Five wells: which five?

Planning a shallow stratigraphic drilling campaign when only a few wells are allowed: which sites to drill, what their cores can date, and what the first cores change.

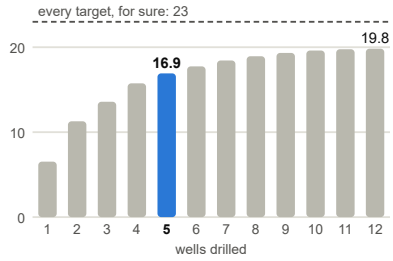
THE CAMPAIGN BEHIND IT

10 wells
300 m of core
13 stratigraphic units

Where older units come up beneath the seabed, short cored holes give the first hard data on source rock, reservoir and seal in a basin with no wells, years before an exploration well. My part as the geologist: planning and supervision of the first shallow stratigraphic drilling campaign on the Russian Arctic shelf (Malyshev et al., 2023, which I co-authored). The campaign was planned for five wells and drilled ten in one season. I appeared in a Discovery Channel documentary on the Arctic drilling campaign.

THREE FINDINGS, ON A MADE-UP EXAMPLE

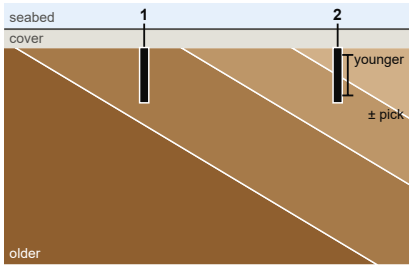
A Why not stop at five: what each next well buys



Five wells out of twelve candidate sites take 85 % of what all twelve could give, and the source rock and one key boundary still rest on a single hole. Fewer wells is not the aim here: the product is core and the scarce resource is the weather window, so each extra hole in the same season is another try at the targets.

> **The real campaign:** sites were principal and reserve; a reserve well, drilled during a storm mooring, reached the same unit as a principal one.

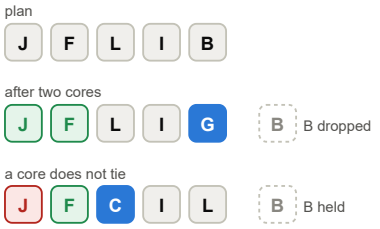
B The weak link is dating, not coring



About six of seven target units are cored, but fewer than three of six boundaries dated. A boundary is dated only if the hole brings back core, the core crosses it, and the rock on both sides gives an age. A core in the middle of a unit is safe on a rough pick; one across a boundary is worth more, and needs a sharp one.

> **The real campaign:** fossil ages moved two boundaries on the seismic; well SSD 23 gave no macrofauna and was dated by palynology.

C The first cores change the plan



A core that fits the seismic pick narrows where its horizon can lie at the other sites, and the wells still to drill are chosen again. Here the fifth well changes, mainly because the first hole brought back what its back-up was planned for. One that does not tie puts the sites on that horizon on hold until it is re-picked.

> **The real campaign:** later sites were adjusted from seismic shot during the drilling, not from cores; the first results tend to make the section older than the base model.

WHERE A RELATED QUESTION COMES UP

- **Core points in an exploration or appraisal well:** the middle of the target or across its top, when the depth of that top comes from seismic with an error.
- **Shallow core holes near outcrop, in clastics and carbonates alike:** core holes tied to Devonian outcrops in northern Saudi Arabia (Breuer et al., 2015) and a 50 m core at a Jurassic carbonate outcrop in central Saudi Arabia (Ramdani et al., 2022, a core dataset).
- **Stratigraphic drilling by geological surveys:** a handful of holes per campaign, sites chosen on several criteria at once, as in Australia's National Drilling Initiative (MinEx CRC).

CHECKED

The page carries 49 checks and all pass: 17 against answers worked out by hand, 32 against an independent count of two million random draws. They test the arithmetic, not the geology.

LINKS

The page: maxim-balaguroff.github.io/how-sure
The paper: doi:10.2113/RGG20224459
Code and DOI: github.com/maxim-balaguroff/how-sure, doi:10.5281/zenodo.24242389

Built with AI assistance; the geology and the checks are mine. The example is made up; no survey or well data. CC BY 4.0

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