Geothermal Potential of Hot Plutons in Western Canada

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Cretaceous and younger intrusive bodies of the Canadian Cordillera have been noted to have higher than average U, Th, K concentrations and consequently high heat generation. Reported heat generation values range up to 6.5 μW/m3 in British Columbia, 11.4 μW/m3 in Yukon, and 14.2 μW/m3 in the Northwest Territories. Previous work has demonstrated high thermal gradients in intrusives up to 54 °C/km. Many of these plutons show signatures of geothermal anomalies such as the common occurrence of thermal springs that discharge along their flanks, including some of the highest temperature thermal springs in Canada (e.g. 83 °C Dewar Creek Spring and 83 °C Hoodoo Spring). Stable isotope data indicate that these springs are fed by deep circulating meteoric waters implying active hydrologic systems. Thus, while the plutonic bodies themselves have very low permeability, adjacent hydrothermal systems point to potential geothermal systems in host rock deformed by the intrusion. These geothermal targets occur throughout the Cordillera but have yet to be fully explored. Here will be presented an overview of known intrusions, the range of heat generation values, and associated thermal spring systems. However, most of these systems in the Canadian Cordillera remain poorly characterized.

INTRODUCTION

As with other nations, Canada faces the challenge of meeting net-zero emission targets that requires bringing online a range of renewable energy sources. While geothermal energy could be part of this solution, Canada has yet to develop this resource. More research is required to define areas of the country with the highest potential to focus exploration and development activity. Here we focus on assessment of localized heat-generation associated with young intrusive rocks of the Canadian Cordillera. The Canadian Cordillera formed during accretion of allochthonous terranes from Early Jurassic through to the Early Eocene via subduction of intervening oceanic lithosphere. Compression was finally terminated through Early to Middle Eocene crustal extension and orogenic collapse. Subduction and extensional events were associated with igneous intrusion that are now exposed as plutonic rocks throughout the Canadian Cordillera (Fig. 1). These Cretaceous and younger intrusive bodies can have higher than average U, Th, K concentrations that leads to anomalously high heat generation. In general, there are limited data on these bodies and we review here what has been studied to date, focusing on three major region, Yukon Territory, Norwest Territories, and British Columbia.

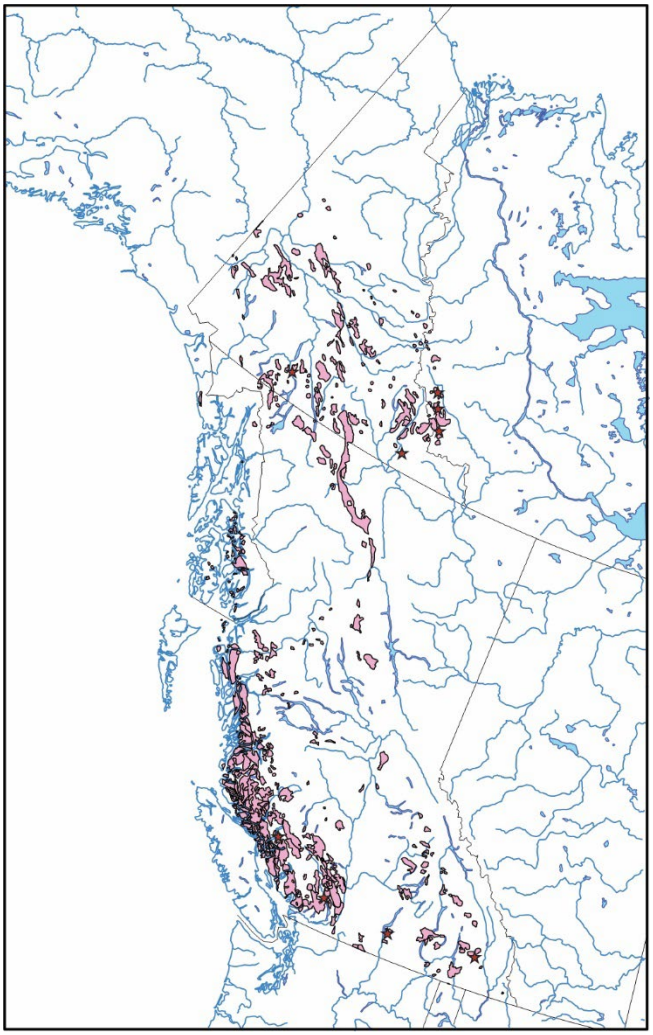

Figure 1. Occurrence of Cretaceous and younger plutons in western Canada. Red starts indicate locations of known thermal springs associated with plutons.