



Minimum data requirements (Round 19) for geochronology, petrography, geochemical analysis and other geological analyses

Overview

This document outlines the minimum data requirements required to be eligible to claim costs for geochronology, geochemical analytical costs, petrology, organic petrology and geochemistry, isotope analysis and/or palaeontological analysis. If you wish to claim for a geological analysis not listed below, please contact the collaborations.DME@nt.gov.au team to confirm eligibility and minimum data requirements.

All project deliverables must comply with the reporting and data in [Guideline 7 Reporting on Mineral Titles](#) and [Guidelines for NT Onshore Petroleum Reporting and Data Submission](#) to meet funding obligations. Amendments to the final report and/or data may be requested via email by the Collaborations grant manager or the Northern Territory Geological Survey Exploration Evaluations Team. The Northern Territory Geological Survey will review and accept the submission.

If data is too large to upload using GrantsNT, please contact the collaborations.DME@nt.gov.au to supply the data by the NTGS FTP site. If unable to successfully transfer via FTP, you will be required to submit via hard drive. The supply of a hard drive and delivery will be at your own cost.

Sampling conditions

Where samples are collected from drill core funded under the “Greenfields drilling” or “Brownfields diamond drilling” project categories, samples can only be taken from the half of the drill core belonging to the proponents. A minimum of half core is still required to be offered to the Northern Territory Geological Survey Core Facility per the Funding Agreement.

All derivative material (e.g. grain mounts of separated minerals, digital mount maps, thin and polished sections or blocks, palaeontological materials, etc.) are required to be offered to the Northern Territory Geological Survey Core Facility where eligible costs were claimed for the production of the material and/or study undertaken on the material.

All analytical results must be reported including sufficient sample source location and any other relevant analytical metadata as specified in relevant section below (e.g. pertaining to geochronology, isotope analyses, geochemistry and palaeontology).

Mandated sample metadata (all datasets)

Every dataset must include:

- **Sample identification** (unique ID).
- **Location details** (either longitude, latitude and datum or easting, northing, projection and zone).
- **Drillhole name and sample depth** (if from drilling).

Additional specific requirements are outlined below for a range of geological analyses, if you wish to claim for a geological analysis not listed below, please contact the collaborations.DME@nt.gov.au team to confirm eligibility and minimum data requirements.

Multi-element analysis

Geochemical analytical costs may be claimed where meeting a minimum standard which must include at least 48 multi-element 4 acid digest ICP-MS, plus fire assay when targeting gold. Full major element oxide analysis by XRF (not pXRF) is highly desirable. Partial digest or partial analysis is not acceptable.

Reporting will be as per [Guideline 7 Reporting on Mineral Titles](#) including lower levels of detection for each element. The collaborations report must detail the:

- Analytical laboratory
- Pre-analysis sample preparation (e.g. screening, crushing, milling, mineral picking)
- Sample preparation (e.g. Digestion, fusion,)
- Elements of interest
- Quality control approach (e.g. reference material samples to be analysed, number of duplicate samples)

Petrography

- All thin sections should be 25 x 48 mm polished thin sections with no cover slips.

Geochronology and trace element analyses

Every dataset must include:

- **Sample identification** (unique ID).
- **Location details** (either longitude, latitude and datum or easting, northing, projection and zone).
- **Drillhole name and sample depth** (if from drilling).
- **Rock description and mineral analysed.**
- **Analytical method** (instrument and lab details, including session protocols).
- **All measured isotope or elemental ratios and concentrations**, with uncertainties and correlation coefficients, for both the sample and the reference material.
- **Data in a structured format** (CSV or Excel, **not PDFs**).
- Copies of images showing labelled locations of analyses

Requirements for specific analyses

If wishing to use a geochronology method not listed below, please confirm with collaborations.dme@nt.gov.au that the method is eligible for co-funding and the requirements for analysis.

Microanalysis of separated minerals (U-Pb, Lu-Hf, trace elements, etc)

- Following concentration, minerals (zircon, monazite, etc.) must be handpicked to >90% purity
- Hand-picked minerals should be mounted in an epoxy mount, normally 25mm in diameter and 5mm thick.
- A labelled reflected-light image must be prepared of the entire mount.
- Detailed images must be prepared of all separated minerals in each sample:
 - For zircon: transmitted-light, reflected-light (or back-scattered electron, and cathodoluminescence.
 - For monazite: transmitted-light, reflected light, and high-contrast back-scattered electron.
 - For other minerals: an appropriate combination of the images listed above for zircon and monazite.
- The detailed images must be used to guide analyses
- Images must be labelled with analysis location in a consistent and meaningful fashion.
- Trace element data that can help improve or supplement the age interpretation should also be provided. For example, for U-Pb geochronology additional data could include: rare earth elements and yttrium, titanium, hafnium, elements used to monitor analysis quality such as iron, phosphorus, calcium, silicon or zirconium.

SHRIMP U-Pb and LA-ICP MS analysis

All analyses must be guided by appropriate images.

For analysis of separated mineral crystals, consistent labels must be applied to both digital analysis results and images.

All raw (unedited) data files must be provided to the Northern Territory Geological Survey. Data filenames must include the sample identifier and date of analysis.

Table(s) of reduced/interpreted data must be provided to the Northern Territory Geological Survey in the specified format.

Copies of images showing labelled locations of analyses must be provided to the Northern Territory Geological Survey.

Isotope studies

Lu-Hf analysis

- Use the same grain/spot analysis label as using during SHRIMP analysis to avoid any post-analysis cross-tabulation problems.

- Provide the metadata for each sample:
 - Date of analysis
 - Instrument, laboratory and analyst
 - Date of data processing and processor/interpreter
 - Parameters used in calculation:
 - Decay constant of ^{176}Lu including reference
 - Chondritic $^{176}\text{Lu}/^{177}\text{Hf}$ and $^{176}\text{Hf}/^{177}\text{Hf}$ ratios and reference
 - Depleted mantle $^{176}\text{Lu}/^{177}\text{Hf}$ and $^{176}\text{Hf}/^{177}\text{Hf}$ ratios and reference
 - Average continental crust $^{176}\text{Lu}/^{177}\text{Hf}$ ratios and reference
- Provide measured and calculated values for both sample and reference material analysed in the same analytical session.
- The data should contain the following fields:
 - Sample spot identification
 - Crystallisation age (Ma) used in calculations
 - Measured $^{176}\text{Hf}/^{177}\text{Hf}$ and measured $^{176}\text{Hf}/^{177}\text{Hf}$ 1 sigma uncertainty
 - Measured $^{176}\text{Lu}/^{177}\text{Hf}$ and measured $^{176}\text{Lu}/^{177}\text{Hf}$ 1 sigma uncertainty
 - Measured $^{176}\text{Yb}/^{177}\text{Hf}$ and measured $^{176}\text{Yb}/^{177}\text{Hf}$ 1 sigma uncertainty
 - Measured $^{178}\text{Hf}/^{177}\text{Hf}$ and measured $^{178}\text{Hf}/^{177}\text{Hf}$ 1 sigma uncertainty
 - Calculated initial $^{176}\text{Hf}/^{177}\text{Hf}$ value and calculated initial $^{176}\text{Hf}/^{177}\text{Hf}$ 1 sigma uncertainty
 - Calculated epsilon-Hf value and calculated epsilon-Hf 1 sigma uncertainty
 - Calculated T_{DM^2} value (Ma)

Oxygen analysis

The data table for oxygen analyses of both samples and standards will contain the following minimum information:

- Sample number
- Date of analysis
- Use the same grain/spot analysis label as using during SHRIMP analysis to avoid any post-analysis cross-tabulation problems
- Measured $^{18}\text{O}/^{16}\text{O} \pm 1$ Standard Error (internal %)
- Measured $^{16}\text{O}^1\text{H}/^{16}\text{O} \pm 1$ Standard Error (internal %)

- Drift-corrected $^{16}\text{O}^1\text{H}/^{16}\text{O} \pm 1$ Standard Error (internal %)
- SIMS corrected $\delta^{18}\text{O}$ (in ‰) normalized to VSMOW.

Data for all sample batches will include information on:

- Instrument, laboratory details and analyst
- True $\delta^{18}\text{O}$ values of all standards analysed and references

Sm-Nd analysis

The data table for Sm–Nd analyses will contain the following minimum information:

For each sample:

- Sample number
- Analyte (whole rock or mineral)
- Analysis date
- Sm ppm
- Nd ppm
- $^{143}\text{Nd}/^{144}\text{Nd}$, measured
- $^{143}\text{Nd}/^{144}\text{Nd}$, normalized to La Jolla (0.511850) or other agreed standard
- 1 sigma uncertainty on $^{143}\text{Nd}/^{144}\text{Nd}$ (within-run variation)
- $^{147}\text{Sm}/^{144}\text{Nd}$

For each sample batch:

- 1 sigma uncertainty on $^{147}\text{Sm}/^{144}\text{Nd}$ (from replicates)
- Standard name
- Standard true value
- Standard measured value
- Lab blank (and blank-corrected $^{143}\text{Nd}/^{144}\text{Nd}$ if blank significant).

Data for all sample batches will include information on:

- laboratory details
- decay constants used.

Rb-Sr analysis

The data table for Rb–Sr analyses will contain the following minimum information:

- Sample number
- Analyte (whole rock or mineral)\

- Analysis date
- Rb ppm
- Sr ppm
- $^{87}\text{Sr}/^{86}\text{Sr} \pm 1$ standard error
- $^{87}\text{Rb}/^{86}\text{Sr} \pm 1$ standard error
- Similar data for standards

Data for all sample batches will include information on:

- Laboratory details
- Decay constants used.

Paleontological analysis

A report containing both basic and interpretative results of any examination of paleontological material must be submitted in PDF format. The report must include at a minimum:

- The full name and affiliation of person undertaking the work
- Full material listing and results
- A range chart in .xlsx or .csv file format if appropriate (mostly for palynological or micropaleontological reports).
- Photos of the palaeontological material

All fossils must be offered for curation within the Northern Territory Geological Survey. This includes all type and figured materials (holotypes, paratypes, and other primary and secondary types).

Petroleum analysis standards

Organic Petrology (source rock and thermal maturity studies)

A report containing both basic and interpretative results must be submitted in PDF format, and must include, at a minimum:

- Name of analysis laboratory
- Listing of samples, including the well/drillhole, sample numbers, sample type and analysis performed on each sample
- Sample preparation details, including mounting, grinding and polishing methods
- Examination/measurement methods and details
- A table summarising reflectance results
- Thermal maturity interpreted from examination/measurement results
- Potential of hydrocarbon or other fluid energy resource.

- Glossary of abbreviations, acronyms and terminology

Tabled results in Excel format, including:

- Sample description including lithology, organic maturity and details of relative maceral abundance and liptinite fluorescence characteristics
- Maceral composition and maturity of the sample suite

Organic Geochemistry (Rock eval/total organic carbon)

A report containing both basic and interpretative results must be submitted in PDF format, and must include, at a minimum:

- Name of analysis laboratory
- Listing of samples, including the well/drillhole, sample numbers, sample type and analysis performed on each sample
- Sample preparation details
- Analysis methodology
- Glossary of abbreviations, acronyms and terminology

Tabled results in excel format, including:

- Sample numbers
- Sample types
- Total organic carbon (TOC) (wt. % of rock)
- Volatile hydrocarbons (HC) (mg/g rock) (S1)
- Hydrocarbon generating potential (mg/g rock) (S2)
- Organic carbon dioxide (mg/g rock) (S3)
- Potential yield (mg/g rock) (S1 + S2)
- S2/S3 (where available)
- Max temperature S2 (°C) (TMax) (where available)
- Production index (PI) (where available)
- Hydrogen index (HI) (where available)
- Oxygen index (OI) (where available)

Routine Core Analysis (porosity/permeability)

A report containing both basic and interpretative results must be submitted in PDF format, and must include, at a minimum:

- Name of analysis laboratory

- Listing of samples, including the well/drillhole, sample numbers, sample type and analysis performed on each sample
- Sample preparation details
- Analysis methodology
- Glossary of abbreviations, acronyms and terminology

Tabled results in Excel format, including:

- Sample numbers
- Sampled well/drillhole
- Sample depth
- Confining stress at which measurements were taken (psi)
- Klinkenberg permeabilities (md) (K_{inf})
- Air permeabilities (md) (K_{air})
- Porosity (%)
- Grain density (g/cc)

Fluid inclusion study

A report containing both basic and interpretative results must be submitted in PDF format, and must include, at a minimum:

- Name of analysis laboratory
- Listing of samples, including the well/drillhole, sample numbers, sample type and analysis performed on each sample
- Sample preparation details
- Analysis methodology
- Chemical zones identified
- Analytical result displays
- Photomicroscopy (where petrography is conducted)
- Reference spectra displays
- Individual spectra displays
- Glossary of abbreviations, acronyms and terminology

Raw analysis results in ASCII format with complete header information must also be provided.