic field for the survey areas Dawes Pond (DAWES_P), Seal Bay (SEAL_BAY), New Bay Pond (NEW_BAY) and Long Island – Pilley's Island – Sunday Cove (PILLEYS). Each area contains a single magnetic image generated using a shading direction from the north.

Positional information of active EM anomalies digitized for all survey areas was matched to anomaly listings extracted from their assessment reports and the results were used to generate point data coverages in a format that could be read

by ArcView™ (Plate 8). The EM anomalies from the three survey areas Pilley's Island, Seal Bay and New Bay Pond were combined into a single database (COMBINED) with fields as described in Table 12. The EM anomalies are categorized separately within each survey area. Descriptions of the database fields for the other three survey areas: Dawes Pond (DAWES_P), Twin Lakes (TWIN_L) and Robert's Arm (ROBS_ARM, spanning most of the Robert's Arm belt) are listed in Table 11.

INDEXES

The indexes included in this atlas are for mineral assessment reports by companies, geological reports by

Table 9. Variables included in till geochemical database from Liverman *et al.* (1995a, 1996) in the Buchans – Robert's Arm Digital Atlas; key to abbreviations for analytical methods; AAS - Atomic Absorption Spectrophotometry; ICP - Inductively Coupled Plasma Emission Spectrophotometry; INAA - Instrumental Neutron Activation Analysis

VARIABLE	DESCRIPTION	VARIABLE	DESCRIPTION
1. Sampleno	Unique sample ID	31. Ni2_ppm	Nickel, ppm, by ICP
2. Ag6_ppm	Silver, ppm, by AAS	32. P2_ppm	Phosphorus, ppm, by ICP
3. Al2_pct	Aluminium, %, by ICP	33. Pb2_ppm	Lead, ppm, by ICP
4. As1_ppm	Arsenic, ppm, by INAA	34. Rb2_ppm	Rubidium, ppm, by AAS
5. Au1_ppb	Gold, ppb, by INAA	35. Sb1_ppm	Antimony, ppm, by INAA
6. Ba1_ppm	Barium, ppm, by INAA	36. Sc2_ppm	Scandium, ppm, by ICP
7. Be2_ppm	Beryllium, ppm, by ICP	37. Se1_ppm	Selenium, ppm, by INAA
8. Br1_ppm	Bromine, ppm, by INAA	38. Sm1_ppm	Samarium, ppm, by INAA
9. Ca2_pct	Calcium, %, by ICP	39. Sr2_ppm	Strontium, ppm, by ICP
10. Cd2_ppm	Cadmium, ppm, by ICP	40. Ta1_ppm	Tantalum, ppm, by INAA
11. Ce1_ppm	Cerium, ppm, by INAA	41. Tb1_ppm	Terbium, ppm, by INAA
12. Co2_ppm	Cobalt, ppm, by ICP	42. Th1_ppm	Thorium, ppm, by INAA
13. Cr1_ppm	Chromium, ppm, by INAA	43. Ti2_ppm	Titanium, ppm, by ICP
14. Cs1_ppm	Cesium, ppm, by INAA	44. U1_ppm	Uranium, ppm, by INAA
15. Cu2_ppm	Copper, ppm, by ICP	45. V2_ppm	Vanadium, ppm, by ICP
16. Dy2_ppm	Dysprosium, ppm, by ICP	46. W1_ppm	Tungsten, ppm, by INAA
17. Eu1_ppm	Europium, ppm, by INAA	47. Y2_ppm	Yttrium, ppm, by ICP
18. Fe2_pct	Iron, %, by ICP	48. Yb1_ppm	Ytterbium, ppm, by INAA
19. Ga2_ppm	Gallium, ppm, by ICP	49. Zn2_ppm	Zinc, ppm, by ICP
20. Hf1_ppm	Hafnium, ppm, by INAA	50. Zr2_ppm	Zirconium, ppm, by ICP
21. K2_pct	Potassium, %, by ICP	51. NTS	NTS sheet (1:50 000)
22. La1_ppm	Lanthanum, ppm, by INAA	52. SOILHORZ	Soil horizon ¹
23. Li2_ppm	Lithium, ppm, by ICP	53. UTMEAST	UTM easting, (m), zone 21
24. LOI_pct	Loss-on-ignition, %, gravimetric	54. UTMNORTH	UTM northing, (m), zone 21
25. Lu1_ppm	Lutetium, ppm, by INAA	55. YEAR	Year of sample collection
26. Mg2_pct	Magnesium, %, by ICP	56. INAAWT_G	g, weight of sample for INAA
27. Mn2_ppm	Manganese, ppm, by ICP	57. TEXTURE	Sediment texture ¹
28. Mo2_ppm	Molybdenum, ppm, by ICP	58. QUALITY	Sample quality for geochemical mapping ¹
29. Na2_pct	Sodium, %, by ICP	59. GEOLOGY	Bedrock geology ²
30. Nb2_ppm	Niobium, ppm, by ICP		

¹ see Table 10 for coding scheme.

² see Table 3 for coding scheme

government agencies, airborne geophysical surveys, and diamond drilling. These are in the sub-directories INDUSTRY, GOVT, AIRBORNE and DDH, respectively.

DIRECTORIES	TYPE OF COVERAGE
+---INDEXES	
+---INDUSTRY	Line
+---GOVT	Line
+---AIRBORNE	Line
\---DDH	Point

Figure 6. Sub-directories in the primary directory INDEXES, Buchans – Robert's Arm Digital Atlas.

Assessment Files

A review of all the assessment reports archived with the Geological Survey has been carried out for the area (directory INDUSTRY). The outline of the area referred to in each report has been digitized and linked in ArcView™ to a database (Table 13). The information in this database has been retrieved from GEOSCAN, checked against the original reports and any errors or omissions have been corrected.

Work done since the assessment reports were written has been drawn upon to update some fields where appropriate (e.g., some geological ages quoted in assessment reports have been revised based on recent geochronology). The database

Table 10. Coding scheme for descriptive variables included in till geochemical database from Liverman *et al.* (1995a), Buchans – Robert's Arm Digital Atlas

VARIABLE	DESCRIPTION
SOILHORZ	Soil horizon. B: Mineral sediment enriched in organic matter, sesquioxides or clay. Characterized by hues associated with oxides and hydroxides of iron and manganese, and darker than underlying soil horizon. C: Mineral sediment comparatively unaffected by pedogenic processes. BC: Intermediate in character between the B and C horizon.
TEXTURE	Sample texture: c_sand coarse sand diamictn diamicton gravel gravel sand_grv sand and gravel
QUALITY	Sample quality for geochemical mapping 1 - good; C-horizon of diamicton 2 - intermediate; C-horizon not available, genesis of sediment doubtful 3 - poor; B-horizon, gravel or residual soil

Table 11. Variables included in volcanic rock geochemical database, Buchans – Robert's Arm Digital Atlas; for complete descriptions, see Saunders (1995)

VARIABLE	DESCRIPTION	VARIABLE	DESCRIPTION
1. MAJUNIT	Lithostratigraphic Group.	31. SR	Strontium, ppm.
2. MINUNIT	Lithostratigraphic Formation.	32. TA	Tantalum, ppm.
3. RTYP	four letter code, field classification	33. TH	Thorium, ppm.
4. RCLS	four letter code, generalized lithological name	34. V	Vanadium, ppm.
5. SIO2	Silica, percent.	35. Y	Yttrium, ppm.
6. TIO2	Titania, percent.	36. ZN	Zinc, ppm.
7. AL2O3	Alumina, percent.	37. ZR	Zirconium, ppm.
8. FE2O3	Ferric iron as oxide, percent (= total iron if FeO=9).	38. LA	Lanthanum, ppm.
9. FEO	Ferrous iron as oxide, percent.	39. CE	Cerium, ppm.
10. MNO	Manganese as oxide, percent.	40. PR	Praesodymium, ppm.
11. MGO	Magnesium as oxide, percent.	41. ND	Neodymium, ppm.
12. CAO	Calcium as oxide, percent.	42. SM	Samarium, ppm.
13. NA2O	Sodium as oxide, percent.	43. EU	Europium, ppm.
14. K2O	Potassium as oxide, percent.	44. GD	Gadolinium, ppm.
15. P2O5	Phosphorus as oxide, percent.	45. TB	Terbium, ppm.
16. LOI	Loss-on ignition at 1000°C, percent.	46. DY	Dysprosium, ppm.
17. TOTAL	Total of major oxides, percent.	47. HO	Holmium, ppm.
18. AG	Silver, ppm.	48. ER	Erbium, ppm.
19. BA	Barium, ppm.	49. TM	Thullium, ppm.
20. CO	Cobalt, ppm.	50. YB	Ytterbium, ppm.
21. CR	Chromium, ppm.	51. LU	Lutetium, ppm.
22. CU	Copper, ppm.	52. SOURCE	Collector of data
23. GA	Gallium, ppm.	53. AGE	Age of geological unit sampled
24. HF	Hafnium, ppm.	54. INFO	Comments, e.g. diamond-drill hole numbers
25. HG	Mercury, ppb.	55. REF	Reference to data source
26. NB	Niobium, ppm.	56. NTS	1:50 000 scale NTS sheet
27. NI	Nickel, ppm.	57. UTMEAST	UTM easting, metres, zone 21
28. PB	Lead, ppm.	58. UTMNORTH	UTM northing, metres, zone 21
29. RB	Rubidium, ppm.	59. FIELDNUM	Original field sample number
30. SC	Scandium, ppm.	60. ID	Unique numeric sample identifier
		61. GEOLOGY	Bedrock geology

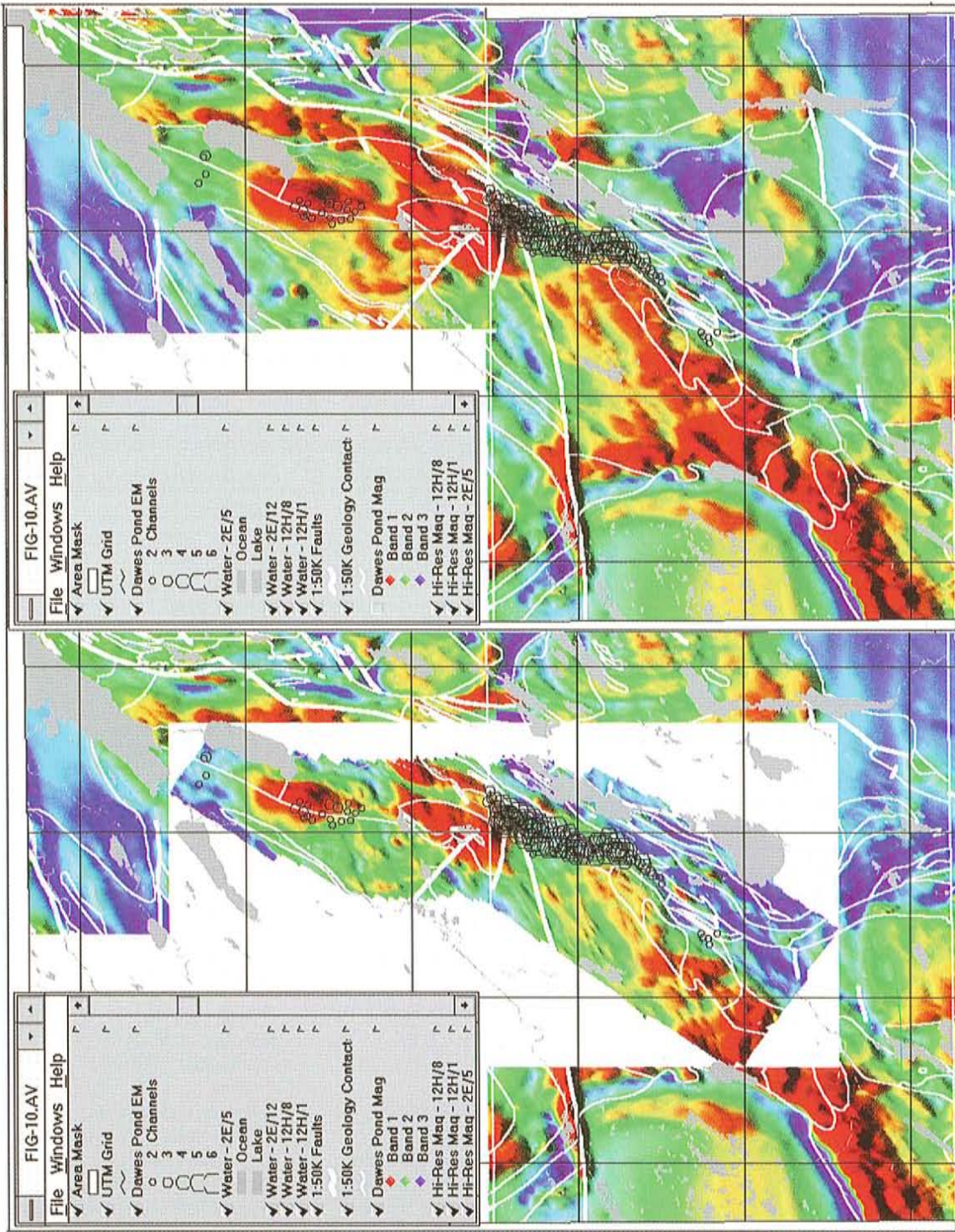


Plate 8. Aeromagnetic data and active EM anomalies classified by number of channels from survey of the Dawes Pond area from Brinex Limited (1980) (centre of left panel). Right panel shows the EM anomalies superimposed on high resolution aeromagnetic data (Geological Survey of Canada, 1988) for the same area. Geological contacts are shown as white lines (faults heavier); the grids are 10 by 10 km.

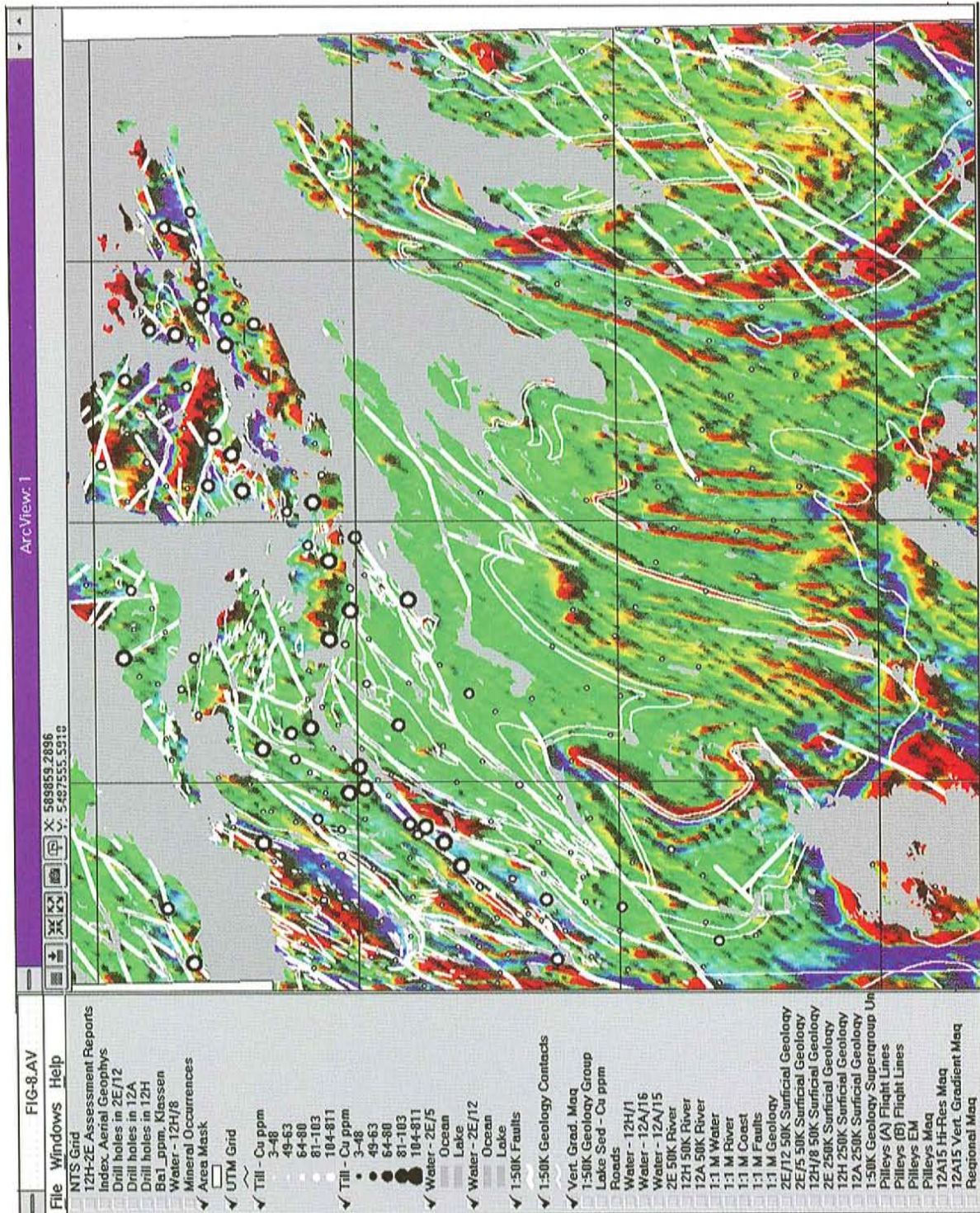


Plate 9. Vertical gradient aeromagnetic data (Geological Survey of Canada, 1988) for the Robert's Arm area in relation to geological contacts, and Cu in till samples as proportional symbols; the grid is 10 by 10 km.

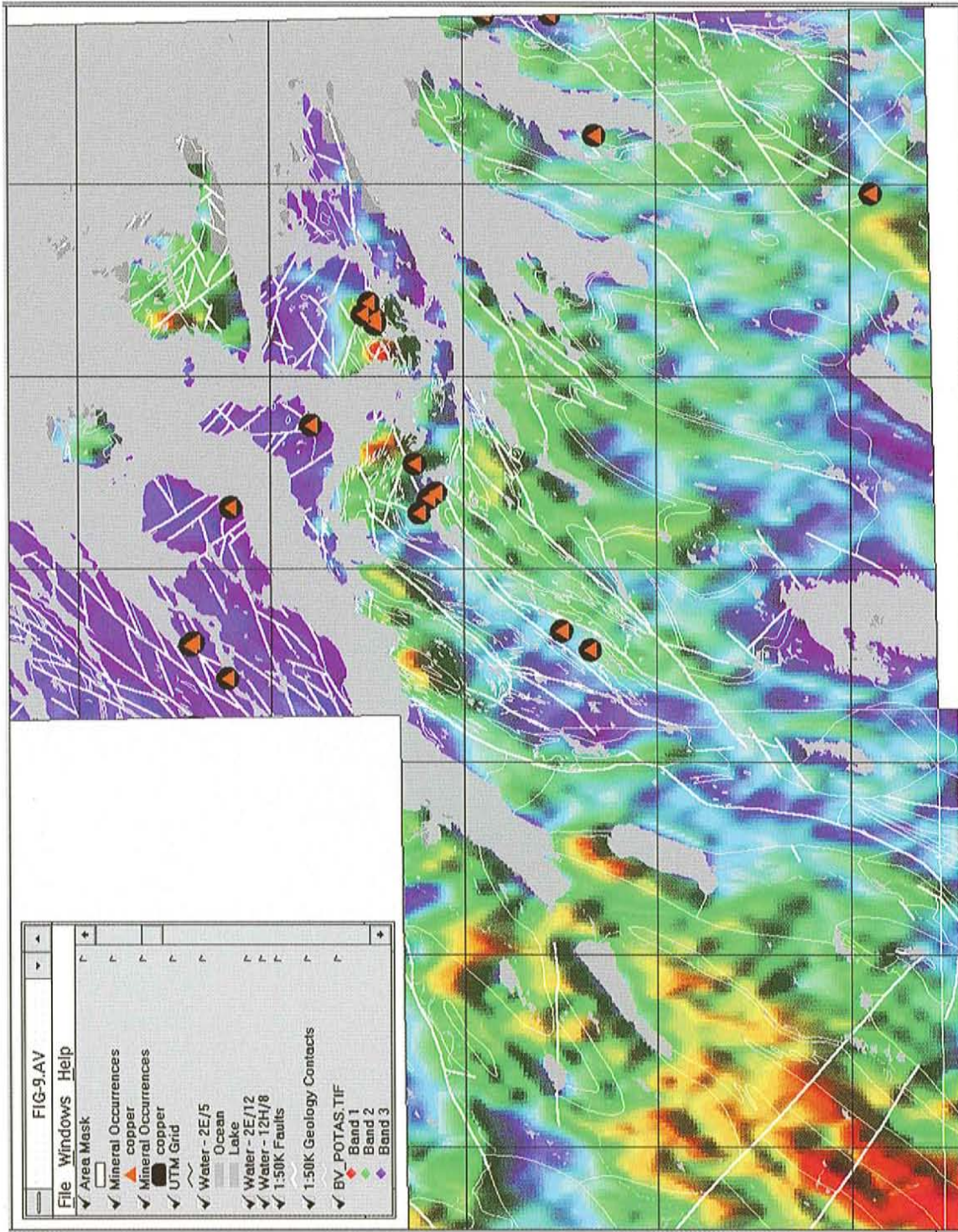


Plate 10. Image of potassium variation from radiometric survey (Geological Survey of Canada, 1989) in relation to geological contacts, and significant Cu showings from MODS/PC. The grid is 10 by 10 km.

Table 12. Brief description of fields and their contents of the databases of EM anomalies in directory GEOPHYS\INDUSTRY\EM_ANOM, Buchans – Robert's Arm Digital Atlas

A) Sub-directory COMBINED [data excerpted exactly from appendices of assessment reports 2E/5(217), 2E/4(402), 2E/12(426)]

1. Surv_Area	Identifies one of three survey areas combined in this file.
2. Line_No	Numeric flight line identifier.
3. Anom_ID	Letter to distinguish each EM anomaly along a flight line.
4. Category	Classification of anomalies based upon EM responses.
5. In_Phase*	The in-phase (real) response of the EM anomaly.
6. Quadrature*	The out-of-phase or quadrature (imaginary) response of the EM anomaly.
7. Rho_T	Calculated conductivity-thickness product of EM conductor, expressed in Mhos.
8. Depth_Ft	Calculated depth to EM conductor, expressed in feet.
9. Height_Ft	Height of EM bird above ground surface, expressed in feet.
10. Geology	Bedrock geology

*All EM transmitter-receiver coil configurations are coaxial with the following frequencies and separations (Dx) in feet: Seal Bay - 870 Hz, Dx=30.; New Bay Pond - 920 Hz, Dx=19.5; Pilley's Island - 4200 Hz, Dx=19.5.

B) Sub-directory DAWES_P [data excerpted exactly from appendix of assessment report 12H(719)]

1. Line_No	Numeric flight line identifier.
2. Anom_ID	Letter to distinguish each EM anomaly along a flight line.
3. Fiducial	Position along flight line relative to fixed control points.
4. N_Chan	Number of EM channels recording an EM response; in general, the more channels affected, the more significant the anomaly.
5. Chan2_Amp	Signal amplitude in EM channel 2.
6. Rho_T_Mho	Calculated conductivity-thickness product of EM conductor, expressed in Mhos.
7. Mag_Fid	Position of corresponding total field magnetic anomaly, if any.
8. Mag_Peak	Amplitude of corresponding total field magnetic anomaly, if any.
9. Bedrock	Bedrock geology

C) Sub-directory TWIN_L [data excerpted exactly from appendix of assessment report NFLD(1578)].

1. Line_No	Numeric flight line identifier.
2. Anom_ID	Letter to distinguish each EM anomaly along a flight line.
3. N_Chan	Number of EM channels recording an EM response; in general, the more channels affected, the more significant the anomaly.
4. Mag_Peak	Amplitude of corresponding total field magnetic anomaly, if any.
5. Bedrock	Bedrock geology

D) Sub-directory ROBS_ARM [data excerpted exactly from appendix of assessment report Nfld(1789)]

1. Line_No	Numeric flight line identifier.
2. Anom_ID	Letter to distinguish each EM anomaly along a flight line.
3. Fiducial	Position along flight line relative to fixed control points.
4. Class	Classification of anomalies based upon EM responses.
5. Rho_T_Mho	Calculated conductivity-thickness product of EM conductor, expressed in Mhos.
6. N_Chan	Number of EM channels recording an EM response; in general, the more channels affected, the more significant the anomaly.
7. Chan_NN	The amplitude of the EM response in each of the channels, where channel NN ranges from 1 to 12.
8. Cond	Response in 60 Hz conditional monitor.
9. Mag_Fid	Position of corresponding total field magnetic anomaly, if any.
10. Mag_Peak	Amplitude of corresponding total field magnetic anomaly, if any.
11. Geology	Bedrock geology

has also been cross-referenced to the MODS, AIRBORNE and DDH databases within this compilation (fields 10, 14 and 15, respectively, in Table 13). This index when overlain on the geoscientific information (Plate 11) provides a convenient way of identifying specific assessment reports in the Newfoundland Geological Survey's geofiles.

Government Reports

The directory GOVT is similar to INDUSTRY. Outlines of the areas referred to in published studies by the geological surveys of Canada and Newfoundland have been digitized and linked in ArcView™ to a database (Table 14). The information in this database has been retrieved from GEOSCAN.

Diamond-Drill Hole Sites

The directory DDH contains a point coverage of drillhole information for the belt (Plate 2). The database was compiled from the catalogue of core sample holdings (Harris and Cochrane, 1995), and the DRILL database (Patey and Gillespie, 1995), together with information from assessment files. The fields and their descriptions are listed in Table 15. Information on assays (although not the assay data) is summarized in fields 12 and 13, and additional information may be given in the corresponding fields 16 and 21 of the INDUSTRY database, which may be cross-referenced by using the unique file number in the field GSB.

Airborne Geophysical Surveys

The directory AIRBORNE contains a line coverage of all the airborne geophysical surveys carried out within insular Newfoundland (including this project area) by mineral exploration companies and the Geological Survey of Canada. The outlines of the extents of survey areas are linked to a bibliographic database (Table 16), which includes information on survey parameters and geophysical instrumentation. This database also contains a field "Digital", which indicates whether the digital data for a particular survey has been included in this atlas, and, if so, the "Comments" field gives the address of the coverage in the directory GEOPHYS.

HELP FILES

Documentation

The overall design of the atlas and its contents are described in a Windows™ help file, which is opened when the atlas is run from the CD-ROM. The help file can be kept open as a window while the atlas is used, or it can be closed and restored only when required. It is linked to a series of specific help files on the bedrock geology, geochemical and

geophysical coverages, as well as the help file containing ArcView™ documentation.

Applications

The atlas contains a comprehensive set of the regional geoscience data for the Buchans – Robert's Arm belt and a map-based index of non-confidential exploration work conducted by mineral exploration companies in the belt, current to the end of 1995. Through ArcView™ the regional data can be examined as individual themes or in combinations of themes for any part of the belt at any desired scale. Through the flexible display options of ArcView™ the user can determine the way any theme or combination of themes is displayed in order to search for spatial relationships between them. The digital indexes can be overlain on any of the regional data so that the more detailed exploration work can be viewed within the framework of the regional database. Page-size colour figures can be printed directly from ArcView™ or exported to a variety of drawing programs for further embellishment. Database tables can be exported in ASCII format in their entirety or specifically selected records.

The few illustrations presented here can only give a hint of the flexibility of the digital atlas. Furthermore, it can be linked directly with other data compilations in ArcView™ format that are currently available, such as the Digital Geochemical Atlas of Newfoundland (Davenport *et al.*, 1995), or in preparation, e.g., Digital Geophysical and Geological Atlases.

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This volume: Management of geological map units in a geographic information system.

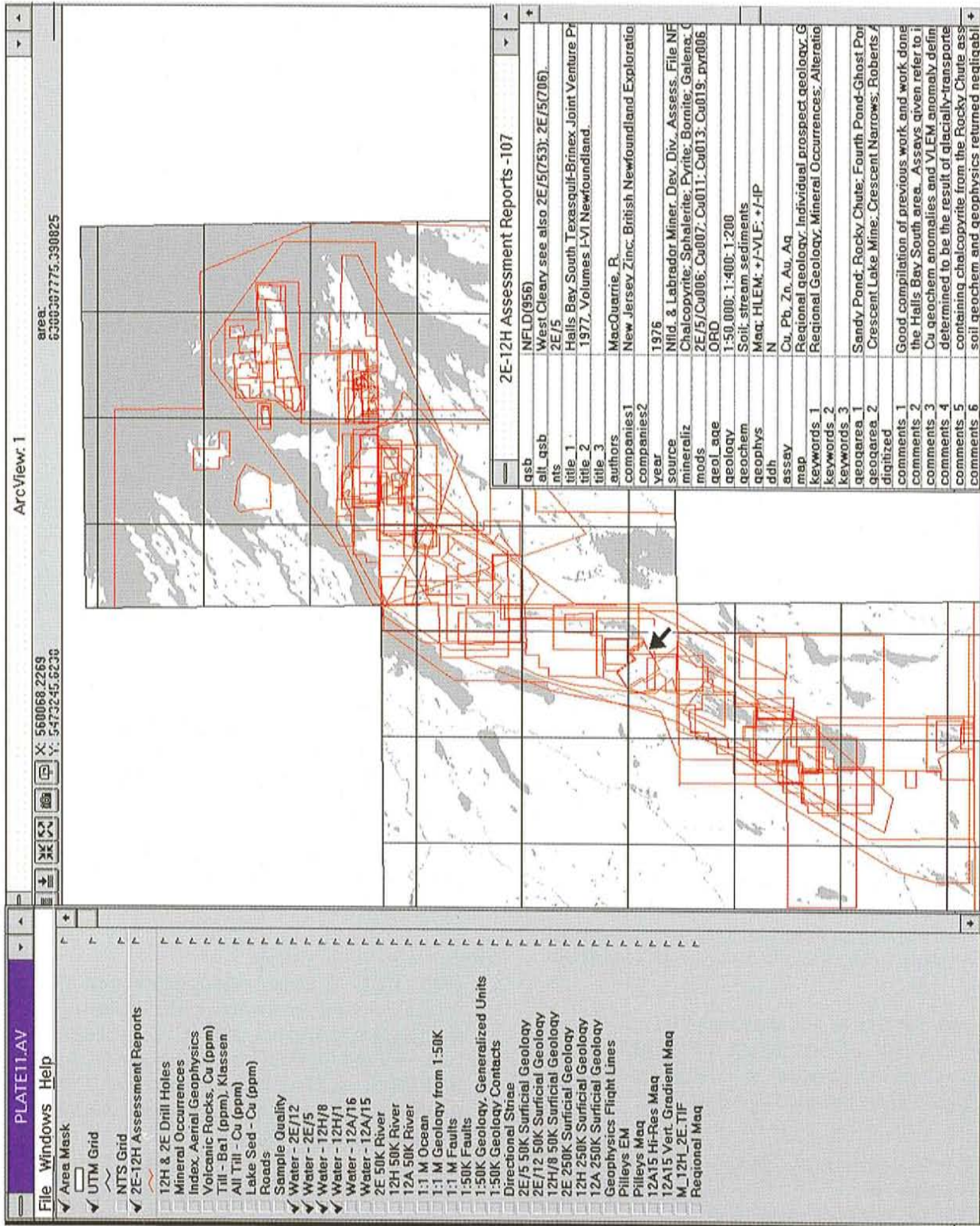


Plate 11. Location of areas covered by assessment reports in the Robert's Arm area. Window contains example of bibliographic information from the assessment file index; the grid is 10 by 10 km.

Table 13. Brief description of fields and their contents in the assessment file database INDUSTRY, Buchans – Robert's Arm Digital Atlas

FIELD NAME	DESCRIPTION
1. GSB	Unique document identifier, Geological Survey files (link to assessment and DDH databases).
2. ALT_GSB	Alternate document identifier, Geological Survey files.
3. NTS	1:50 000 National Topographic System sheet(s) covered by report (project area only).
4. Title	(Three fields) Report title.
5. Authors	Report authors.
6. Companies	(Two fields) Companies by or for whom the assessment work was done.
7. Year	Year report submitted.
8. Source	Type of source document in Geological Survey files; P - paper copy (usually in addition to fiche) FO - fiche only.
9. Mineraliz	Brief description of mineralization noted in report. 'N' means report contains no reference to mineralization.
10. MODS	Identifies mineral occurrences in assessment reports by their unique ID in the Mineral Occurrence Data System (MODS).
11. Geol_Age	Geological age (from report or updated if age has been revised).
12. Geology	Scale of geology map (where present); 'N' means no geology map in report.
13. Geochem	Survey type (e.g., litho geochemistry, till, soil, lake sediment), where reported; 'N' means no geochemistry included in the report.
14. Geophys	Method specified, and airborne surveys identified; more detail for airborne surveys contained in AIRBORNE database, to which entries are cross-referenced. 'N' means no geophysics is included in the report.
15. DDH	'Y' diamond-drill hole information reported; if location available, drillholes will be in DDH database. 'N' no DDH information reported. Reports containing earlier DDH info may be referenced in the comments field (see below).
16. Assay	Elements assayed are listed if reported for DDH, trench or grab samples.
17. Map	List of maps included in report that fall within project area.
18. Keywords	(Three fields) If DDH logs are available this will be noted in this field.
19. Geog-Areas	(Two fields) Specified geographic areas from GEOSCAN with additional specifics from reports
20. Digitized	Any maps, geophysical data, etc. digitized from reports will be cross-referenced here.
21. Comments	(Six fields) Additional useful information, i.e. good assays, summary of fieldwork, references to other pertinent reports.

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1995: Index to the most recent geological maps for the Island of Newfoundland (scale 1:1 000 000). Newfoundland Department of Natural Resources, Geological Survey, Map 95-018, Open File NFLD/2245, version 8.0.

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1990: Geology of the Island of Newfoundland. Newfoundland Department of Mines and Energy, Geological Survey Branch, Map 90-01.

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Environmental Systems Research Institute Incorporated
1992: ArcView™ User's Guide, second edition, Redlands, California.

Geological Survey of Canada
1985: High resolution aeromagnetic total field and vertical gradiometer surveys of the Buchans (12A/15) and Badger (12A/16) map areas, Newfoundland: maps C20355G and C20356G, combined aeromagnetic total field and VLF-EM total field profiles; and C40097G and C40098G; combined aeromagnetic total field and VLF-EM quadrature profiles.

1988: High resolution aeromagnetic total field and vertical gradiometer surveys of the Springdale area, Newfoundland: maps 21121G to 21136G (total field); 41121G to 41136G (vertical gradient); C21137G to

Table 14. Brief description of fields and their contents in the government reports database GOVT., Buchans – Robert's Arm Digital Atlas

FIELD	NAME	DESCRIPTION
1.	GSB	Unique document identifier, Geological Survey files (link to assessment and DDH databases).
2.	NTS	1:50 000 National Topographic System sheet(s) covered by report (project area only).
3.	Title	(Three fields) Report title.
4.	Authors	Report authors.
5.	Reference	Document source.
6.	Year	Year report submitted.
7.	Source	Type of source document in Geological Survey files; P - paper copy (usually in addition to fiche) FO - fiche only.
8.	Mineraliz	Brief description of mineralization noted in report.
9.	MODS	Identifies mineral occurrences in assessment reports to their unique ID in the Mineral Occurrence Data System (MODS), if applicable.
10.	Geology	Scale of geology map (where present); 'N' means no geology map in report.
11.	Geochem	Survey type (e.g., litho-geochemistry, till, soil, lake sediment), where reported; 'N' means no geochemistry included in report.
12.	Geophys	Method specified, and airborne surveys identified; more detail for airborne surveys contained in AIRBORNE database, to which entries are cross-referenced.
13.	Map	List of maps included in report that fall within project area.
14.	Keywords	(Three fields) Specified keywords from GEOSCAN, edited to refer to pertinent geographic areas with additional information from reports.
15.	Geog_Areas	(Two fields) Specified geographic areas from GEOSCAN with additional specifics from reports.
16.	Digitized	Any maps, geophysical data, etc. digitized from reports will be cross-referenced here.
17.	Comments	(Six fields) Additional useful information, i.e., references to assays or diamond-drill hole information, summary of fieldwork, references to other pertinent reports.

C21141G, combined aeromagnetic total field and VLF – EM total field profiles; and C41137G to C41141G, combined aeromagnetic total field and VLF – EM quadrature profiles.

1989: Preliminary release of airborne gamma ray spectrometric colour maps at 1:250 000 scale, Baie Verte area, Newfoundland (parts of 2E, 2L, 12H and 12I). Geological Survey of Canada, open file 1993.

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1995: Catalogue of core sample holdings to October 1995. Newfoundland Department of Natural Resources, Mines Branch, 61 pages.

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This volume: New perspectives on the stratigraphy, volcanology, and structure of island-arc volcanic rocks in the Ordovician Roberts Arm Group, Notre Dame Bay

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1990: Regional aeromagnetic data grids (200 m grid cell), in digital form, for all of insular Newfoundland. Newfoundland Department of Mines and Energy, Geological Survey Branch, Open File NFLD/2063.

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1992: Reclaiming geophysical data from mineral-assessment reports. *In* Current Research. Newfoundland Department of Mines and Energy, Geological Survey Branch, Report 92-1, pages 309-319.

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1994: Till geochemistry and ice-flow data, central Newfoundland (NTS 12A/10, 15 and 16, 12H/1). Geological Survey of Canada, Open File 2823, 350 pages.

Liverman, D.G.E. and Taylor, D.M.

1990: Surficial geology of insular Newfoundland; preliminary version. Newfoundland Department of Mines and Energy, Geological Survey Branch, Map 90-08.

1994a: Surficial geology of the Botwood map area [NTS 2E]. Newfoundland Department of Mines and Energy, Geological Survey Branch, Map 94-233, Open File 002E/0890.

Table 15. Brief description of fields and their contents in the DDH database, Buchans – Robert's Arm Digital Atlas

FIELD	DESCRIPTION
1. Company_ID	Drillhole ID assigned by company.
2. Company	Company for whom drilling carried out.
3. NTS	1:50 000 National Topographic System sheet
4. Geog_area	Name used in drilling report to refer to general location.
5. Year	Year of drilling.
6. Length_m	Length in meters.
7. Dip	Angle DDH was spotted at surface (if available).
8. Azimuth	Direction DDH was spotted (if available).
9. Core diam	Core Size (AQ, BQ etc.).
10. Overburd m	Overburden in meters, if available.
11. Collar lith	Collar lithology, if available.
12. Assays	List of elements assayed, if available.
13. Lab	Geochemical lab performing assays.
14. GSB	Unique document identifier, Geological Survey files (link to assessment and geophysical index databases).
15. Geophys	Y/N; Downhole geophysics.
16. Core_info	Type of information available in assessment reports; Log/Map/Section
17. East	Metres; easting, UTM zone 21
18. North	Metres; northing, UTM zone 21
19. Pos_Acc	Estimated accuracy of collar location in meters (especially a concern for DDH from older reports where no logs/maps are available).
20. Mines_ID	Unique identifier from Harris' DDH database. Note that this ID is only available for DDH in core storage, will be blank otherwise
21. Core_lib	Dept. of Natural Resources Core Library where core stored. Refer to Harris' database/DRILL for information of percentage and date stored, rack number, number of boxes.
22. Comments	(Four fields) Notes on presence/absence of mineralization, etc. References to other assessment reports are made, as logs/maps/sections all referring to the same DDH may not be within the same report. Text references to DDH are used where no logs exist.

1994b: Surficial geology of the Red Indian Lake map area [NTS 12A]. Newfoundland Department of Mines and Energy, Geological Survey Branch, Map 94-236, Open File 012A/0681.

1994c: Surficial geology of the Sandy Lake map area [NTS 12H]. Newfoundland Department of Mines and Energy, Geological Survey Branch, Map 94-237, Open File 012H/1312.

Liverman, D.G.E., Honarvar, P. and Davenport, P.H.

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1991: Landform classification and surficial geology of the Springdale map sheet (12H/8), scale 1:50 000. Newfoundland Department of Mines and Energy, Geological Survey Branch, Map 91-12, Open File 012H/08/1216.

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Saunders, C.M.

1995: Volcanic Rock Geochemical Database; user's manual. Newfoundland Department of Natural

Table 16. Brief description of fields and their contents in the airborne index database, Buchans – Robert's Arm Digital Atlas

1. Year	Year of survey (Numerical)
2. GSB	Unique document identifier, Geological Survey assessment files.
3. Alt_GSB	Identifiers for other documents that relate to the survey area.
4. Scale	The scale at which geophysical data are presented in document.
5. Block	Identifies an individual survey block where survey covers multiple areas.
6. Surv_date	Interval(s) during which survey block was flown.
7. Altitude	Nominal survey altitude.
8. Line_space	Survey flight line spacing and azimuth.
9. Extent	Approximate size of survey, usually in line-kilometers.
10. Instrument	Geophysical instrument(s) employed during survey.
11. Parameters	Geophysical parameter(s) measured.
12. Digital	List of parameters which have been digitized or were submitted digitally. See Comments field for locations of compiled data.
13. Title	Title of descriptive document.
14. Authors	Author(s) of document.
15. Pages	Length of descriptive document.
16. Date	Date that document was submitted.
17. Companies	List of companies involved with commissioning and flying the survey and with interpreting the results.
18. NTS	List of 1:50 000 scale National Topographic System areas in which survey is located.
19. Areas	Name(s) of area(s) covered by the survey.
20. Keywords	A searchable list of document descriptors (taken from GEOSCAN).
21. Index_id	A unique numeric identifier for the survey block.
22. Key	A numeric key to identify type of survey.
23. Comments	Notes on other important aspects of survey not covered above, overall quality of geophysical data and its presentation, and, if digitized, location of organized databases and images prepared from the results.

Resources, Geological Survey, Open File 2414, version 2.0.

Stapleton, G.J. and Parsons, W.K.

1993: MODS/PC Mineral Occurrence Data System for personal computers; user's manual. Newfoundland Department of Mines and Energy, Geological Survey Branch, Open File NFLD 2252.

Taylor, D.M, St. Croix, L., and Vatcher, S.V.

1994: Newfoundland striation database. Newfoundland Department of Natural Resources, Geological Survey Branch, Open File NFLD/2195, version 3.

Thurlow, J.G. and Swanson, E.A.

1981: Geology and ore deposits of the Buchans area, central Newfoundland. *In* The Buchans Orebodies: Fifty Years of Geology and Mining. *Edited by* E.A. Swanson, D.F.Strong and J.G. Thurlow. Geological Association of Canada Special Paper 22, pages 113-142.

Note: Geological Survey file numbers are included in square brackets.