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CANADIAN GEOSCIENCE MAP 97

GEOLOGY

CARCAJOU CANYON (SOUTHWEST)

Northwest Territories



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Cover Illustration

View looking north-northwest along the Conundrum Fault in the Tigonankweine Range of the Mackenzie Mountains, Northwest Territories. This steeply dipping reverse fault, placing dark grey Abraham Plains Formation sandstone over light grey and orange carbonate of the Stone Knife Formation, is a pre-Cordilleran normal fault inverted during Cordilleran deformation. Photograph by K.M. Fallas. 2013-240

ABSTRACT

The southwest quadrant of Carcajou Canyon map area (NTS 96-D) lies within the mountainous Canyon and Backbone ranges of the eastern Mackenzie Mountains, Northwest Territories. Widespread exposures in the Mackenzie Mountains include siliciclastic and carbonate strata ranging from Neoproterozoic to Devonian. These strata have been deformed by northwest- to southeast-trending folds and contractional faults associated with Cordilleran deformation. A pre-Cordilleran set of approximately north-trending extensional faults are preserved within Proterozoic and Cambrian strata, and were locally reactivated by Cordilleran deformation. Cryogenian igneous activity

resulted in the emplacement of gabbroic sills and dykes into strata of the Mackenzie Mountains Supergroup. A major unconformity between Proterozoic (Cryogenian) and Cambrian strata represents a significant gap in the local geological record.

RÉSUMÉ

Le quadrant sud-ouest de la région cartographique de Carcajou Canyon (SNRC 96-D) se situe dans la région montagneuse des chaînons Canyon et Backbone de la partie est des monts Mackenzie (Territoires du Nord-Ouest). Les affleurements généralisés dans les monts Mackenzie renferment des strates silicoclastiques et carbonatées dont les âges s'échelonnent du Néoprotérozoïque au Dévonien. Ces strates ont été déformés par le jeu de failles de contraction et de plis de direction nord-ouest à sud-est associés à la déformation cordillérienne. Un ensemble de failles d'extension de direction approximativement nord de formation antécordillérienne ont été conservées dans les strates du Protérozoïque et du Cambrien et celles-ci ont été réactivées par endroits lors de la déformation cordillérienne. Une activité magmatique au Cryogénien s'est traduite par la mise en place de filons-couches et de dykes gabbroïques dans les strates du Supergroupe de Mackenzie Mountains. Une discordance majeure entre les strates du Protérozoïque (Cryogénien) et du Cambrien rend compte d'une importante lacune dans la géologie locale.

ABOUT THE MAP

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Stratigraphic sections measured by R.B. MacNaughton, E.C. Turner (Laurentian University), M. Pope (Texas A&M University), and S. Leslie (James Madison University), 2010–2012, J.D. Aitken, D.G.F. Long, and D.W. Morrow, 1976–1979, and R.W. Macqueen, 1969

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Map projection Universal Transverse Mercator, zone 9.
North America Datum 1983

Base map at the scale of 1:50 000 from Natural Resources Canada,
with modifications.
Elevations are in metres above mean sea level

Some geographic names on this map are not official.

Mean magnetic declination 2014, 22°34'E, decreasing 29' annually. Readings vary from 22°42'E in the NW corner of the map to 22°25'E in the SE corner of the map.

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ABOUT THE GEOLOGY

Descriptive Notes

The authors have updated and revised map unit terminology from the Operation Norman map (Aitken et al., 1974). In general, terminology for Cambrian units is that of Dixon and Stasiuk (1998) with modifications by Fallas and MacNaughton (2012), and Silurian to Devonian usage follows that of Morrow (1991). Neoproterozoic to Ordovician units have recently undergone revision to their terminology, as outlined below.

Recent stratigraphic work in the Mackenzie Mountains has formalized the Mackenzie Mountains Supergroup and revised its formation-level nomenclature. The oldest exposed unit, previously the H1 unit of Aitken and Cook (1974), has since been defined

as the Tabasco Formation (Turner and Long, 2012). No revisions have been applied to the overlying Tsezotene Formation. Within the Katherine Group, the Eduni, Tawu, Grafe River, Etogochile, and Shattered Range formations of Long and Turner (2012) correspond to the lower part of the Katherine Group as shown on the GSC maps for Carcajou Canyon (Aitken et al., 1974), and to the K1 to K5 divisions of Aitken et al. (1978) and Long et al. (2008). Delineation of these new formations depends on the ability to recognize the recessive Tawu and Etogochile formations. These formations are poorly exposed in the mapping area and so the five lower formations of the Katherine Group were grouped during mapping. The McClure and Abraham Plains formations correspond to the upper Katherine Group on the Carcajou Canyon map (Aitken et al., 1974), and to the K6 and K7 divisions of Aitken et al. (1978) and Long et al. (2008).

The Little Dal Group previously was mapped in this region as two units: H5, and Little Dal Formation (Aitken et al. 1974). Regionally, those two units were reorganized into seven informal units of formation scale by Aitken (1981). In the present mapping area, Aitken's terminology can be applied as follows: the lower part of H5 corresponds to the 'Mudcracked formation'; the upper part of H5 and the Little Dal Formation correspond to the 'Basinal assemblage'. Most recently, Turner and Long (2012) have formalized the internal stratigraphy of the Little Dal Group. Their nomenclature applies as follows to the present study area: the Mudcracked formation is now the Dodo Creek Formation; the Basinal Assemblage is now the Stone Knife Formation, consisting of four informal members (1, 2, 3, and 4). In the present series of maps the Dodo Creek Formation and the lower Stone Knife Formation (equivalent to its member 1) have been combined due to similarity of weathering profile and colour. Our middle Stone Knife Formation corresponds to the lower part of member 2 (typically a bright red shale in this area), and the upper Stone Knife Formation encompasses the upper part of member 2 (carbonate-dominated). Turner and Long (2012) have also formalized the 'Grainstone formation', 'Gypsum formation', and 'Rusty Shale formation' as the Gayna Formation, Ten Stone Formation, and Snail Spring Formation, respectively. Each of these units is exposed in the extreme southwest corner of this map area.

Previous work by the Geological Survey of Canada in southwest Carcajou Canyon map area (Aitken and Cook, 1974) subdivided the Cambro-Ordovician Franklin Mountain Formation into four informal units. In ascending order they are: Basal red beds, Cyclic member, Rhythmic member, and Cherty member (Norford and Macqueen, 1975). The present work separates the basal red beds from the Franklin Mountain Formation and applies the term Nainlin Formation to this shale- and sandstone-dominated unit (MacNaughton and Fallas, in press). Field relationships suggest the Nainlin Formation is laterally equivalent to the evaporitic Saline River Formation. For the remaining carbonate-dominated members of the Franklin Mountain Formation, the older unit names correspond, in ascending order, to informal lower, middle, and upper members. These also correspond to the units 1, 2, and 3 of the Franklin Mountain Formation described by Turner (2011).

Although the Devonian Hare Indian and Canol formations (Aitken and Cook, 1974) can be distinguished in some well exposed sections, at the map scale these recessive, shale-dominated units are combined and the name Horn River Group is applied.

Comparison with recent mapping in the Wrigley Lake map area (NTS 95-M) by Fallas et al. (2011) shows some discrepancies in the location of map unit contacts, as well as changes in terminology along the boundary between the Carcajou Canyon and Wrigley Lake maps. In the absence of direct observations along the northern edge of Wrigley Lake map area, Fallas et al. (2011) relied upon the original interpretations of Gabrielse et al. (1973), which accounts for most differences in contact positions and some stratigraphic differences. The changes to the terminology of the Katherine and Little Dal groups across the map boundary are outlined above, with older informal terms being used on the Wrigley Lake map area (Fallas et al., 2011). Strata equivalent to the Nainlin Formation were not recognized in the Wrigley Lake area by Fallas et al. (2011) or by Gabrielse et al. (1973). Southward from Carcajou Canyon map area, Franklin Mountain Formation passes laterally into Broken Skull Formation, Bear Rock Formation correlates with Arnica and/or Landry formations, and Hume correlates with Headless and Nahanni formations. Tsetso Formation is locally recognized in both map areas. It is equivalent to the Delorme Formation of Gabrielse et al. (1973), which was raised to Group status by Morrow (1991).

For detailed information on surficial deposits, here shown as “Quaternary sediment”, see Duk-Rodkin and Hughes (2002).

The name Bolstead anticline has been introduced to facilitate future discussion of this structural feature. The names Canyon Fault, Nainlin Fault, Conundrum Fault, Foran syncline, Tawu anticline, Bolstead syncline, and Tigonankweine anticline have been incorporated from the older Carcajou Canyon map (Aitken et al., 1974). The geology of this map area is dominated by Cordilleran folds and associated contractional faults. Tigonankweine, Bolstead, and Tawu anticlines are cored by Neoproterozoic Katherine Group strata, with Little Dal Group locally preserved on the flanks and Paleozoic strata preserved in the intervening synclines. Oblique to the northwest-trending Cordilleran structures are north-northwest-trending extensional faults crosscutting Neoproterozoic and Cambrian strata. Some of these faults were reactivated during Cordilleran deformation, resulting in changes in the amount and sense of offset along strike. The Conundrum Fault is a good example of this phenomenon with west-side-down offset at the south end and west-side-up offset to the north where it links with a Cordilleran thrust fault.

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Coordinate System

Projection: Universal Transverse Mercator

Units: metres

Zone: 9

Horizontal Datum: NAD83

Vertical Datum: mean sea level

Bounding Coordinates

Western longitude: 128°00'00" W

Eastern longitude: 127°00'00" W

Northern latitude: 64°30'00" N

Southern latitude: 64°00'00" N

Data Model Information

Surface bedrock data are organized into feature classes and themes consistent with logical groupings of geological features. All field observation point data are related through the Station_ID property of the Station theme. These feature attribute names and definitions are identical in the shapefiles and the XML files.

Consult PDFs in Data folder for complete description of the feature classes, feature attributes, and attribute domains.

The Bedrock Data Model and the Bedrock Domains documents are intended to describe all bedrock features which may be compiled at the 1:50 000 scale. Therefore, some of the feature classes and feature attributes described in these documents may not be present.

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- II. **ATTENDU QUE** le Détenteur de licence désire obtenir certains droits sur les Données, sous réserve des modalités énoncées ci-après;
- III. **ATTENDU QUE** le Canada déclare avoir la pleine autorité pour accorder les droits demandés par le Détenteur de licence, sous réserve des modalités énoncées ci-après;
- IV. **ET ATTENDU QUE** les parties veulent en venir à une entente d'utilisation à partir de ce qui suit.
- V. **À CES CAUSES**, en considérant les conventions contenues dans cet Accord, les parties conviennent de ce qui suit :

1.0 DÉFINITIONS

1. Données du Canada signifie toute Donnée dont le Canada détient le droit de propriété.
2. Données signifie toute donnée numérique, métadonnée ou documentation visée par les modalités de cet Accord.
3. Produits dérivés signifie tout produit, système, sous-système, appareil, composant, matériel ou logiciel qui comprend ou utilise toute partie des Données.
4. Droits de propriété intellectuelle signifie tout droit de propriété intellectuelle reconnu par la loi, y compris tout droit de propriété intellectuelle protégé par une législation telle que celle qui régit, sans être limitée à, les droits d'auteur et les brevets.

2.0 CESSION D'UNE LICENCE

1. 2.1 Sous réserve des modalités du présent Accord, le Canada octroie au Détenteur de licence une licence non exclusive, sans frais ni redevances exigibles, et le droit d'exercer tous les Droits de propriété intellectuelle sur les Données. Ceci comprend le droit d'utiliser, incorporer, accorder des licences d'utilisation (avec droit subséquent d'accorder des licences d'utilisation), modifier, améliorer, développer et distribuer les Données; et de fabriquer ou distribuer des Produits dérivés.
2. Les Droits de propriété intellectuelle découlant de toute modification, amélioration, développement ou traduction des Données, ou de la fabrication de Produits dérivés, effectués par ou pour le Détenteur de licence seront détenus par le Détenteur de licence ou tout substitut identifié par le Détenteur de licence.

3.0 PROTECTION ET IDENTIFICATION DE LA SOURCE

1. L'utilisation des Données ne constitue en aucune façon une reconnaissance par le Canada d'un Produit dérivé. Le Détenteur doit identifier la source de données, de la façon suivante, lorsque toute partie des Données est redistribuée ou comprise dans un Produit dérivé :
© Le ministère des Ressources naturelles Canada. Tous droits réservés.

4.0 GARANTIE, EXCLUSION ET INDEMNISATION

1. Le Canada ne fait aucune représentation ou garantie, expresse ou tacite, découlant de la loi ou d'autres sources, en ce qui concerne entre autres l'exactitude, l'utilité, la nouveauté, la validité, l'étendue, l'intégralité ou l'actualité des Données et rejette expressément toute garantie implicite de qualité loyale et marchande ou l'à propos à une fin particulière des Données. Le Canada n'assure ni ne garantit la compatibilité du site qui contient les Données avec les versions antérieures, actuelles et futures de n'importe quel fureteur.
2. Le Canada ne peut être tenu responsable par le Détenteur de licence en ce qui a trait à toute réclamation, revendication ou action en justice, quelle qu'en soit la cause, concernant toute perte ou tout préjudice ou dommage ou frais, direct ou indirect, qui pourrait résulter de la possession ou de l'utilisation des Données par le Détenteur de licence.
3. Le Détenteur de licence tiendra le Canada et ses représentants, employés, agents et exécutants, indemnes et à couvert à l'égard de toute réclamation, revendication ou action en justice, quelle qu'en soit la cause, alléguant toute perte, tout frais, toute dépense, tout dommage ou toute blessure (y compris toute blessure mortelle) qui pourrait résulter de la possession ou de l'utilisation des Données par le Détenteur de licence.
4. Le Détenteur de licence devra accorder des licences d'utilisation à toute personne ou partie qui obtient les Données ou des Produits dérivés au moyen d'un accord de licence, et cet accord devra imposer à ces personnes ou parties les mêmes modalités que celles qui sont énoncées dans la section 4.0 de cet Accord.
5. L'obligation du Détenteur de licence d'indemniser le Canada selon cet Accord ne peut affecter ni empêcher le Canada d'exercer tout autre droit selon la loi.

5.0 DURÉE

1. Cet Accord entre en vigueur à partir de la date et de l'heure d'acceptation des modalités de l'Accord (Heure de l'Est) et restera en vigueur pour une période d'un (1) an, en vertu de la sous-section 5.2 et de la section 6.0 qui suivent.
2. À la fin du premier terme, cet Accord sera automatiquement renouvelé pour des termes successifs d'un (1) an, en vertu de la section 6.0 qui suit.

6.0 RÉSILIATION

1. 6.1 Nonobstant la section 5.0, cet Accord peut être résilié :
 - i. automatiquement et sans préavis, si le Détenteur de licence manque à ses engagements ou obligations selon cet Accord;
 - ii. par un préavis écrit de résiliation émis par le Détenteur de licence, en tout temps, et cette résiliation prendra effet trente (30) jours suivant la réception d'un tel préavis par le Canada; ou
 - iii. par consentement mutuel des parties.

2. Lors de la résiliation de cet Accord, pour quelque raison que ce soit, les obligations qui incombent au Détenteur de licence en vertu de la section 4.0 continueront de s'appliquer et les droits du Détenteur de licence en vertu de la section 2.0 cesseront immédiatement.
3. Lors de la résiliation de cet Accord, pour quelque raison que ce soit, le Détenteur de licence devra immédiatement effacer ou détruire toutes les Données obtenues en vertu de cet Accord, ou à l'intérieur d'un délai raisonnable lorsque les Données sont nécessaires pour terminer la livraison de Produits dérivés commandés avant la résiliation de cet Accord.

7.0 GÉNÉRAL

1. Lois d'application

Le présent Accord est régi et interprété en vertu des lois en vigueur dans la province de l'Ontario. Les parties acceptent de tomber sous la juridiction de la Cour supérieure de la Province de l'Ontario.

2. Totalité de l'Accord

Le présent Accord constitue l'intégralité de l'entente conclue entre les parties relativement à l'objet du présent Accord. Toute modification à cet Accord ne peut être que par écrit, doit porter la signature de chaque partie et exprimer clairement l'intention de modifier cet Accord.

3. Solution des litiges

Si un litige survient à propos de cet Accord, les parties tenteront de le résoudre par des négociations de bonne foi.