

Barents Sea: Improved chronology of Cenozoic exhumation using (U-Th)/He dating of apatite



A new study proposed by Geotrack International

The importance of Cenozoic exhumation to hydrocarbon exploration in the Barents Sea is well known. However, a range of opinions have been expressed regarding the precise chronology of exhumation, with some workers favouring a post-glacial (<1 Ma) onset for the main phase.

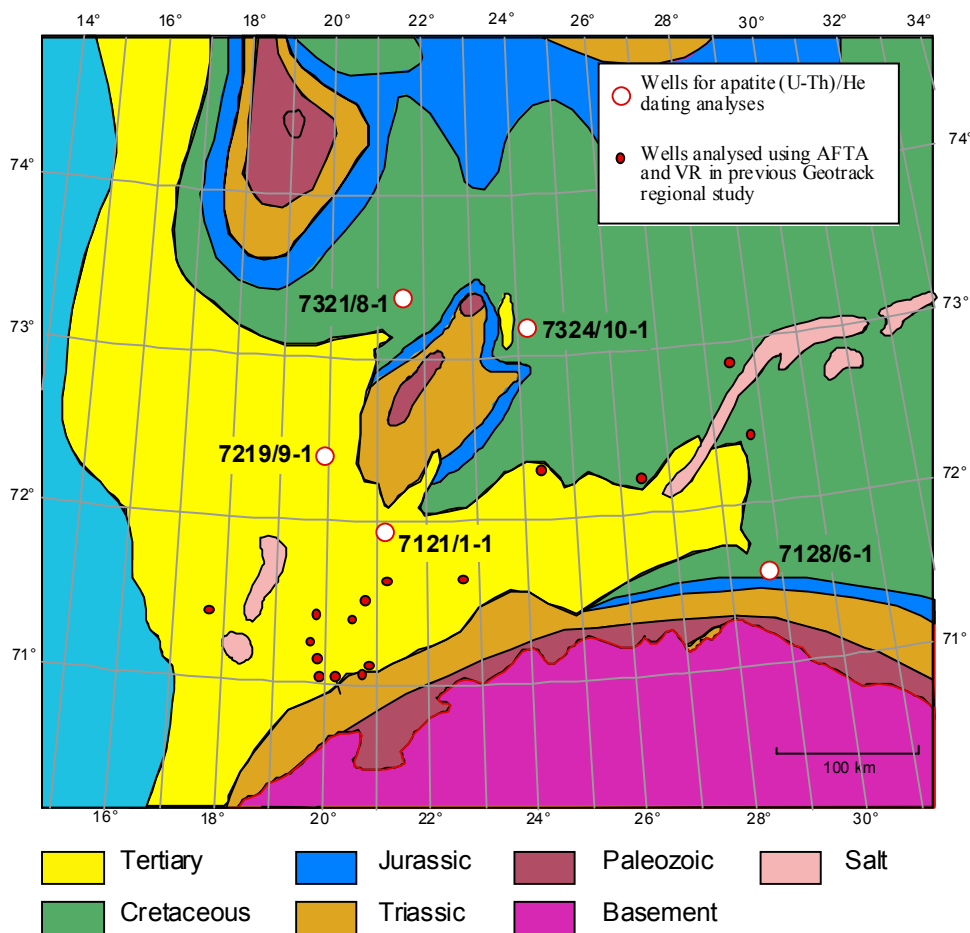
In Geotrack's recent non-exclusive study of the Barents Sea region, three discrete Tertiary exhumation episodes were identified, with preferred timings in the intervals: 65 to 45 Ma (Early to mid-Tertiary), 40 to 35 Ma (mid-Tertiary) and 10 to 5 Ma (Late Tertiary). Very little effect could be attributed to post-glacial events, in contrast to widely held beliefs regarding the evolution of this basin.

Establishing an accurate chronology of events forms a vital part of any successful exploration program, particularly in order to identify regions in which elements of the petroleum system were assembled in the sequence required such that economic accumulations can be preserved to the present day.

With this in mind, the advent of (U-Th)/He dating of apatite, offering unique sensitivity in constraining low temperature (<70°C) thermal histories, provides a unique opportunity to further refine the chronology of exhumation in the Barents Sea. The proposed project is based on samples currently in-house, allowing the project to be initiated immediately.

Benefits of supporting the study include:

- improved chronology of exhumation
- improved understanding of regional thermal history trends for petroleum prospectivity assessment
- evaluation of the new technology of (U-Th)/He thermochronology
- detailed report containing all data and interpretations



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Proposed work program

The proposed study is based on new (U-Th)/He dating analyses of apatite conserved from previous Geotrack studies in the Barents Sea region. These results will be integrated with the thermal history framework established from the existing AFTA and VR data from each well in order to define the chronology of Cenozoic cooling related to exhumation with greater precision than currently available.

Wells for the proposed study have been selected based largely on the existence of good thermal history constraints from AFTA and VR, from our previous non-exclusive study of the Barents Sea region (Geotrack Report #642), and availability of further quantities of apatite for analysis, in addition to providing broad regional coverage. To obtain useful results from (U-Th)/He dating, samples must be taken from relatively low present-day temperatures, such that the effects of heating in the past can readily be resolved from any loss of Helium produced by the present-day thermal regime. This poses rigorous constraints on the selection of suitable samples for analysis. In practical terms, this requires that all samples should be from temperatures less than ~60°C. When combined with the requirement of analysing samples over a range of depths, in order to constrain thermal history models in detail, the following wells have been selected for analysis:

7121/1-1	(U-Th)/He dating in 4 samples.
7128/6-1	(U-Th)/He dating in 4 samples.
7219-9-1	(U-Th)/He dating in 4 samples.
7321/8-1	(U-Th)/He dating in 4 samples.
7324/10-1	(U-Th)/He dating in 2 samples.

Further details on the apatite (U-Th)/He dating technique and its application to low temperature thermochronology can be found e.g. on our website; www.geotrack.com.au. A number of additional AFTA and VR analyses are also planned in selected wells to fill in sampling gaps.

Timeframe

The project is ready for immediate initiation as soon as sufficient commitments are received, with samples currently in house and awaiting analysis. We anticipate completion of the final report four months after initiation.

Budget

Cost per company is US\$14,500, with group escalation rates for working groups as follows:

2 companies - 1.6 times: 3 companies – 2.1 times: 4 companies - 2.5 times.

Deliverables

All sponsoring companies will receive a detailed report containing :

- Thermal history interpretation of (U-Th)/He dating results in the context of reconstructed thermal history framework derived from AFTA and VR data in each well (including best estimate of peak paleotemperatures and the time at which cooling commenced).
- Regional synthesis of results in terms of chronology of Cenozoic exhumation in each well and variation across the region.
- Background information on analytical details and (U-Th)/He dating of apatite.
- All basic data (including (U-Th)He dating, fluid inclusion results, new AFTA and VR data).

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