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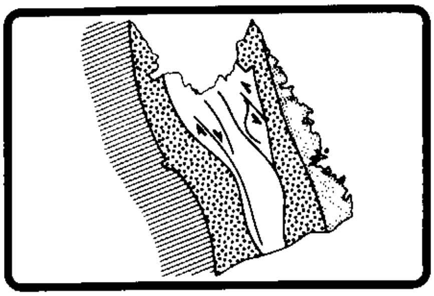
Résumé de l'article

Lbrogène Torngat est orientée NO à l'est dela baie d'Ungava et contient des roches sô-dimentaires protérozoïques et des ortho-gneiss archéens. Le complexe de Burwell,un terrane mlgmatltique au faciès granulltepasse graduellement vers le SO dans lesgneiss de Tasiuyak composés de plaglo-clase-grenat-quartz-sllltmanite et graphite.Au SO, les gneiss de Tasiuyak sont Intercalésavec des métasédlments du groupe de LakeHarbour. Plus à l'ouest, le groupe de LakeHarbour formé de quartzita, de marbre et deparagnelss au faciès amphibolite supérieurest associé à des gneiss granodiorittquesarchéens du Segment de Kuujjuaq. On infèrequ'une phase D, est la cause d'une foliationprimaire et de chevauchements à vergenceSO Intercalant les roches du groupe de LakeHarbour et des gneiss du segment de RivièreGeorge. D2 est une phase en transpressionreprenant les plis dans le groupe de LakeHarbour et développant des mylonites sur 15km dans le cisaillement d'Abloviak. Il s'agit degneiss transposés et de mylonites définis-sant un cisaillement majeur, décrochant etsenestre. Le Groupe de Lake Harbour estformé de structures en dômes et bassinsd'échelle kilométrique à l'interface socle/couverture; elles sont orientées NNO et sonttransposées verticalement en sapprochantdu cisaillement d'Abloviak.



The Abloviak shear zone and the NW Torngat Orogen, eastern Ungava Bay, Québec

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Summary
The NW-trending Torngat Orogen in eastern Ungava Bay, which contains Early Proterozoic sedimentary rocks and Archean orthogneiss, is subdivided into the Burwell terrane, Tasiuyak gneiss, Lake Harbour Group and the George River segment. The Burwell terrane, a granulite-facies migmatitic complex, grades to the southwest into the Tasiuyak gneiss composed of plagioclase-garnet-quartz-sillimanite and graphite. Further to the southwest, the Tasiuyak gneiss passes gradationally into amphibolite-facies pelitic gneiss, quartzite and marble of the Lake Harbour Group, which is associated with granodioritic Archean orthogneiss of the George River segment. The 15 km wide Abloviak shear zone, a high strain zone within the eastern Torngat Orogen, overprints and subvertically transposes the Tasiuyak gneiss, part of the Lake Harbour Group and its Archean basement. D_1 deformation is interpreted to have resulted in development of early foliation, and west- to southwest-verging thrusts that interleaved Lake Harbour Group rocks and George River segment gneiss. D_2 was a transpressional deformation event responsible for refolding in the Lake Harbour Group and development of mylonitic fabrics in the Abloviak shear zone. The latter comprises medium- to highly strained rocks (mylonites) formed in a major transcurrent sinistral shear environment. The Lake Harbour Group is deformed into km-scale NNW-trending dome-and-basin structures, involving Archean basement, that were vertically transposed in a northwestward direction toward the Abloviak shear zone.

Résumé
L'orogène Torngat est orientée NO à l'est de la baie d'Ungava et contient des roches sédimentaires protérozoïques et des orthogneiss archéens. Le complexe de Burwell, un terrane migmatitique au facies granulite passe graduellement vers le SO dans les gneiss de Tasiuyak composés de plagioclase-grenat-quartz-sillimanite et graphite. Au SO, les gneiss de Tasiuyak sont intercalés avec des métasédiments du groupe de Lake Harbour. Plus à l'ouest, le groupe de Lake Harbour formé de quartzite, de marbre et de paragneiss au facies amphibolite supérieur est associé à des gneiss granodioritiques archéens du Segment de Kuujjuaq. On infère qu'une phase D_1 est la cause d'une foliation primaire et de chevauchements à vergence SO intercalant les roches du groupe de Lake Harbour et des gneiss du segment de Rivière George. D_2 est une phase en transpression reprenant les plis dans le groupe de Lake Harbour et développant des mylonites sur 15 km dans le cisaillement d'Abloviak. Il s'agit de gneiss transposés et de mylonites définissant un cisaillement majeur, décrochant et senestre. Le Groupe de Lake Harbour est formé de structures en dômes et bassins d'échelle kilométrique à l'interface socle/couverture; elles sont orientées NNO et sont transposées verticalement en s'approchant du cisaillement d'Abloviak.

Introduction
The Torngat Orogen (TO) is a NNW-trending Early Proterozoic high strain belt that extends from the Burwell Peninsula, Québec, in the north to central Labrador in the south (Figure 1). The Orogen separates the Archean Nain Province from a western tectonometamorphic terrane composed of amphibolite- and granulite-facies Archean basement and Early Proterozoic supracrustal rocks that extends west in an unevenly distributed fashion to the Labrador Trough (Taylor 1979; Hoffman 1988) (Figure 1). It is subdivided into the Kuujjuaq segment to the west and George River segment to the east (together equivalent to the Rae Province of Hoffman, 1988), representing an Archean basement infolded with the Early Proterozoic platformal sequence of the Lake Harbour Group.

Regional studies in the south by Wardle (1983, 1984), Ryan *et al.* (1984, 1988) and Ermanovics *et al.* (1989) show that the TO affects the Nain Province and the unconformably overlying lower Proterozoic Ramah Group and extends to the west to include highly strained amphibolite- to granulite-facies meta-igneous and metasedimentary rocks. The Abloviak shear zone (ASZ) is a major high strain zone affecting rocks along the eastern part of the TO; it affects the Tasiuyak gneiss (Korstgård *et al.*, 1987), but also overprints the western Nain Province (Mengel, 1984; Ermanovics *et al.*, 1989). In the northern part of the TO, the Early Proterozoic metasedimentary rocks of the Lake Harbour Group and the western Burwell terrane are bounded to the west by the George River segment, and to the east by inferred granitic Archean basement (Korstgård *et al.*, 1987).

In order to improve our understanding of the Archean/Proterozoic relations and the ASZ within the northern TO, a study of a cross-section of eastern Ungava Bay, from the George River to the Burwell terrane (Figure 2a), was carried out in the summers of 1988–1990.

Geological setting
From SW to NE, the section of northern TO shows: (1) Archean meta-igneous basement of the George River segment, (2) the Early Proterozoic metasedimentary rocks of the Lake Harbour Group, (3) the Tasiuyak gneiss, and (4) metasediments and diatexites of the Burwell terrane (Figure 2).

Archean basement. The rocks of both the Kuujjuaq and the George River segments (Figure 1) comprise medium-grained migmatitic granodiorite to granite gneiss with minor inclusions of amphibolitic, ultramafic and metasedimentary rocks. West of George River in the Kuujjuaq segment (Figure 1), U/Pb dating of a migmatitic granitic gneiss yielded discordia ages between 2779 Ma and 2688 Ma and concordia ages of 2922 Ma on zircon and 1808 Ma on monazite (Machado *et al.*, 1989).

Lake Harbour Group (LHG). The LHG is dominantly a metasedimentary assemblage defined by Davison (1959) on southern Baffin Island and introduced as a group and extended to northeast Québec by Jackson and Taylor (1972). It consists of marble, quartzite, rusty pyritic and graphitic gneiss, hornblende-pyroxene-biotite gneiss, biotite-garnet-cordierite-sillimanite gneiss and minor amounts of conglomerate and amphibolite. A formal stratigraphy of the LHG cannot be established due to the intensity of metamorphism and deformation, and the lack of detailed mapping. Marbles are the lowest in the apparent stratigraphy and the first lithology found in tectonic contact with the basement gneiss in the western part of the LHG.

Tasiuyak gneiss. The Tasiuyak gneiss, defined by Wardle (1983), consists of an homogeneous leucocratic garnetiferous quartz-plagioclase gneiss with minor sillimanite, graphite and rutile (±pyrite). It forms an elongate NNW-trending belt (15 km wide in the study area) located in the eastern TO and extends 500 km from central Labrador to Ungava Bay (Taylor, 1979; Ermanovics *et al.*, 1989).

Burwell terrane. The Burwell terrane occupies the entire Burwell Peninsula east of Ungava Bay. It is bounded to the south and southwest by the ASZ and the Tasiuyak gneiss and to the east by the Komaktorvik shear zone (KSZ), a mylonitic zone consisting of reworked Archean gneiss and highly strained anorthosite (Korstgård *et al.*, 1987). The eastern part of the Burwell terrane is inferred to be a granitic Archean basement. The western part comprises biotite-garnet and biotite-orthopyroxene-bearing paragneiss showing metatexitic textures and containing garnet-hornblende-clinopyroxene amphibolite and ultramafite. Orthopyroxene-bearing diatexite is found to the northeast of this rock package, together with minor intercalations of Tasiuyak gneiss and LHG-type metasedimentary rocks (Taylor, 1979).

Stratigraphic relations

The western part of the LHG metasedimentary assemblage containing marble and quartzite is believed to represent a thin platformal sequence overlying an Archean basement. Toward the NE, the LHG apparently thickens and is represented by predominantly pelitic gneiss that passes gradationally into a finer grained granulite-facies equivalent. This passes further northeast into a homogeneous, fine-grained orthopyroxene-bearing metasedimentary rock containing thin layers of garnetiferous Tasiuyak gneiss. The garnetiferous interlayers thicken to the NE and pass gradationally into the Tasiuyak gneiss *sensu stricto*. The NE contact of the Tasiuyak gneiss with the Burwell metasedimentary and migmatitic rock package is gradational and is marked by thick layers of garnet-poor Tasiuyak gneiss intercalated with biotite-orthopyroxene-bearing metasedimentary rocks. The western part of the Burwell terrane is dominated by metasedimentary rocks and related migmatite. Intercalations of Tasiuyak gneiss, minor amphibolite, possibly of volcanic origin, and ultramafic rocks have been identified near the NE limit of the migmatitic and diatexitic part of the Burwell terrane.

Structure and metamorphism

The Archean component of the George River segment is dominated by granitic orthogneiss showing NW-trending steeply dipping foliation and minor subhorizontal foliation. The rocks display a pervasive southeast-plunging lineation (L2, Figure 2a) and are characterized by internal folding and brecciation related to a well-developed migmatization. Most of the Archean structures were transposed and refolded during two coaxial Early Proterozoic deformations (D_1 and D_2). Rocks show upper-amphibolite- to granulite-facies metamorphism with clinopyroxene-hornblende, hornblende-biotite and orthopyroxene-hornblende-biotite ± magnetite assemblages.

The Lake Harbour Group forms dome-and-basin structures that become subvertically transposed to the northwest toward the ASZ. The open structures are characterized by an S_1 schistosity, subsequently affected by large folds showing a well-developed, NW-trending S_2 schistosity, which is locally axial planar; Archean basement windows are exposed in the cores of the domal structures (Figure 2a). Stretching L_2 lineations are well developed, and plunge moderately to the SE and to the NW (Figure 2a). The dome-and-basin structures are progressively replaced toward the NE by transposed, large-scale, NW-trending intercalations of basement and Proterozoic metasedimentary gneiss packages. Stretched, large scale F_2 fold hinges within the metasedimentary rocks are preserved in the transposition zone. Metamorphic mineral assemblages in the LHG pelitic gneiss, amphibolite and marble consist of biotite-garnet symplectites, biotite-garnet-cordierite sillimanite-magnetite, calcite-olivine-spinel-diopside, scapolite-diopside-plagio-clase-quartz, hornblende-clinopyroxene and orthopyroxene-hornblende-magnetite-biotite. Cordierite, biotite and garnet are syn-S_1; fibrolitic sillimanite and biotite occur locally in garnet cores, but are mainly found in S_2 foliation planes.

The transposition zone passes gradually into the ***Abloviak shear zone*** and the proportion of mylonites increases significantly. From SW to NE, the ASZ comprises:

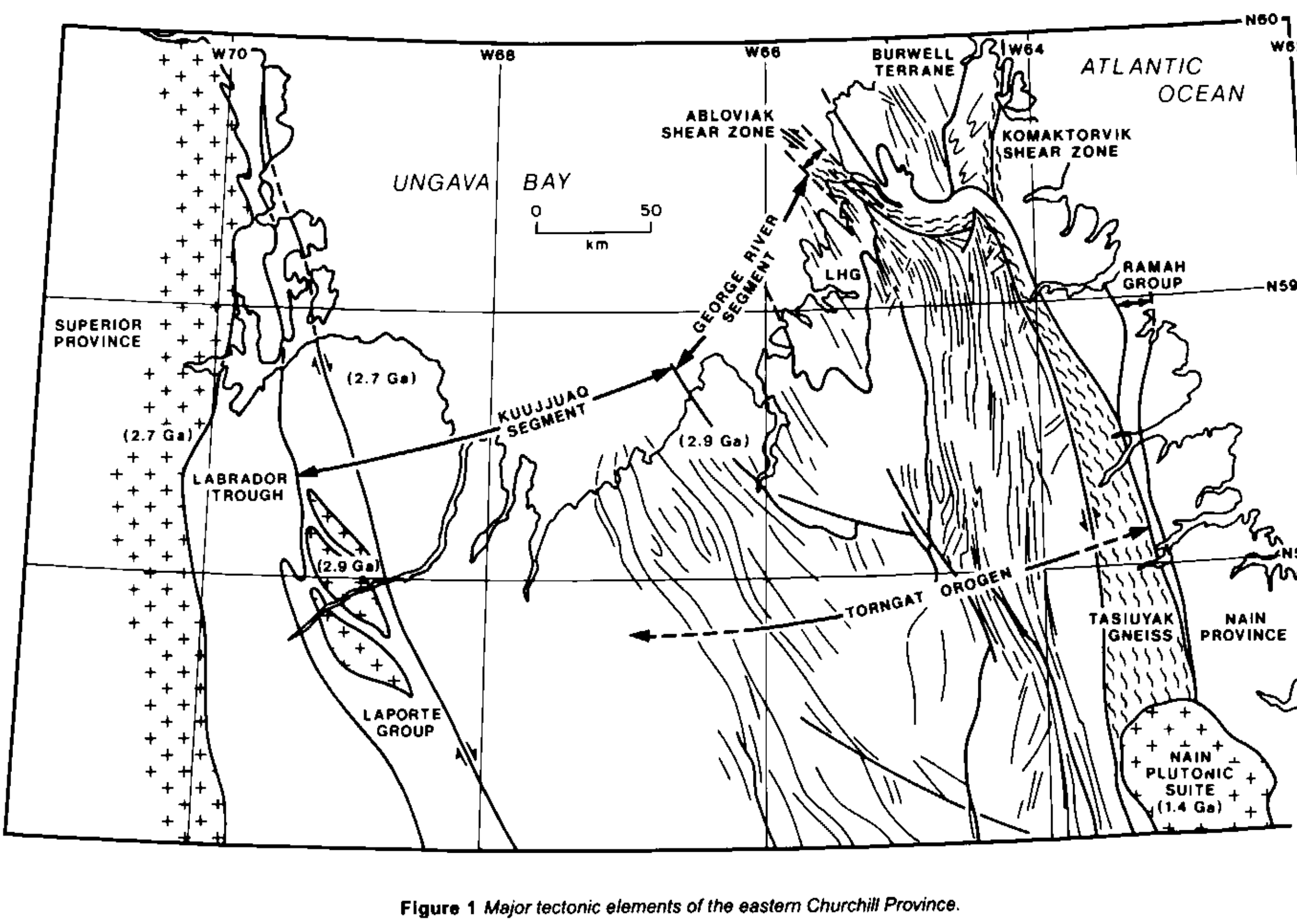


Figure 1 *Major tectonic elements of the eastern Churchill Province.*

(1) interlayered LHG and basement gneiss, (2) LHG metasedimentary gneiss, minor pegmatites and a local basement gneiss-pegmatite-anorthosite association, and (3) the southwest portion of the Tasiuyak gneiss (Figure 2a). Interleaving of basement gneiss and LHG rocks is interpreted as a syn- or late D_1 thrust phase. The following D_2 deformation involved the main NW-trending phase of transcurrent subvertical shearing, the development of subhorizontal mineral lineation, and F_2 folding (Figure 2a). D_2 shearing is unevenly distributed and mylonites laterally co-exist with zones of less strained transposed gneiss. Kinematic indicators show a general sinistral sense of shear. Pegmatites are variously affected by shearing and in mylonite zones show local sheath folding. Metamorphic assemblages in the ASZ metasedimentary rocks and amphibolites comprise biotite-garnet, biotite-garnet-sillimanite, biotite-sillimanite, clinopyroxene-hornblende and orthopyroxene-hornblende-biotite. Garnet preserves remnants of S_1 foliation and sillimanite prisms and fibrolite grew syn- to late-S_2.

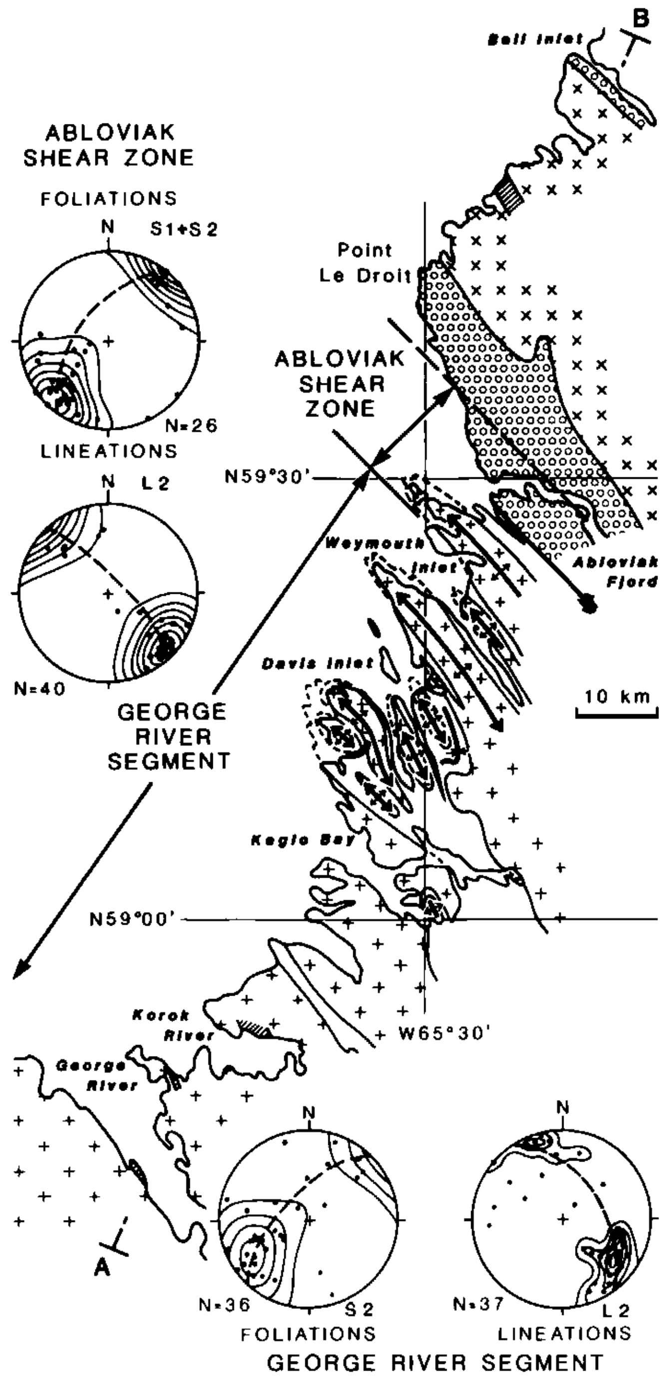
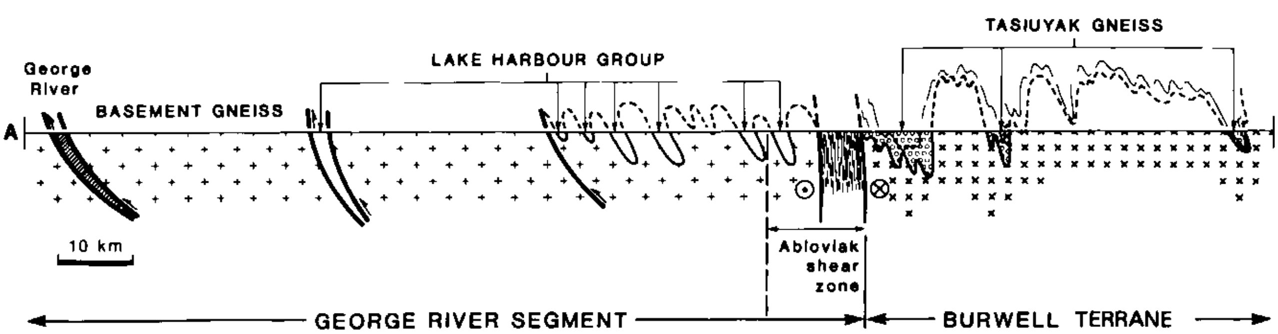


Figure 2 (a) *(right, with legend below) Schematic geological map of eastern Ungava Bay with stereographic projection of the main linear and planar structural features.*
(b) *(bottom of page) Schematic cross-section A–B of the northern Torngat Orogen.*

PROTEROZOIC
- LAKE HARBOUR GROUP
  Metasediments
  Marble, pyrite paragneiss, garnet-sillimanite gneiss, quartzite
- TASIUYAK GNEISS
  Garnet-quartz-plagioclase gneiss

ARCHEAN and/or PROTEROZOIC
- BURWELL TERRANE
  Orthopyroxene diatexite, granulitic gneiss
- AMPHIBOLITE

ARCHEAN
- BASEMENT
  Quartzo-feldspathic gneiss



A brittle deformation, D_3, has affected the ASZ to produce late NW-trending faults associated with thick (2m+) pseudotachylyte veins. Slickensides developed on pseudotachylytes are the result of late normal and reverse faulting. The trend of brittle deformation features is slightly oblique to the NW-trending D_2 transposition fabric that affects the LHG and the Tasiuyak gneiss.

The D_2 transposition fabric dies out northeast of the ASZ and the Tasiuyak gneiss assumes an overall NE dip. In Abloviak Fiord (Figure 2a), a pre-D_2 subhorizontal compositional layering showing a parallel mylonitic fabric is believed to represent the hinges of km-scale, shallow-plunging F_2 folds. The subhorizontal fabric is overprinted by a NW-trending, vertical, S_2 foliation containing a subhorizontal L_2 stretching lineation defined by quartz. Toward the Burwell terrane boundary, the NE dip remains constant and the Tasiuyak gneiss contains strongly recrystallized ribbon quartz, S_1 garnet, syn- to late-S_2 prismatic sillimanite and fine-grained biotite.

The Burwell terrane is characterized by small-scale F_2 dome- and-basin style folding (Taylor, 1979); NW-trending foliations dip to the NE and folds are overturned to the SW. The rocks show a low strain state and orthopyroxene-biotite-garnet-magnetite is the main metamorphic assemblage.

Discussion and summary

The Abloviak shear zone is a NW-trending high strain zone that affects the central part of the NW Torngat Orogen. From SW to NE, it comprises: (1) LHG metamorphic rocks that originated from a carbonate-quartzite platformal sequence, likely to have been deposited unconformably upon Archean basement gneiss, (2) deeper water sediments (LHG and Tasiuyak gneiss), and (3) distal greywackes and minor volcanic and ultramafic rocks of the Burwell terrane now represented by biotite paragneiss, amphibolite and ultrabasite (Taylor, 1979).

It has been established that these various metasedimentary packages are apparently gradational into one another across the NW Torngat Orogen and it is suggested that this corresponds to continuous sedimentation in a craton-margin environment. The Lake Harbour Group sedimentary sequence may be correlative with similar rocks (including marbles) of the Laporte Group on the eastern margin of the Labrador Trough. It is hypothesized that these Early Proterozoic sediments formed symmetrically in a central shallow water basin deepening to the east and west between the Labrador Trough and the basement of the eastern Burwell terrane. The possibility exists that the Kuujjuaq and George River segments and the eastern Burwell terrane are part of the same Archean basement, (which may be an eastern extension of the Superior craton), suggesting that the deposition of the Torngat Orogen metasedimentary protolith took place upon a basement of rifted Archean continental crust.

D_1 was a compressional phase evident across the whole of the NW Torngat Orogen. In the SW, it resulted in development of S_1 foliation, F_1 folds and the west- to southwest-verging thrusts responsible for interleaving of Lake Harbour Group rocks and Archean basement. In the NE, it produced the NE-dipping foliation and SW-vergent folds of the Tasiuyak gneiss and Burwell terrane. D_2 was a large-scale sinistral transpressional phase responsible for the superposition of S_2 foliation, the development of NW-trending dome-and-basin structures in the Lake Harbour Group, and the subsequent subvertical mylonitic fabric and subhorizontal lineation of the Abloviak shear zone.

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