Proterozoic Pinguicula Group: Age, Stratigraphic Contacts, and Correlations

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Summary

The Pinguicula Group is a Proterozoic succession of clastic and carbonate rocks exposed in the Wernecke and Ogilvie Mountains of northern Yukon (Eisbacher, 1981). The strata were deposited with angular unconformity on the Wernecke Supergroup following the Racklan orogeny. Previous workers in the Wernecke and Ogilvie Mountains have provided basic stratigraphic descriptions and mapped part of the succession in detail (Abbott, 1997; Thorkelson, 2000); however, the remaining areas have yet to be mapped beyond reconnaissance level and several questions regarding the age, depositional environment and contact relationships with other strata remain unresolved. Sedimentological details of the Pinguicula Group units A through C remain poorly understood and little information on sediment composition and provenance has been obtained. Correlations with strata in adjacent mountain ranges have yet to be tested. Our current research is designed to provide a detailed characterization of the Pinguicula Group including age, lithology, stratigraphic relationships and basin configuration, and to define the extent of the Pinguicula Group by correlating it with similar strata in adjacent mountain ranges.

Two contact relationships were resolved in the 2009 field season. The first, a 1380 Ma dyke previously thought to crosscut unit A, has instead been recognized to crosscut the underlying Wernecke Supergroup strata. This relationship is significant because it calls the lower age limit of the Pinguicula Group into question and may reposition the deposition of the Pinguicula Group within the history of geologic events. Secondly, the previously undefined contact relationship between units B and C has been identified as a gradational contact confirming the placement of unit C within the Pinguicula Group. In addition, preliminary data collected from the western Ogilvie Mountains draws similarities between units PR1 and PR2 of the lower Fifteenmile Group and units A, B, and C of the Pinguicula Group. Although preliminary results from the 2009 field season have resolved some of the unknowns surrounding the Pinguicula Group, they have also raised more questions.

Introduction

The Proterozoic Pinguicula Group consists of clastic and carbonate rocks in the Wernecke Mountains of northern Yukon (Eisbacher, 1981). These strata were deposited with angular unconformity on the Wernecke Supergroup following the Racklan orogeny (ca. 1600 Ma), an event of contractional deformation and metamorphism (Eisbacher, 1978, Thorkelson, 2000). Eisbacher (1981) divided the Group into six units, simply termed units A-F. Thorkelson et al. (2005) divided the group into two successions separated by a lacuna, and retained the name Pinguicula Group for the three lower units (A, B, and C). The upper three units (D-F) were renamed the Hematite Creek Group. Previous work, summarized in Thorkelson et al. (2005), described the main characteristics of the group, but questions remain about its age, depositional

environment, areal extent and relations with Proterozoic successions in adjacent inliers. Suggested correlations between the Pinguicula Group and strata in the Ogilvie Mountains (Abbott, 1997) have not been tested.

The Pinguicula Group *sensu stricto* is located in the Wernecke Mountains approximately 150 km north-northeast of Mayo along the Bonnet Plume River. Possible correlative strata are exposed in the eastern Ogilvie Mountains, approximately 140 km northeast of Dawson City, and in the western Ogilvie Mountains approximately 90 km north of Dawson City.

Theory and/or Method

Geochronology

Detrital zircon ages for basal sandstone of Pinguicula Group unit A will provide an indication of sandstone provenance. Ages, derived from U-Pb geochronology, will reflect the ages of the source region and not the time of Pinguicula Group deposition, but will still provide a lower age constraint for the Pinguicula Group. Zircon grains will also be extracted from dykes crosscutting Pinguicula Group strata and help to constrain the upper age limit of the succession.

In addition, clasts from conglomerates will be sorted into lithologic groups and, where possible, dated using U-Pb zircon geochronology. This may provide insight into the possibility that strata were deposited, or that a terrane was obducted, during the lacuna marked by the end of deposition of the Wernecke Supergroup deposition (<1640 Ma; Furlanetto et al., 2009) and formation of the Pinguicula basin.

Stratigraphic Contacts

Stratigraphic sections were measured at two locations in the Pinguicula Group in the Wernecke Mountains. Contact relations between units B and C were evaluated. The purpose of evaluating this contact is to confirm the placement of unit C within the Pinguicula Group. In addition, the contact between unit A and a crosscutting dioritic intrusion was re-evaluated. This contact was previously used to constrain the lower age limit of the Pinguicula. Igneous zircons from the diorite were dated at approximately 1380 Ma, and the diorite was assigned to the Hart River sills of Abbott (1997). As a result, the deposition of the base of the Pinguicula Group was constrained between 1380 Ma and 1590 Ma (the age of the underlying Wernecke Breccia in other locations) (Thorkelson, 2000; Thorkelson et al., 2005). However, new data that bear on this contact relationship has lead to a reassessment of the age of the Pinguicula Group.

Correlations

Correlations between the Pinguicula Group (units A – C) and the lower Fifteenmile Group (units PR1 and PR2) are based on stratigraphic similarities and contact relationships with the underlying rock units. The lower Fifteenmile Group unconformably overlies the Wernecke Supergroup and Wernecke Breccia. This relationship is analogous to that in the Wernecke Mountains, where unit A of the Pinguicula Group unconformably overlies a regolith developed in Wernecke Supergroup and Wernecke Breccia. In addition, unit PR1 and units A and B of the Pinguicula Group have similar stratigraphic characteristics, including sandstone overlain by black and green siltstone and orange-weathering dolostone. Similarities can also be drawn between unit PR2 and Pinguicula Group unit C, which are both grey-weathering dolostone.

Conclusions

The age of the Pinguicula Group may not be as old as previously considered by Thorkelson et al. (2005). A 1380 Ma dyke, previously thought to crosscut Pinguicula unit A, is now regarded as crosscutting only the Wernecke Supergroup. The contact relationship between the Pinguicula Group and the Hart River sills is now comparable to the relationship in the eastern Ogilvies

documented by Abbott (1997), which shows the Pinguicula Group unconformably overlying the Hart River sills and possibly related volcanic strata. Elimination of the crosscutting relationship between the 1380 Ma intrusion and the Pinguicula Group means that the latter could be nearly as young as the overlying Hematite Creek Group. Forthcoming age determinations on detrital minerals and crosscutting dykes will test this idea and may further constrain the age and affinity of the Pinguicula Group.

Contacts between units A, B and C of the Pinguicula Group are gradational. The gradational contact between units A and B was previously suggested, but the nature of the contact between units B and C was not well understood. Firm documentation of a gradational contact between units B and C confirms that all units of the Pinguicula Group belong to a single, conformable succession.

Correlations between the Pinguicula Group and strata in the adjacent western Ogilvie Mountains were revisited. At this stage, correlations between PR1 and PR2 of the lower Fifteenmile Group with units A, B and C of the Pinguicula Group seem most favourable. Additional work involving comparison of isotopic signatures and detrital mineral populations will serve to test this hypothesis.

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