

Thermal structure of the Cornwall Batholith

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Keywords: Cornubian Batholith, Cornwall, United Kingdom, temperature, radiogenic heat production.

ABSTRACT

The Cornubian Batholith is the geological backbone of the Cornwall peninsula, composed of six major granitic plutons (Dartmoor, Bodmin, St. Austell, Carnmenellis, Land's End, and the Isles of Scilly) and extends SW to the offshore. It is of Permian age and was emplaced into Devonian and Carboniferous sedimentary and igneous rocks that were deformed and regionally metamorphosed during the Variscan orogeny.

Cornwall has long been recognized as having a strong geothermal potential. The first geothermal project began here in 1977 as a research HDR (Hot Dry Rock) project at Rosemanowes Quarry. In the present day, a number of projects are based here with the aim of retrieving geothermal energy for power and heat generation, with perhaps the best-known example being the Eden Project. In all cases, however, the project development relies on the radiogenic heat production as a source of heat. This thermal origin is supported by surface heat flow measurements that show very high values ($> 120 \text{ mW.m}^{-2}$).

To support the development of geothermal energy, this work aims to understand the temperature evolution in depth based on an integrated study. The 3D model is the core of this model and will consider the thermal conductivity and heat production in both the granite bodies and covering sediments. The airborne geophysics measurements (including airborne radiometric) is a very good source of information on the heat production in the granites and the heat flow measurements acquired through the last few decades will give a good calibration to the system.

1. GEOLOGICAL OVERVIEW OF CORNWALL

The Cornubian Batholith (Fig. 1) represents a significant part of the Cornwall peninsula. The batholith is composed of six major granitic plutons (Dartmoor, Bodmin, St. Austell, Carnmenellis, Land's End, and the Isles of Scilly). The top of each individual granitic intrusive body is outcropping but a

significant part remains buried under sedimentary rocks.

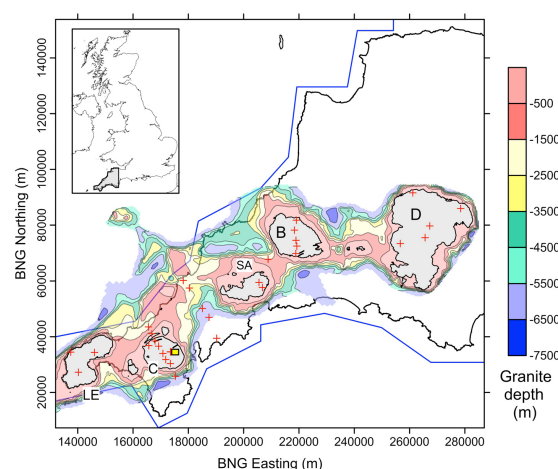


Figure 1: Depth of the Cornubian Batholith. D: Dartmoor, B: Bodmin, SA: St. Austell, C: Carnmenellis, LE: Land's End, and the Isles of Scilly (source: Beamish and Busby, 2016).

The sediments (Fig. 2) that are covering the Cornubian Batholith have been deposited at the Lower Carboniferous (Silesian and Dinantian) and Devonian. The composition of these sedimentary layers can be seen as complex as most of the deposition is detritic and has happened during the tectonically active period.

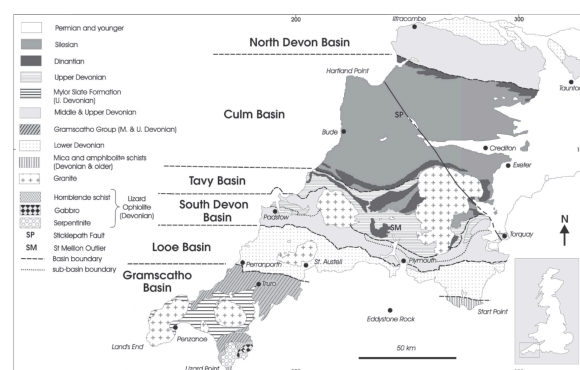


Figure 2: Sediments on the Cornwall Peninsula (source: Leveridge and Hartley, 2006).

2. TEMPERATURE MODELLING

The modelling of the temperature has been performed in 1D. The aim of this case study is to test a few parameters including the impact of the radiogenic heat production and sedimentary cover on the final temperature, and the relationship between measured surface heat flow and actual temperature in depth.

The fixed parameters for this modelling are show in Table 1:

Thickness lithosphere 110 km (Hardebol et al 2010)

Crustal thickness 30 Cloetingh et al. 2010

For citations, please use (name year) for one author, (name and name year) for two authors, or (name et al year) for three or more authors. If the name of the cited author is part of the sentence, use (year) after the name; example: As Smith (2012) has stated, ...

Make sure that all items referenced are listed in the chapter “References”, and also that all entries in “References” are actually cited in the text.

Each equation should be shown on its own line line and carry a number (in consecutive order) on the right margin, in squared brackets, as shown below.

$$2 + 2 = 4$$

[1]

This will allow you to make references to individual equations, as here to equation [1].

2.1 Subchapter Title, bold, 3 pt spacing before and after

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FIGURE

Figure x: This is a figure caption, bold, 6 pt space before and 9 pt space after, indented from the second line on by 0.95 cm.

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3. CONCLUSIONS

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Author, A. and Author, B.: Example of a conference paper, *Proceedings of the European Geothermal Congress 2007*, Unterhaching, Germany, (2007), paper #001, 1-6.

Author, A., Author, B., Author, C. and Author, D.: Example of a journal publication, *Journal*, **xx**, city, (year), 153-166.

Author, A.: Example of a book, *Publishers*, city, (year).

Author, A. and Author, B.: Example of a chapter in an edited book, in: Edited Book, Author, C. (Ed.), 153-166, *Publishers*, city, (year).

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