Geological Survey of Canada
Commission géologique du Canada

PAPER 87–8

CURRENT ACTIVITIES FORUM 1987
PROGRAM WITH ABSTRACTS

1987

Canada

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PAPER 87–8

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CURRENT ACTIVITIES FORUM

19-21 JANUARY, 1987

1987 Forum Chairman

R.G. Blackadar, Director,
Geoscience Information Division

Place:	Halls A and E, Ottawa Congress Centre, 55 Colonel By Drive, Ottawa.
Non-Technical Events:	An informal get-together with cash bar on Tuesday afternoon (20 January) from 1530h to 1900h in the poster hall. CIM Luncheon Lecture, Wednesday 21 January 1200-1400h in the adjoining Westin Hotel. Tickets available at the Forum.
Popular Lecture:	At 1930h on the evening of Monday, 19 January, R.W. Boyle will present a talk entitled "The Romance of Gold". The poster sessions will be open from 1930h to 2100h.
Program:	More than 60 poster sessions and 17 formal presentations.

PROGRAM / PROGRAMME

Tuesday, 20 January 1987 / *mardi, le 20 janvier 1987*

0845	R.A. Price, J.G. Fyles	Welcome and opening remarks / *Accueil et allocution d'ouverture*
0900	M.J. Keen, L. Law	Geological and geophysical mapping offshore
0925	G.F. Bonham-Carter	Digital cartography and data integration: application of computer technology to geological maps
0950	A.K. Sinha	Exploration and mapping of deep targets with surface EM techniques
1015		**Official Opening of Poster Sessions / *Ouverture officielle de la salle des exposants-chercheurs***
1020		**Coffee break / *Pause-café***
1045	P.W. Basham	Canadian earthquakes, seismic hazards and seismic verification programs in the Geological Survey of Canada
1110	R.A. Gibb, J.B. Boyd, A.K. Goodacre, R.A.F. Grieve, R.K. McConnell	Gravity program at GSC
1135	R.L. Coles	The geomagnetic field monitoring program in the GSC
1200-1330		**Lunch / *Déjeuner***
1330	P.F. Hoffman	Tectonic subdivision of the Churchill Province
1355	K.D. Card	Geology and tectonics of the Superior Province, Canadian Shield
1420	J.A. Percival	Geology of the Ashuanipi Granulite Complex in the Schefferville area, Quebec
1445	R.A. Klassen, F.J. Thompson	Glacial history and dispersal train configurations in Labrador
1510	M. Lamothe	Quaternary geology and till geochemistry in central and northern New Brunswick

Poster sessions / *Salle des exposants-chercheurs (1000 - 1900)*

1535-1900 **Informal get-together in poster hall; cash bar / *Réunion-détente dans la salle des exposants-chercheurs; bar payant***

Wednesday, 21 January 1987 / *mercredi, le 21 janvier 1987*

0900	M.R. St-Onge, S.B. Lucas, D.J. Scott, N.J. Bégin	Structure and thermo-tectonic evolution of the Cape Smith thrust-fold belt: implications for platinum exploration
0925	L. Hulbert	Platinum group element environments in the Churchill Province of northern Saskatchewan and Manitoba
0950	J.W. Lydon	The potential for platinum in hydrothermal mineral deposits
1015		**Coffee break / *Pause-café***
1045	O.R. Eckstrand	Selenium and the source of sulphur in magmatic nickel and platinum deposits
1110	R.F.J. Scoates, O.R. Eckstrand	Stratigraphic distribution and interelement correlation of Platinum Group Elements in the Bird River Sill, Manitoba
1135	D.A. Walker	Image and particle analysis: applications in the characterization of precious metals
1200-1400		**CIM Luncheon / *Déjeuner du CIM***

Poster sessions / *Salle des exposants-chercheurs (0900-1400)*

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Ressources minérales

R.M. Laramée
Computer-generated map overlays for mineral deposit data, using popular geographic projections

D.J. Ellwood, G.F. Bonham-Carter
Capture and display of geological maps using raster-scanning technology

D.J. Ellwood, G.F. Bonham-Carter, P.J. Rogers
Integration and display of surficial geochemical data using catchment basins, Cobequid Highlands, Nova Scotia

A.N. Rencz, J.R. Bélanger, J.R. Harris
Remote sensing imagery for the investigation of regional structure and surficial geology

W.D. Goodfellow, S. Aronof, D.J. Ellwood, G.F. Bonham-Carter
Integration of Landsat, geology, surficial geochemistry and mineral deposit data for locating tungsten skarn deposits, Nahanni River area, Yukon, NWT

B.W. Charbonneau, D.D. Hogarth
Geophysical expression of the Quinnville Carbonatite, east of Cantley, Quebec

V.R. Slaney, R. Simard
The use of terrain elevation information for the analysis and representation of geological information

H.J. Broome, R.L. Grasty et al.
Ternary radiometric mapping

C.J. Mwenifumbo, P.G. Killeen
Application of borehole geophysics to sandstone Pb deposits: the Yava deposit, Nova Scotia

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R.G. Garrett
From data to diagrams using IDEAS: an interactive computer graphics tool to assist the exploration geochemist

Y.T. Maurice, D.G. Paré
Cartographie géochimique de la région des placers aurifères du sud du Québec en se servant de la technologie des minéraux lourds
Geochemical mapping of southern Quebec placer gold districts using heavy mineral technology

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Research activities in the analytical laboratories

R.K. Herd
P-T time paths and metamorphic reactions in sapphirine-bearing assemblages

R.V. Kirkham
Global distribution of sediment hosted stratiform copper deposits

W.D. Goodfellow
Data integration and its application to tungsten exploration in the Nahanni map area, NWT

J.W. Lydon
PGE distribution in sulphide occurrences of magmatic affinity in the Bay of Islands ophiolite complex

R.T. Bell
Olympic Dam: geological framework and implications for exploration in Canada

J.M. Franklin
Studies of hydrothermal systems on Galapagos, Juan de Fuca and Explorer Ridges

R. Mason, N. Melnik
Hollinger, McIntyre and Coniaurum gold deposits

J. Hill
Geology and geochemistry of Precambrian marbles in Cape Breton, Nova Scotia

P.G. Killeen, L.D. Schock
Making borehole geophysics quantitative: development of calibration facilities

A.N. Rencz, G.P. Watson
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A.L. Sangster, M. Justino
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A.G. Galley et al.
Southern Churchill Province gold deposits

T.C. Birkett
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Canada-Terre-Neuve: Entente d'exploitation minérale

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Science des terrains

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Engineering geology and ground ice conditions, Yukon Coastal Plain

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Application of seismic techniques: recent application of shallow reflection techniques, deep-tow refraction development, and Ice Island - deep reflection in the Arctic Basin

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A. Kopf-Johnson
GEOSCAN: a database for the geosciences in Canada

STRATIGRAPHIC DISTRIBUTION AND INTERELEMENT CORRELATION OF PLATINUM GROUP ELEMENTS IN THE BIRD RIVER SILL, MANITOBA

R.F.J. Scoates and O.R. Eckstrand

Anomalous contents of platinum group elements (PGE) in the Bird River Sill occur in peridotites and chromitites in the lower part of the chromitite sequence. The PGE-rich rocks commonly consist of harrisitic peridotites which invade and disrupt the chromitites. They may represent upward ponding of intercumulus liquid.

Interelement correlations among the PGE and Au indicate three separate associations. Ru, Os and Ir are strongly intercorrelated and are clearly affiliated with chromitites. They probably reflect incorporation of laurite ((Ru, Os, Ir)S_2) inclusions in chromite at liquidus conditions. The second association, Pt-Pd-Rh, is affiliated with sulphides, representing the scavenging of these PGE into a magmatic sulphide liquid. Gold shows no significant correlation with the PGE, apparently because it has undergone subsolidus remobilization out of the magmatic sulphides.

Selenium is enriched well above mantle levels in these sulphides, implying involvement of post-cumulus volatiles.

GLACIAL HISTORY AND DISPERSAL TRAIN CONFIGURATIONS IN LABRADOR

R.A. Klassen and F.J. Thompson

Strategies for efficient mineral exploration by drift prospecting require detailed knowledge of ice flow history to predict distance and direction of glacial transport of indicator erratics. For large areas of Canada, particularly in remote regions, glacial history is poorly known, and recently-developed models of the Laurentide Ice Sheet indicate a greater complexity of ice flow than is shown by the Glacial Map of Canada alone. Work funded by the Canada-Newfoundland Mineral Development Agreement has shown this to be the case in central Labrador. There, cross-cutting striae record two or more distinct ice flow directions throughout much of the region, and they portray a history of flow that becomes increasingly complex between the Labrador coast and the position of dispersal centres located in the Schefferville region. Composition of till in Labrador is the composite product of the different phases of ice flow, although the influence of one phase can be predominant over another. At local scales (glacial transport of tens of kilometres) glacial history is recorded by the size, shape and definition of glacial dispersal trains. For example, to the east, near the margins of the Ice Sheet, dispersal from the Flowers River Intrusive Suite appears simple, forming a narrow train of outcrop width extending over 30 km NE toward the coast. In central Labrador, midway between the margins and central zone of the Ice Sheet, glacial dispersal from the Red Wine Alkaline Complex (RWAC) appears fan-shaped and is the product of at least two phases of flow. Transport of >200 km to the NE, as defined by rare indicator erratics, is the product of early flow, and a broad fan-shaped area of dispersal, which is defined by relatively abundant RWAC debris, is the product of later flow to the E and SE and extends up to 50 km down-ice. Near dispersal centres in the Schefferville region patterns of glacial dispersal vary from broad fans, which are bounded by two distinct flow directions, to full circles centred about the outcrop source. The geochemical expression of the dispersal trains appears generally more limited ($\leq$10 km) than trains defined by coarse clasts (>10-100 km).

QUATERNARY GEOLOGY AND TILL GEOCHEMISTRY IN CENTRAL AND NORTHERN NEW BRUNSWICK

Michel Lamothe

Geochemical investigations of the glacial deposits overlying the Miramichi zone in New Brunswick have focussed on two distinctive mineralized areas.

Surficial till geochemistry around the late Devonian tin-bearing granite of central New Brunswick defines a regional eastward to northeastward glacial dispersal pattern for tin, uranium, and arsenic. A trenching program implemented this summer has defined the vertical compositional variability of the till. In the Todd Mountain area, the discovery of inter-till organic sediments bearing a cold fauna and flora suggests the existence of two different glacial episodes. A sub-till interstadial organic-bearing paleosol(?) was also found in the Juniper area (>36 000 BP; GSC 4199). Identification and tracing of these two different till sheets at the surface is needed in order to adequately interpret the regional geochemical pattern for mineral exploration.

Investigations were also carried out in the gold district of northern New Brunswick. So far 35 samples of till were found to contain gold in the <63 µm fraction. Striations observed on the Charlo-Pointe-Verte-Bathurst area record at least three different ice flow directions. However, glacial transport of debris seems to be restricted to the east-northeast event. Based on compositional and sedimentological analyses the nature of the so-called Elmtree interlobate moraine is questioned.

DIGITAL CARTOGRAPHY AND DATA INTEGRATION: APPLICATION OF COMPUTER TECHNOLOGY TO GEOLOGICAL MAPS

G.F. Bonham-Carter

Traditional methods of making geological maps result in a high-quality product, visually pleasing, but static, inflexible, and often difficult to use effectively with other maps. Modern computer technology now permits the production of digital maps with a spatial resolution and colour range that matches traditional geological maps. Once a database has been created, digital maps may be updated, simplified, combined with other digital maps, and displayed at various scales and projections.

Digital capture of geological map data may be achieved by manual digitizing, or more efficiently by raster-scanning. Interactive editing and automatic processing are used to create a map database. The resulting large image files will soon be sorted using optical disks, ensuring durable archiving and fast access. Outputs can be on video, printers or plotters.

Digital databases for geological maps not only offer cartographic advantages; they also make possible the application of statistical and image processing techniques for data integration. Employing image analysis equipment, creative use can be made of data, with both qualitative and quantitative methods in an interactive environment.

Some examples of applications include: 1) integration of bedrock geology and stream geochemistry to produce mineralization rating maps; 2) production of mineral resource favourability maps derived from combinations of geochemical, geophysical and geological maps; 3) study of the relationship of regional structure visible on remote sensing imagery to bedrock geology and ore deposits; 4) mapping of surficial geology and drift geochemistry based on remote sensing and geobotany.

Once a range of digital databases are established, map production on a customized basis will be desirable. A computerized directory to map databases, similar to a bibliographic database, would allow a rapid search for digital coverage, data accessibility and related information for any area of Canada.

EXPLORATION AND MAPPING OF DEEP TARGETS WITH SURFACE EM TECHNIQUES

Ajit K. Sinha

Transient and multifrequency electromagnetic (EM) surveys were carried out over three conductive massive sulphide bodies to evaluate the effectiveness of deep EM sounding techniques to detect and delineate conductors beyond the range of standard EM systems.

The transient system clearly detected the Winston Lake conductor in northern Ontario at depths in excess of 400 m. However, the system did not detect an equally deep conductor near Matagami, Quebec because of the effect of 30 m thick surface clay layer. At Buchans, Newfoundland, the system failed to detect a low-conductivity sphalerite-rich orebody at 300 m depth, although the multifrequency system detected the conductor. Both systems have been used successfully in geological mapping of strata 400 m thick in southern Ontario. Generally, the transient system performed better in resolving the individual layers especially in areas with lateral inhomogeneity.

IMAGE AND PARTICLE ANALYSIS: APPLICATIONS IN THE CHARACTERIZATION OF PRECIOUS METALS

David A. Walker

Recent advances in technology associated with energy dispersive X-ray microanalysers permit complete external control of the electron beam and motorized stage of a scanning electron microscope. In addition to this capability, there is extensive software available to carry out sophisticated image analysis and chemical characterization of mineralogical materials.

Grey level thresholds based upon average atomic number contrast are established to include those mineral types of interest. The electron beam is then scanned under external control in a digitized grid over the field of view. When a grain is detected as being within the atomic number contrast range previously set, X-rays are collected and analyzed. If the X-ray data collected match any one of several chemical classification schemes set by the investigator, then a series of image analysis measurements is made in combination with quantitative X-ray analysis. After each field is analyzed the motorized stage is automatically driven to the next position, and the analysis repeated.

The above procedure has been applied to several studies involving mineralogical samples. This presentation will describe the usefullness of such technology in analyzing gold-bearing and platinum-group minerals.

THE POTENTIAL FOR PLATINUM IN HYDROTHERMAL MINERAL DEPOSITS

J. W. Lydon

Exploration for platinum has traditionally focused on magmatic concentrations in mafic/ultramafic complexes. However, consideration of mantle and crustal geochemical cycles of platinum and gold leads to speculation that large quantities of platinum have gone unrecognized in other mineral deposit types, particularly those in which low temperature (0°C-400°C) hydrothermal fluids have played a genetic role. The sparse experimental data base on the solubility of platinum in hydrothermal fluids precludes theoretical prediction of the deposit types in which platinum is most likely concentrated. Empirical data show that platinum can be concentrated over a wide range of geological and physico-chemical environments, including those which give rise to porphyry Cu and Mo, skarn, quartz-Cu-Au veins and Kupferschiefer-type deposits, but the factors controlling the source, mobility and deposition of the platinum are not understood. The most favourable sources of platinum include mafic-ultramafic rocks, carbonaceous sediments, manganese and iron-formations; its mobility in aqueous solutions is greatly enhanced by the presence of chloride; and its precipitation is aided by the presence of sulphur and arsenic. If these factors alone dominate the hydrothermal concentration of platinum, then it can be expected to correlate positively with gold in some hydrothermal deposit types but be distributed independently of gold in other types.

SELENIUM AND THE SOURCE OF SULPHUR IN MAGMATIC NICKEL AND PLATINUM DEPOSITS

O.R. Eckstrand

Selenium is geochemically similar to sulphur, and occurs in the crust mainly in sulphides, substituting anionically for sulphur. However, selenium is less soluble (or mobile) than sulphur, particularly in oxidizing environments. Thus sulphides produced in different crustal environments tend to have different, and to some extent diagnostic Se/S ratios. Consequently, mantle sulphur and clastic sedimentary sulphides have Se/S ratios of 250 to 350 x 10^6 and generally less than 100 x 10^6, respectively.

The source of sulphur (crust vs mantle) in magmatic sulphides is of considerable importance in understanding the genesis of nickel and platinum deposits, but is problematic to determine. Recent studies suggest that Se/S ratios may be more useful than previously appreciated. They suggest clearly that sulphur in Archean komatiitic nickel deposits and in those of the Thompson Belt is mainly of sedimentary (contaminated) origin, whereas that in certain platinum-rich sulphide occurrences is mainly mantle-derived. Exploration implications are examined.

PLATINUM GROUP ELEMENT ENVIRONMENTS IN THE CHURCHILL PROVINCE OF NORTHERN SASKATCHEWAN AND MANITOBA

L. Hulbert

A number of magmatic, hydrothermal and sedimentary environments in northern Saskatchewan and Manitoba have been investigated for their PGE potential. In the magmatic environment the most PGE-enriched mafic-ultramafic intrusions are in the granitic terranes (Rottenstone and Namew Lake Ni-Cu deposits) whereas those confined to the La Ronge-Lynn Lake greenstone belt are depleted (Lynn Lake, Gochager Lake, Clam Lake etc. Ni-Cu deposits).

Significant levels of PGEs have been found in hydrothermal environments associated with sheared gabbros and peridotites. To date the most significant occurrences are in the Peter Lake Complex and in the Nicholson no. 2 uranium ores from the Beaverlodge area of northern Saskatchewan.

Sulphides from syn-sedimentary and exhalative environments are very poor hosts and none have been found with PGEs exceeding 22 ppb Pd and 8 ppb Pt.

CANADIAN EARTHQUAKES, SEISMIC HAZARDS AND SEISMIC VERIFICATION PROGRAMS IN THE GEOLOGICAL SURVEY OF CANADA

P.W. Basham

Canada has experienced significant and damaging earthquakes throughout its history, most notably on the Grand Banks, in the St. Lawrence Valley, on Vancouver Island, off the Queen Charlotte Islands and in the northeastern Cordillera. The GSC monitors on-going seismicity with a network of 100 seismograph stations. The current understanding of Canadian earthquakes (in many locations less than desirable) is utilized to provide seismic zoning maps for the National Building Code and to assess seismic hazards to critical facilitities such as nuclear power plants, LNG storage and offshore petroleum production structures. Seismic monitoring has a role in Arms Control by providing a means to verify compliance with a ban on underground nuclear weapon tests. The Yellowknife seismic array is within detection range of all nuclear test sites, and will play an important role in a global seismic monitoring system under a treaty.

GRAVITY PROGRAM AT GSC

R.A. Gibb, J.B. Boyd, A.K. Goodacre, R.A.F. Grieve, and R.K. McConnell

Completion of the regional gravity survey of Canada's landmass and offshore areas by the year 2005 is a major objective of the GSC's Gravity Program. Areas that remain to be surveyed include parts of the Rocky Mountains of northern British Columbia and the Yukon Territory, parts of the Arctic Islands and Arctic Channels and parts of the Arctic Ocean. These regions all pose special problems with respect to horizontal and vertical positioning and logistic difficulties of terrain and climate. New technologies such as ISS and GPS are helping to solve these problems but high costs and low budgets mean progress is relatively slow.

Gravity data for Canada will shortly be released in 1:1 000 000 scale maps alongside existing aeromagnetic, bathymetric and geological maps. In addition, several new gravity maps of Canada (scale 1:10 000 000) have recently been compiled; these include Bouguer, free air, isostatic and horizontal gradient maps. The DNAG Gravity Map of North America, an international project with GSC participation is currently in preparation and will be printed in Canada.

Gravity data are available on tape or plots from the National Gravity Data Base in Ottawa. Also available are control station data, calibration line data, earth tide listings, a variety of maps, and facilities for customized requests. Gravity and aeromagnetic data may soon become available from a common data centre within the Geophysics Division of GSC.

A portable absolute gravity apparatus has been acquired recently. Unlike commonly used relative gravity meters, which measure gravity with respect to a known value, this instrument measures the actual or absolute value of gravity at a point with an accuracy of a few microGals (1 microGal = 10^{-8} ms^{-2}). Absolute gravity measurements will be used to provide first order datum and scale for the Canadian Gravity Standardization Net and will be used in a variety of geodynamics investigations of long term crustal stability. One of the first problems to be studied will be the post-glacial uplift of the Hudson Bay region.

Regional gravity applications currently underway include (i) the investigation of broad-scale horizontal gradient features and gravity trends of the North American landmass to aid a structural interpretation and (ii) preparation of a new geoid map of Canada.

THE GEOMAGNETIC FIELD MONITORING PROGRAM IN THE GSC

R.L. Coles

Forecasts of geomagnetic activity are in demand by a variety of users, including geophysical exploration companies, electrical power utilities, and radio communications agencies. The GSC geomagnetic program provides both short-term (3 day) and long-term (27 day) forecasts, on a continuing basis. Magnetic declination values and rates of change are also in demand by federal and provincial agencies and by the general public, and are made available both in computer-accessible form and as published maps. To develop and maintain these services, and to provide digital magnetic data for national and international users, the geomagnetic program includes research and field monitoring capabilities. A digital geomagnetic observatory network is operated to encompass the major magnetic regions over Canada – sub-auroral, auroral, and polar cap. The character of the temporal variations of the magnetic field differs greatly from region to region. Magnetic repeat stations are reoccupied at intervals of a few years to provide additional data to determine the long-term (secular) variations of the geomagnetic field.

GEOLOGY AND TECTONICS OF THE SUPERIOR PROVINCE, CANADIAN SHIELD

K.D. Card

Superior Province, a remnant Archean Craton, is one of the world's largest regions of relatively undisturbed Archean crust. Northern and southern high grade gneiss domains are characterized by high-pressure granulite gneisses and abundant plutonic rocks whereas in central Superior Province there are alternating east-west subprovinces whose supracrustal rocks are dominated by metavolcanics or by metasediments, all intruded by voluminous plutonic rocks. Volcanic-rich subprovinces are characterized by sinuous greenstone belts, low- to medium-grade komatiitic, tholeiitic, calc-alkalic and rare alkalic volcanics with volcanogenic clastic and chemical sediments. Most belts comprise several lensoid piles each consisting of several polymodal or bimodal mafic felsic volcanic cycles with associated sedimentary intercalations and aprons. In terms of rock types, sequences, geochemistry, and overall configuration, Archean greenstone belts are most closely analogous to modern island arcs. The intervening metasedimentary subprovinces consist of turbiditic wacke and pelite metamorphosed at grades ranging from low greenschist facies at belt margins to low-pressure granulite facies in belt interiors. The metasediments are broadly correlative with adjacent greenstone sequences, and were probably derived from nearby volcanic-plutonic highlands and deposited in inter-arc basins. Plutonic rocks, including early, pre- and synkinematic sodic suites (tonalite gneiss, synvolcanic trondhjemite, quartz diorite) and later, syn- to post-kinematic, predominantly potassic suites (granodiorite, monzogranite, syenite-diorite, and S-type granitic suites) surround and intrude the supracrustal rocks. Unconformities between greenstone belt sequences and older plutonic rocks are rare, as is evidence for inheritance of older components in the igneous rock isotopic systems.

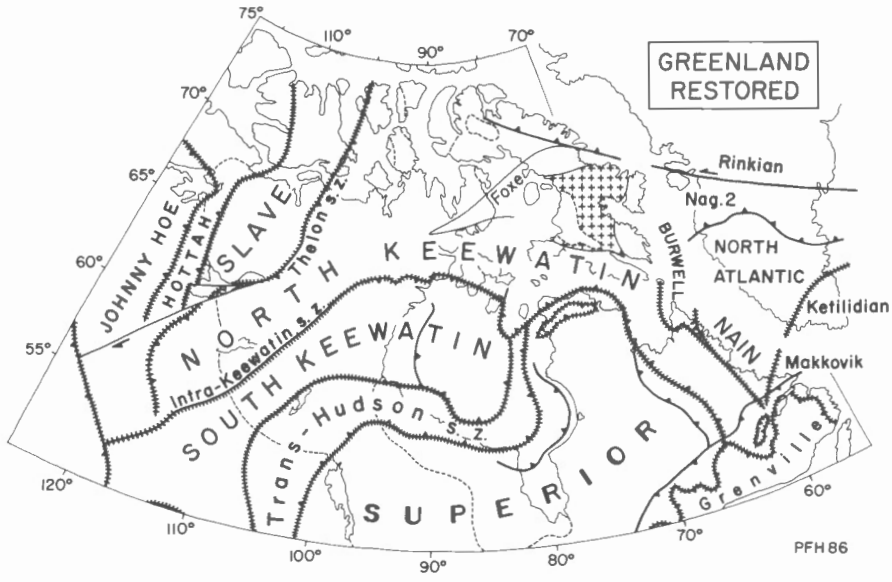
The rocks of Superior Province were formed during several volcano-plutonic episodes that represent major crust-mantle separation events and formation of new continental crust. One occurred 3.5 Ga or more ago in Minnesota River Valley, others at about 3.0 Ga to 2.8 Ga were mainly in the north, whereas another at about 2.7 Ga occurred throughout Superior Province. Major orogenic events involving polyphase deformation, regional metamorphism, and extensive plutonism occurred at about 3.1 Ga, 2.8 Ga, and 2.7 Ga. During the last major event, the Kenoran Orogeny, 2.7 Ga and older rocks were subjected to major north-south compression with formation of complex, generally upright folds in the supracrustal sequences and domal structures in the plutonic terranes that are attributable to both diapirism and polyphase folding. During later, increasingly brittle transpressional deformation major dextral transcurrent faults and thrusts were formed. The transcurrent faults constitute subprovince boundaries in part and are the loci of late alluvial-fluvial sedimentary and shoshonitic-alkalic volcanic accumulations, the Timiskaming-type sequences. The Kapuskasing Structural Zone, a product of late thrusting, is a transverse zone of high-grade gneisses that exposes an oblique cross-section through some 20 km of Archean crust. There is evidence that the Kenoran events differ in age from place to place. Major ductile deformation culminated in the north about 2.73 Ga whereas in the south it occurred at about 2.70 Ga. Similarly, late brittle deformation, faulting, and deposition of Timiskaming-type sequences occurred at about 2.7 Ga in the north and 2.68 Ga in the south.

Contemporaneity of magmatic and deformational events along the lengths of the belts and the general southward younging of events, coupled with evidence of major horizontal compression and transpression, is consistent with a subduction-dominated tectonic regime for assembly of the Superior Province orogen. Successive accretion of volcanic arcs and inter-arc sedimentary basins, accompanied and followed by voluminous plutonism in a convergent plate setting led to crustal thickening and stabilization of the Superior craton. Parts of the northwest Pacific Basin may be a modern analog.

TECTONIC SUBDIVISION OF THE CHURCHILL PROVINCE

Paul F. Hoffman

It has long been recognized that the "Churchill Province" of the Stockwell era, in addition to being larger, is more heterogeneous than the other structural provinces of the Canadian Shield. Based on geophysical anomalies, zircon geochronology and a 1.1 million scale compilation of existing geological maps, a new fundamental subdivision (see figure) is proposed:



Basically, the province is viewed as comprising two continental platforms (north and south Keewatin platforms) bounded by four Early Proterozoic suture zones. The formerly independent north and south Keewatin platforms have basements comprising lithologically distinct late Archean granite-greenstone terranes (eg. Prince Albert and Kaminak greenstone belts respectively). The inferred collision between them is believed to post-date their Early Proterozoic platform covers (Amer and Hurwitz groups respectively), which are preserved as relicts of basement-cover fold and thrust belts related in orientation and vergence to the Intra-Keewatin suture zone (segments of which correspond to the previously identified Rimbey, Virgin River, Black Lake, Tulemalu, Baker Lake, and Daly Bay crustal breaks). The suture zone east of Baker Lake dips south but elsewhere its dip is equivocal. Alkaline volcanic and sedimentary strata of the Dubawnt Group (ca 1.85 Ga) and subsequent epicratonic granite-rhyolite suites (ca 1.75 Ga) form overlap assemblages to the Intra-Keewatin suture. The overall order of suturing is tentatively interpreted as being Intra-Keewatin (after ca 2.07 Ga), Slave-Keewatin (ca 1.94 Ga), Superior-Keewatin (ca 1.85 Ga), and North Atlantic-Keewatin (ca 1.82 Ga?). Subduction zones dipped beneath all the exposed margins of the amalgamated Keewatin terrane, consistent with its notably greater Early Proterozoic magmatism and degree of tectonometamorphic reactivation relative to the Slave, Superior and North Atlantic platforms. The only extensively preserved juvenile Early Proterozoic crust in the Churchill Province occurs in the Manitoba-Saskatchewan segment of the Trans-Hudson suture zone, which appears to terminate northward in a very large (3×10^5 km^2) crustal pop-up underlying central Hudson Bay. A remaining enigma is the gigantic triangular (2×10^5 km^2) granite-charnockite batholith (ca 1.89 Ga) of southern Baffin Island, which is fringed by the Foxe, Dorset and Hoare Bay fold belts.