

# SAMPLING FOR AFTA®

AFTA® requires samples of sandstone or coarse siltstone - unwashed, or washed and dried cuttings, whole core, sidewall cores or outcrops. Apatite is among the most resistant of accessory minerals and is common in sediments and many basement rock types. Sandstones, coarse silts, sandy or silty shales and a range of igneous and metamorphic rock types are suitable for analysis. In sandstones, it is advisable to collect the most mineralogically immature units, and in general we find that 80 to 90% of sandstone samples collected on this basis contain sufficient apatite for analysis.

In a downhole AFTA study, each cuttings or core sample can be composited over a depth interval representing a range in downhole temperature of not more than about 5°C, corresponding to a depth range <170m for a typical geothermal gradient of 30°C/km. A single sample should not be composited across a major stratigraphic boundary or unconformity. If core is used, we do not need an integral solid piece of core. As the sample will be crushed anyway, we can use offcuts, rubble or scraps left behind from previous sampling.

Samples from depths where present downhole temperatures exceed about 110°C are not generally useful for AFTA (corresponding to about 3400m for a typical geothermal gradient of 30°C/km).

## SAMPLE SIZE

A composite sample of 500-1000g (1-2lb) is required. There may be situations where a greater or lesser amount is needed e.g., if the sample is a clean quartzose sand, a larger sample may be required. In contrast, for a less mature sandstone, or a granitic rock, 200-500g may yield enough

apatite. It is better to err on the side of too much rather than too little.

## SAMPLING STRATEGY

Sampling strategy depends on the problems to be addressed. We recommend that you contact us to discuss your specific requirements. It is always very useful, where possible, to review vitrinite reflectance (VR) data before planning an AFTA program. Geotrack provide a VR service and we are happy to evaluate existing data before recommending an optimum sampling strategy for AFTA. If VR data indicate that the section has been hotter in the past, this can help target the optimum AFTA samples to obtain the timing of maximum paleotemperatures. Some examples of sample strategy to address specific problems are given below.

### Constraining paleogeothermal gradient, uplift and erosion:

If a key problem is constraint on paleogeothermal gradients, e.g., to determine the amount of section removed by uplift and erosion, a vertical sequence of AFTA and VR samples is required through the largest possible section in a well, i.e. from near surface to TD, bearing in mind the maximum present downhole temperature limit for AFTA. Between 4 and 8 AFTA samples may be needed in this case, depending on the quantity and quality of the VR data.

### Constraining time of maximum paleotemperatures:

If the problem is to determine when a section cooled from its maximum paleotemperatures, the optimum samples for AFTA would come from sections where the VR is about 0.7% or more, and where the downhole temperature is less than about 90°C if possible. A single sample from this setting may be sufficient to provide a tight

constraint on timing, but 2 or 3 samples over a limited range of depths would be advisable.

### Reconnaissance survey:

If little is known of the thermal history, we would advise 6 to 8 AFTA samples spread over the largest possible vertical section in the well, from near surface down to a depth where present day temperatures are about 110°C. All major stratigraphic units should be sampled, and a complete VR profile should be collected if possible.

### Outcrop surveys:

The application of AFTA in frontier basins utilising either outcrop samples or samples from seismic shot holes is extremely cost-effective in defining thermal history constraints early in an exploration program. The number of samples needed to provide a thermal history framework will depend on the complexity and size of the area. We recommend that you discuss specific details with us before collecting samples for AFTA.

## OTHER REQUIREMENTS

A certain amount of basic information is required to produce a comprehensive interpretation report; e.g., general stratigraphic data (depths to formation tops), sample depths and stratigraphic ages, and estimates of present-day downhole temperatures.

It is also useful to have some knowledge of the location of the samples in relation to known regional structure. We highly recommend obtaining vitrinite reflectance data from the area of an AFTA survey. In our reports, we routinely integrate AFTA interpretations with vitrinite reflectance results to provide the most rigorously constrained thermal history available using existing technology.

For further details contact: Email: [mail@geotrack.com.au](mailto:mail@geotrack.com.au)

WEB: [www.geotrack.com.au](http://www.geotrack.com.au)

**Geotrack International Pty Ltd** ABN 16 006 821 209

37 Melville Road, Brunswick West, Victoria 3055 Australia

telephone: national (03) 9380 1077 international +613 9380 1077 facsimile +613 9380 1477

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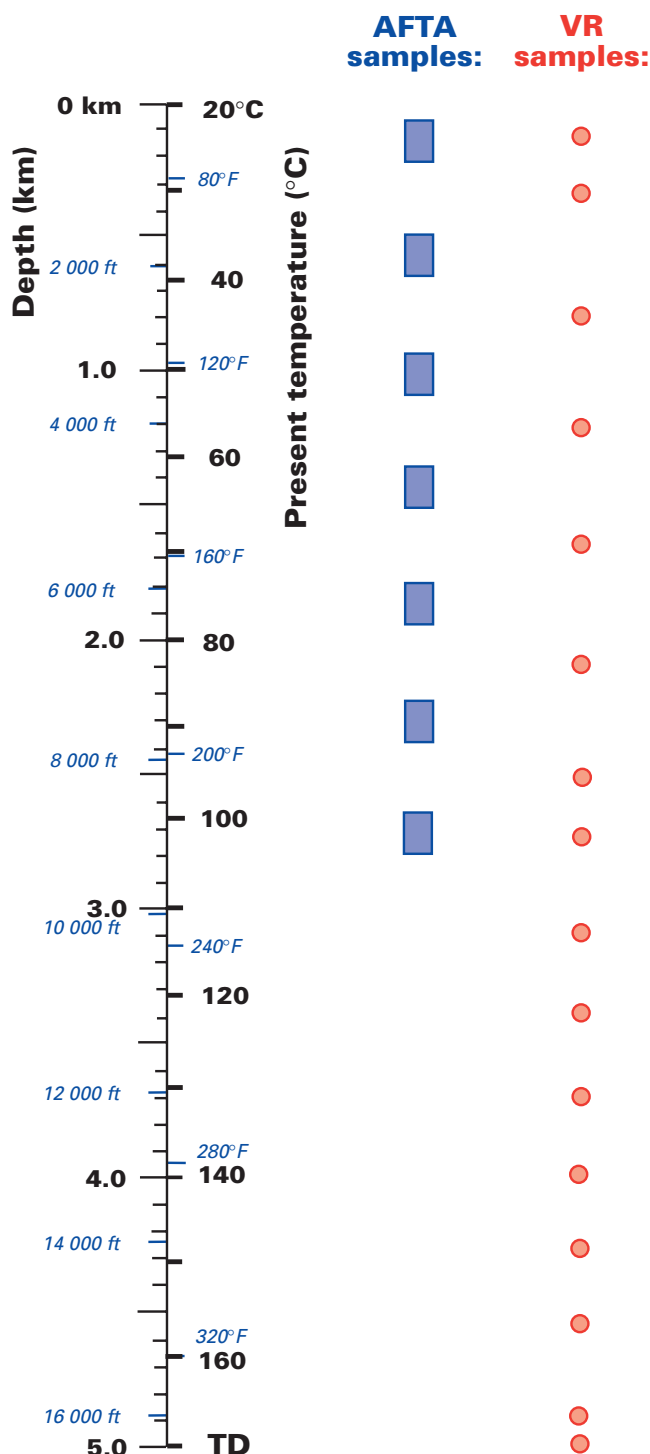
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## EXAMPLE OF AN AFTA SAMPLING SCHEME FOR A RECONNAISSANCE WELL:

- In this example, the surface temperature is 20°C (68°F) and the present geothermal gradient is 30°C/km (1.65°F/100ft).
- Samples should be collected across a temperature range of no more than 5°C (9°F), so that in this example, samples are composited over intervals no more than 170 metres (560 ft).
- Samples should not be composited across a major unconformity. If an unconformity exists, samples should be selected to closely bracket the unconformity on either side.
- Although not specified in the adjacent diagram, AFTA (apatite fission track analysis) samples should be collected from predominantly sandy lithologies, while VR (vitrinite reflectance) samples will be from predominantly finer grained lithologies. Hence, the full well sequence can often be covered by these complementary techniques.
- Sample collection throughout the entire well (where possible) is encouraged to enable the tightest possible control on the paleo-temperature profile, and hence the paleo-geothermal gradient.

***Remember that no sampling strategy can apply universally - which is why we offer a free appraisal of your thermo-tectonic problem so as to customise the most cost-effective sampling program which can address your study objectives.***

### Reconnaissance well



For further details contact: Email: [mail@geotrack.com.au](mailto:mail@geotrack.com.au)

WEB: [www.geotrack.com.au](http://www.geotrack.com.au)

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