Fossil Record Electronic Database (FRED) User Manual
Version 1.0
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1 Document Purpose

The purpose of this document is to provide a basic overview of FRED for new users, and detailed operating instructions for all new and current users. The sections describing FRED's search capabilities are presented as a series of tutorials rather than a usage reference, because it is impossible to anticipate how different researchers may want to use these features.

2 Intended Audience

This document assumes that the reader will have an adequate knowledge of their own computer equipment and browser to be able to follow links, open and close tabs, etc., and enough knowledge of simple paleontological and stratigraphic concepts to be able to follow the examples. FRED is a resource intended for amateur fossil collectors and professional paleontologists alike; these instructions are aimed at the same audience.

The authors hope you will find it useful.

3 Version Information

This document is the first edition of the user manual. It does not provide coverage for all functions.
In particular, although there may be passing references to the following topics, comprehensive instructions have been held back for a future edition of this manual:

- creating and editing drill hole records
- creating and editing vertical section records
- managing confidentiality
- adding adoption data
- formatting of "special" taxonomic comments to record census data, slide coordinates, etc.
- administrator and curator functions

Finally, instructions for the bulk entry of data using spreadsheets has been deferred pending the complete redevelopment of the current mechanism, which is in progress at the time of writing. Full user instructions will be added when the new modules become available, which is expected to be in September or October 2018.

4 Background

The New Zealand Fossil Record File is a collection of data concerning fossil collections made primarily on mainland New Zealand and the adjacent Exclusive Economic Zone. In principle, there is nothing to prevent users from recording fossils collected from anywhere in the world, although some functions may be limited.

The Fossil Record File (FRF) is jointly governed by the Geoscience Society of New Zealand and GNS Science, and it is recognised as a "database of national significance" by the New Zealand Government. In terms of its scope, completeness and routine use by the paleontological research community of New Zealand, it is unique in the world.

The paper version of the Fossil Record File was established in 1946, and transcription to the first in a series of electronic platforms commenced in 1970 (see Raine 1992 for a more detailed history and a description of one such platform, which ran through much of the 1980s). Today, the database is served on an Oracle platform, hosted by GNS Science, and the user interface is delivered via HTTP. The electronic version is known as the Fossil Record Electronic Database, or FRED.

Some brief online instructions are provided within the application for operations such as data entry, but these are not context-sensitive, complete, or comprehensive. An initiative is underway to progressively improve this position, and the following manual has also been developed as a partial response.

Please note that this manual is a work in progress and is neither complete nor comprehensive itself. It is intended that new versions will be posted as omissions are progressively filled. Corrections and contributions are welcomed (see Section 6.5 for contact details).

5 Conceptual Overview

The following sections describe some of the terminology which will be used throughout this manual, and provide a conceptual overview to the Fossil Record File, and the data it contains.

5.1 Essential Terminology

Fossil Record File (FRF)	As used in this manual, the phrase "Fossil Record File" refers to the *entire collection of fossil record data*, irrespective of whether it is held on paper or in an electronic database. The two (paper and electronic) datasets are definitely not the same: Whereas the great majority of the old paper records have been transcribed to the electronic database, and only a few are likely to still be hiding in dusty drawers somewhere, most records since the early 1980s have never been committed to paper at all, but have instead been entered directly into the electronic database. Therefore, the electronic version of the data is by far the most comprehensive and includes almost all of the paper-based data as a subset.
FRED	FRED was originally an acronym for "Fossil Record Electronic Database" although, here and in general, the name is mostly used to mean the *online application* that is used to access the FRF database, rather than the database (or the data) itself.
Fossil Record Number (FRN)	Each fossil record in the FRF is identified by a unique "fossil record number" or FRN. The FRN consists of two parts: a map sheet reference and a serial number, separated by the two characters /f. Initially, the map sheet reference was based on the imperial NZMS1 map series. During the 1970s, however, the entire system was migrated to the then-new metric NZMS260 map series, and has remained there despite the NZMS260 having been overtaken by the current NZTopo50 series.

5.2 High Level Description of a "Fossil Record"

The original paper Fossil Record Form was literally a single page (originally foolscap) form designed to capture the key data concerning a *specific fossil collection from a specific location*. The forms were available in pads from which they used to be filled in, torn off, and filed. Extensive files of paper forms still exist. Although the great majority of them have been transcribed to the electronic file, the paper forms continue to be a valuable resource (e.g., for checking suspected inaccuracies).

Each form was assigned a unique number – the Fossil Record Number or 'FRN' – by an administrator with responsibility for the particular region from which the collection was made. As noted above, the FRN consists of two parts: a map sheet reference and a serial number.

On the front side of the paper forms, there are fields to record the FRN, the geographical locality, depth interval in the case of drill holes, collectors' names, collection date, stratigraphic horizon, stratigraphic relationships with other nearby records, and nature of the rock unit.

On the back of the form are fields to record the identifications of the fossils included in the collection, grouped together according to the kind of fossil (e.g. bivalves, foraminifera, pollen) and what we will here call the "*taxonomic analysis*", which is characterised by the person making the fossil identifications and the date when they did so. This is an important concept because, typically, several different people will examine the same collection, each studying and identifying different kinds of fossil, often at different times. Each of these separate examinations will result in a separate "taxonomic analysis" for the same collection. Moreover, the same or a different person might re-examine any of the fossil groups and revise some or all of the identifications at a later date. If this happens, the original taxonomic analysis is retained and a new one is simply appended to the overall record.

The “front” and “back of form” terminology is still widely employed by the paleontological community, especially the older members, even though there is no longer any analogue in the electronic version of the Fossil Record File.

Stages (by convention, chronostratigraphic stages rather than geochronologic ages are used) can be assigned at multiple points. On the front, together with the stratigraphic data, are fields for the known stage limits (bearing in mind that what is “known” is sometimes incorrect) and for the inferred stage. On the back of the form, *each* of the taxonomic analyses has a field for the “determined” stage – i.e., the age indicated by the fossils. Finally, there are also fields for the “adopted” age, which is assigned after consideration of all available data.

In summary, the major conceptual entities embodied in the paper forms that we have examined so far are [1] location, [2] collection, [3] taxonomic analysis, and finally [4] the list of fossils identified in the collection. The same concepts exist in FRED, although they are not always clearly distinguished.

5.3 Re-Collections

Although it happens only rarely in practice, any collection can be re-collected in principle. Perhaps this idea had more merit when the fossil record file was initially conceived in the 1940s, when paleontology was primarily the study of molluscs occurring in beds which were often thick and – as far as could be determined from the macrofossils alone – essentially uniform. If a “re-collection” was made from a metre or two above, below, or to the side of the original collection, nobody would ever know and it probably made little difference anyway.

Today, however, the great majority of new fossil collections are of microfossils, which cannot be seen in the field, and it is now important to distinguish stratigraphic intervals of only a few decimetres, or even millimetres in some cases. Consequently, almost all collections are designated as “new” collections, nowadays, and are allocated their own new FRNs.

Where they are used, re-collections are identified by the addition of an ‘A’, ‘B’, ‘C’, etc. to the FRN of the original collection.

5.4 Outcrops, Sections and Drill holes

A sample collection made in isolation, what most field geologists would call a “spot sample”, is termed an “outcrop” in FRED parlance.

A sequence of rocks occurring along a more or less continuous exposure is usually called a “section”.

In general use, the term “section” is most often applied to a *horizontal* sequence, such as a river bed or roadside outcrop. Although adjacent collections may be only a metre or two apart, and inseparable on a map or by GPS, *in principle* they come from slightly different geographic locations and would have different latitude-longitude references if the coordinates could be made accurate enough.

However, the vertical exposure available from a cliff or high bank is also a small section. In this case the latitude and longitude will be the same for all sample collections, in principle as well as in practice.

Drill holes are somewhat different again. The usual conception is of a vertical hole drilled straight down through the ground but, in fact, drill holes are very often drilled at an angle from vertical, and horizontal holes are commonly employed for fracking. Thus, collections made from drill holes will have differing latitude-longitude coordinates, depending upon depth.

FRED treats these concepts as follows:

- An outcrop sample collection is treated as if it has no context. All data necessary to identify the location, stratigraphic level, and so on, it collected explicitly. Although there are provisions to enter stratigraphic relationships with lithological units and with other sample collections, they must be separately and fully entered for each collection[1]. Each outcrop collection is given a unique FRN.

[1] For example, entering data against collection A to state that it occurs 1 m above B, does not automatically create a record against B to state that it occurs 1 m below A.

- There is no explicit recognition afforded to “conventional” (horizontal) sections at all: Each collection from a typical river- or road-side section is treated as an independent outcrop, and given a discrete FRN, exactly as they would be if they have no relationship at all.
- FRED does explicitly recognise vertical sections and provides a data-entry mechanism to collect locality data once for the entire section, and only collects separate collection data for values (such as lithology) which is likely to vary from sample to sample. The entire vertical section is allocated a single FRN, and the stratigraphic height is used to distinguish the different individual sample collections.
- Drill holes are treated somewhat like vertical sections insofar as data applying to the entire drill hole is collected only once. In particular, the common practice of drilling inclined and deviated holes is ignored; only the latitude-longitude coordinates for the top of the hole are recorded in the Fossil Record File, and the same coordinates are arbitrarily applied to all of the collections from the same hole, which allows an entire construct to be treated as a single “location”. The entire hole is allocated a single FRN, and the depth within the hole is required to distinguish the different collections.

In some cases, the bedding is obvious or can be worked out somehow, and so the stratigraphic relationship between the collections made from a single section can be stated. Both the paper form and FRED systems provide a mechanism for recording stratigraphic relationships between collections, but it is somewhat clumsy and often omitted.

5.5 What the Data Means

A table showing all the different kinds of data item and how to interpret them (or what to enter if you are adding new data) is given in Section 12.1. However, the following sections provide a high level overview.

5.5.1 Locality Data

As noted above, FRED recognises three different “kinds” of locality: outcrops (including horizontal sections), vertical sections, and drill holes. All are required to have the physical locality established as accurately as possible, although not all of the data items apply to every kind of locality. Some of the most important data items are:

Field Number: This field is for the collector’s field number. When data is being entered, prior to a proper Fossil Record Number being allocated, this may be the only way you have of referring to a specific record. Unfortunately, an existing bug in FRED means that the system can be confused by other identical field numbers which may have been entered in the system years ago, so care is required.

Registration Area: When new locality records are added to FRED, they are manually checked (by a human curator) prior to being allocated Fossil Record Numbers and accepted into the database. The ‘registration area’ is used, in conjunction with the actual locality indicated by the coordinates, to divide up the workload among multiple curators. Most often the value will be “Mainland NZ” although a total of 22 registration areas are recognised.

Coordinate System: Before it can accept a grid reference or lat/long coordinates, FRED needs to be told which coordinate system you are using. The most commonly used systems are NZMG, NZTM, NZTopo50, and NZGD2000 (for GPS coordinates), although numerous older systems have been retained for backward compatibility with historic records.

Easting/Northing: These fields record the coordinates in the chosen coordinate system. When entering new data, note that up to 6 decimals places can be entered. For lat/long coordinate systems, enter only degrees (with decimal places rather than separated minute and second components). Do not place a letter ‘S’ after the number; use a leading negative sign unless you really are entering a record for the Northern Hemisphere.

Method: This field records the method by which the coordinates were established. Most often, these days, the location is established either by direct GPS measurement (“GPS – Field”) or by interpolation between these (“GPS – Differential”) but older locations were often established by examining map coordinates.

Locality Description: This field provides space for a free text description of the locality. Less experienced collectors should think carefully about the trade-off between specificity and permanence. Reference points such as fence posts, buildings or trees are often very useful for pinpointing a location exactly, but may no longer be present or recognisable if a site is revisited decades later.

5.5.2 Collection Data

Collectors/Collection Date: The name(s) of the collector(s) and the date the collection was made should be recorded here. At present, FRED is not particularly good at recognising people's names, and it does not attempt to check for duplicates. To help minimise these difficulties, users entering new data are requested to enter collectors' names carefully and consistently, in the "surname comma initials" format. Names in FRED have traditionally been written with full stops between initials. Unless you know that a name has never been entered in FRED before, it is best to stick with this convention, to avoid creating synonyms of people's names.

In the particular case of drill holes, note that the "collector" is the person who sub-samples the core/cuttings for the purposes of making a paleontological analysis. Sometimes this may be the on-site geologist who bags the cuttings. However, in general it is not the exploration company or the rig operator.

Sent To: This field describes who the collected material has been sent to (a person's name and institution), and what for (normally a broad discipline, like "microflora").

5.5.3 Representing Age

There are several places where age data may be recorded within a single fossil record. Each is structured as a "pair", allowing the lower and upper limits of a range to be specified. Each "half" of the pair has a field for specifying the stage, and another which will accept a question mark to indicate uncertainty. By convention, age data in FRED is expressed in chronostratigraphic rather than geochronologic units (e.g., series and stages rather than epochs and ages). Absolute numeric ages are not used for data entry, but can be used in searches.

"Known" stage limits are included in the 'Collection' data. There is one pair (lower and upper) of known stage limit fields for each fossil record. This information is normally supplied by a member of the collecting party at the time the form is registered, which in turn should be soon after field work is completed. It should be remembered that what is "known" is sometimes incorrect; however, these data are not changed over time as new information comes to hand (e.g., from examination of the fossils), but should remain as a permanent record of what was – or what appeared to be – known at the time of the collection.

"Inferred" stage data are also included in the 'Collection' data. Again, this information should be supplied by a member of the collecting party at the time the form is registered, and should not be changed in the light of new information. For obvious reasons, the inferred stage should lie between the known stage limits, assuming the latter are present (they are not mandatory).

"Determined" stages. On the back of the form, *each* of the taxonomic analyses has a field for the "determined" stage – i.e., the age indicated by the fossils. It is important that the age entered is that determined by the individual taxonomic group being studied, and not modified or refined by other evidence known to the paleontologist. The (multiple) determined stages can be anything: there are several reasons why determined stages do not always lie between the known stage limits (e.g., caving, reworking, long or indeterminate stratigraphic ranges for the particular group of fossils being studied, or perhaps the "known" stage limits simply prove to be incorrect) and equally valid reasons why different taxonomic groups might yield mutually inconsistent determinations, too (most obviously reworking, which affects some groups more than others). Again, the determined stages are not updated if/when new information comes to hand, but stand as a record of the analysis carried out at the time.

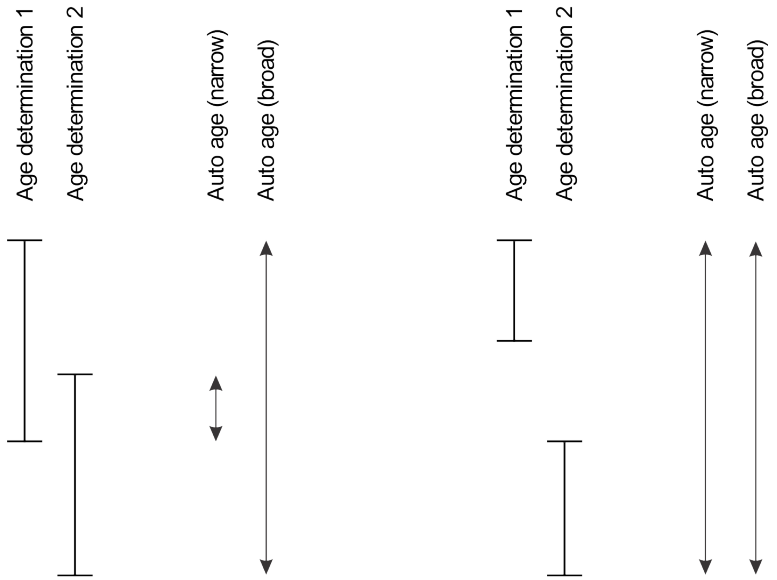
"Adopted" stage. Finally, there are also fields for the "adopted" age, which is assigned after consideration of all available data. This is the one age assignment which may be modified over time, as new data becomes known. The adopted age can thus be entered at any time after the fossil record is registered; however, there is no specific "trigger" to prompt such entry, and many – perhaps most – fossil records do not have adopted ages at all. FRED retains a history of adopted ages for each fossil record.

Retrieving fossil records based on age data differs somewhat from entering data. Firstly, both the simple and advanced query facilities (see sections 7.2 and 7.3) permit searches using absolute (numeric) ages expressed in Ma. There is also another group of age fields which can be interrogated: the "consensus" age fields.

"Consensus" age. For every sample recorded in FRED, two age fields are calculated automatically from all available information, namely "auto consensus-age (narrow)" and "auto consensus-age (broad)". The consensus ages are recalculated after any change to a record, so they are always current.

If an adopted age has been entered, the narrow and broad calculated fields will both be set to the adopted age. Otherwise, the narrow field is set to identify the minimum overlap (if overlap exists) between multiple age estimates. It is the more discriminating of the two fields – i.e., it will yield the fewest results in a search. The broad field will reflect the maximum possible range that is consistent with all age estimates and therefore "casts the widest net". This field should be used for searches that aim to return every possible matching record.

Example 1 Example 2



5.5.4 Stratigraphic Data

Stratigraphic Name: This field is available to record the name of the stratigraphic unit collected. Ideally, this should be a published stratigraphic name (e.g., as recorded in the StratLex application) although informal unit names are accepted also.
StratLex can be found at: https://data.gns.cri.nz/stratlex/search.jsp

Known Stage Limits: Here should be recorded the *definitely known* age/stage limits for the collected material, unless they are hopelessly broad (there is little point in recording "Cambrian to Recent"). This knowledge may come from stratigraphic interpolation, lithostratigraphy, or from location on a geological map, and possibly from field assessment of the fossils themselves, provided there is no possibility that they are reworked. Use chronostratigraphic rather than geochronologic units (e.g., Lower Haumurian rather than Early Haumurian).

Inferred Stage Limits: In general, however, collectors will have a good idea of the age of the fossils which is more precise than what is definitely known. That information can be recorded here.

Column/Map: If available, a reference where a map or column of the collection site may be found can be recorded in this field. If there is an appropriate entry in the New Zealand Measured Section database, that would be an ideal resource to reference.
The New Zealand Measured Section database is accessible via PBE at: https://data.gns.cri.nz/pbe/index.html?map=GeolSetting).

Dip/Dip Direction/Strike/Facing: The usual stratigraphic attitude data can also be captured in FRED. In general, these are among the more poorly populated data fields in FRED, and collectors are encouraged to capture this information.

5.5.5 Lithological Data

Grain Size: Separate fields record primary and secondary grain size, and whether a comparator was used.

Stratification: Fields are provided to record stratification thickness and stratification features (graded, slumped or cross-bedded).

Colour: Separate fields record shade, primary and secondary colour, and whether the sample was wet or dry.

Further fields are available for attributes such as weathering, hardness and carbonate content.

5.5.6 Paleontological Data

Paleontological data captured by FRED includes the name of the fossil researcher producing the analysis, and a date (somewhat arbitrary because the examination of a large collection might easily take more than a day), curation data, age interpretations, and, of course, taxonomic identifications. A few of the data are:

Stage and Stage Modifier: Age (stage) interpretations are expressed as ranges recorded in separated "age from" and "age to" fields, each with its own "modifier" which allows a question mark to be placed against the interpreted age assignment.

Laboratory, Series and Number: Three separate fields record [1] which institution has the fossil material in its collection, [2] which curatorial series is being used, and [3] the catalogue number. The 'series' may require some explanation: Larger institutions often hold their material in a number of separate collections, each of which may be identified by a prefix to the catalogue number or some similar encoding. For example, GNS Science holds plant macrofossils in its 'B' collection. Thus, the three fields for a fossil plant leaf would be 'GNS', 'B', and a number. Pick-lists of valid institutions are provided for both the forms and spreadsheet data entry modes, because many of the abbreviations which have been employed in the past are somewhat idiosyncratic. The data entry "builder" for this field combines the Laboratory name and the Curatorial Series into a single field (e.g., "GNS: L"). This may change in the future, but is the case for the present. Although the field name suggests that the Laboratory Number" should be numeric, it is actually a text field which can accommodate alphabetic characters.

Taxonomic Group: Taxa are divided into a number of different groups which owe at least as much to historical accident as they do to phylogeny. A full listing is provided in Section 12.2, where it will be seen that the groups are drawn from multiple taxonomic ranks, and some such as "algae" are not true taxa at all. Moreover, they are not mutually exclusive. For example, Ammonoidea and Nautiloidea are subsets of Cephalopoda, which together with Bivalvia, Gastropoda and Scaphopoda, is a subset of Mollusca. In general, you should enter taxa under the most narrow (least inclusive) group heading you can find. Pick-lists of valid groups are provided for both the forms and spreadsheet data entry modes.

Taxonomic Name: The taxonomic name is recorded in a single field even though it is, typically, a binomial. It is not required or expected that all binomials will necessarily reflect currently accepted combinations. In fact, it is preferred that anybody entering historical data should use the combination indicated by the original identifier, even if it is no longer considered correct. Names are checked against a thesaurus and all those that are found will be accepted immediately. Names that do not occur in the thesaurus will be sent to an appropriate expert in the particular group for manual acceptance (or rejection). Be careful to avoid typos; they can waste a lot of time. Currently, FRED fails to compensate for trivial errors such as trailing spaces, or two spaces between the genus and species epithet. This shortcoming is scheduled for correction; for the present, users are asked to take care to avoid such errors.

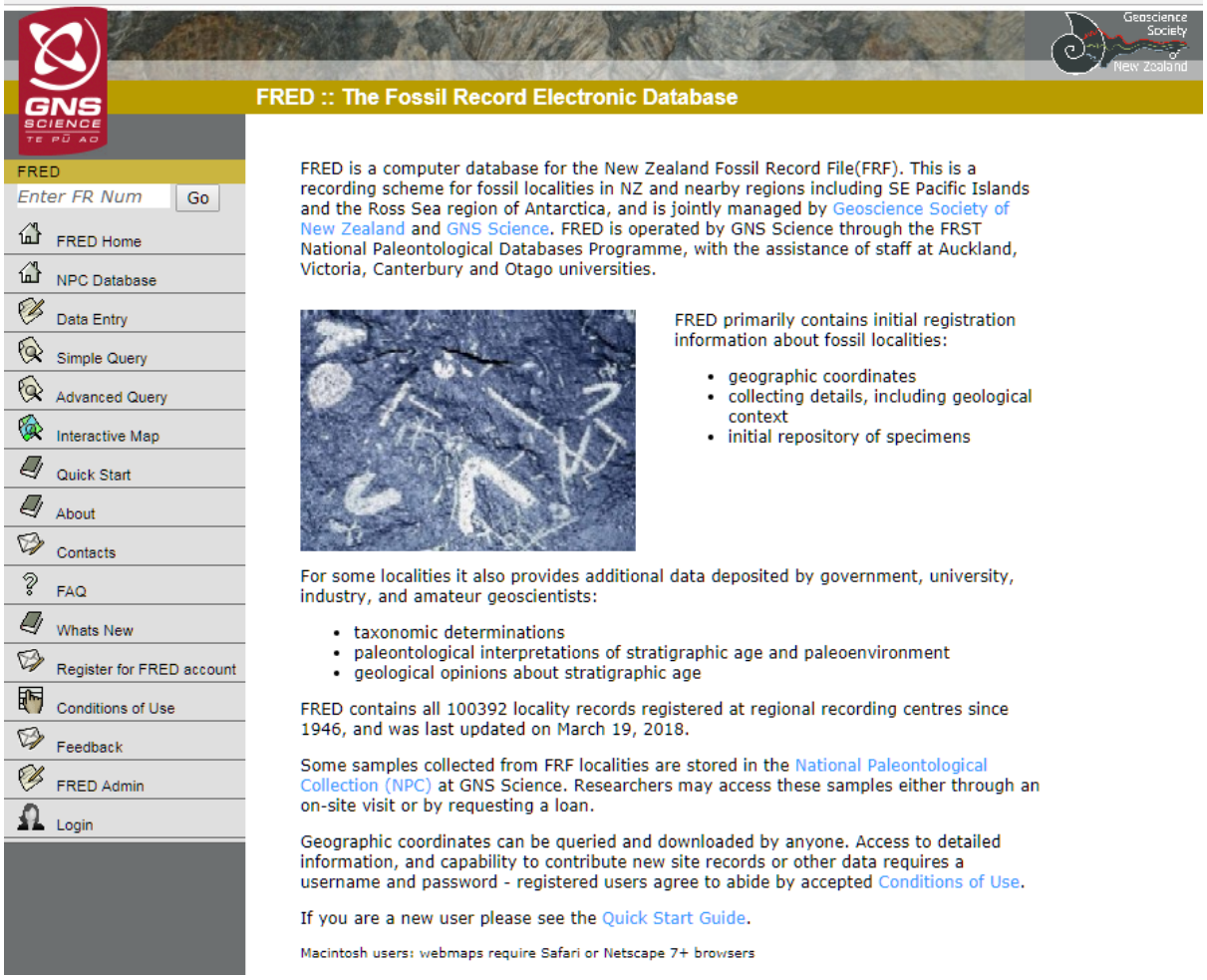
Other fields are provided to record supplementary data, such as census counts, stage coordinates for microscope slides, and comments on each identification.

6 Getting Set Up to Use FRED

6.1 Finding FRED

For the purposes of consistency, this manual has been compiled using Google Chrome (version 55), although any browser should work similarly. It is probably best to stick to one of the most popular browsers (Chrome or Internet Explorer) because common compatibility problems are more likely to have already been encountered and fixed by the FRED support developers.

Enter the URL fred.org.nz (with or without "www." in front of it; it doesn't matter) and, optionally, save it to your favourites list.



6.2 Familiarise Yourself with the Home Page

The main screen elements to acquaint yourself with first are the "quick search" box, the navigation menu, and the workspace:

- The Quick Search box is found at the top of the menu, on the left side of the screen, and is labelled "*Enter FR Num*". It is active even without logging in, although only a very limited set of result data will be displayed to users who are not logged in.
- The navigation menu is arranged down the left-hand side of the screen, with a light grey background. All of the options appear to be active, although most of them will simply take you to a log in screen if you attempt to use them prior to logging in.
- The workspace is the large area to the right of the menu. Prior to logging in, it displays some basic descriptive information about FRED, including a link to the "Conditions of Use" page, which you should read before going too much further.

Before you can do anything really useful with FRED, however, you will have to register for a user account and log in.

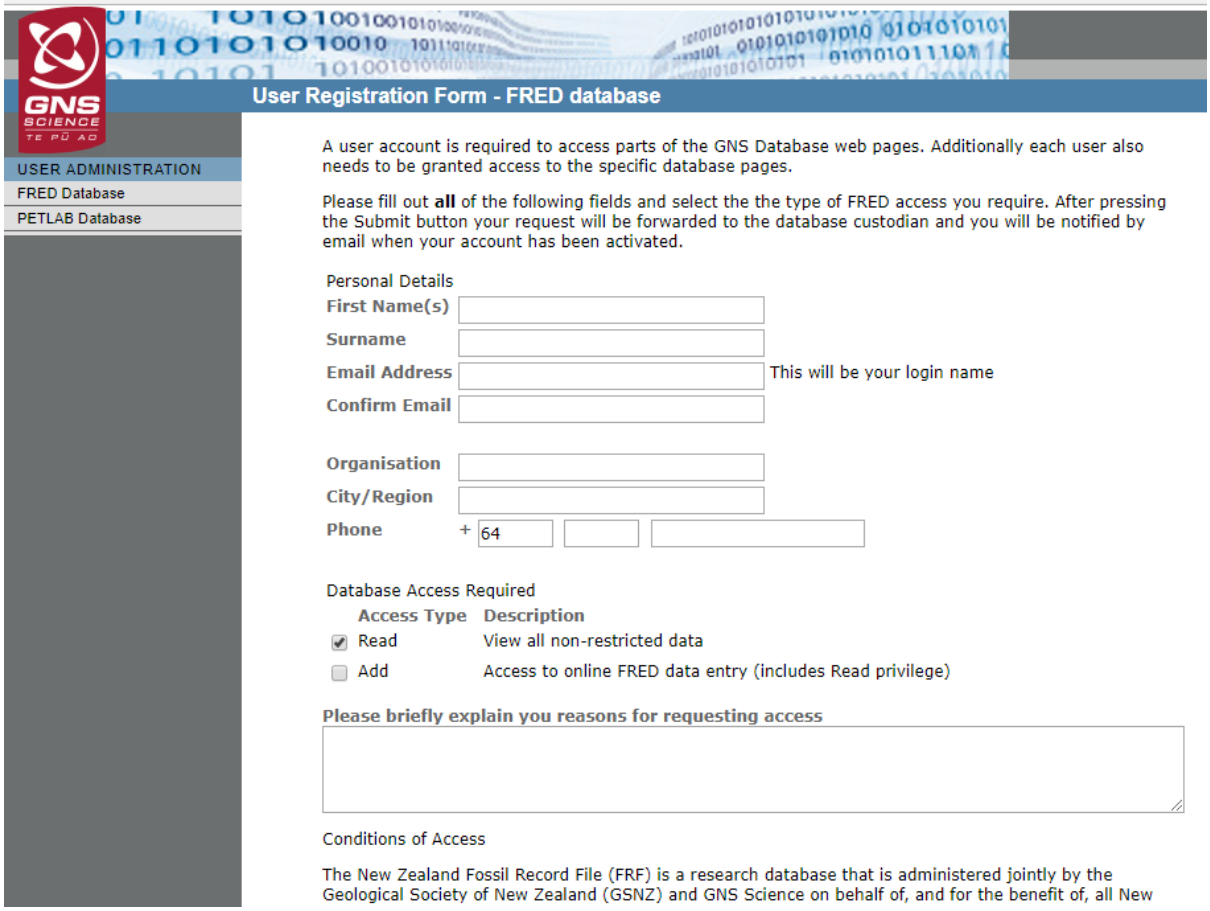
6.3 Register as a User

Unregistered users have access only to locality numbers, coordinates, and the map facility to display locality positions. To accomplish anything productive with FRED, you need to register as a user.

Registration is free.

Registered users can display full locality data and paleontology/adopted age data that is released and, by additionally requesting edit privileges, they can enter and submit new data. Edit privileges are not granted automatically, but users wishing to add new FRED data are positively encouraged so they are almost never declined either. The best advice is to request them only if you are genuinely planning to add new data, rather than "just in case". It is a simple matter to sign up for read-only access at first, and add edit privileges later.

Registration takes only a few moments to complete the application form. About ¾ of the way down the navigation menu on the left-hand side of the screen is an option to "Register for FRED account". Click on this option to see the following registration form:



Fill out the registration form, check the box at the bottom of the usage conditions to acknowledge that you have read them, and press the Submit button.

Most fields have an obvious purpose. The email address you enter will be used as your user "identity". Ideally, it should be one which you check frequently, since it will be used to communicate with you, initially to provide you with instructions for logging in, but also to provide feedback to users who enter new data.

At present, processing your application is a partly manual process, and can take a few days, especially if you apply late on a Friday afternoon, for example. In a case like that, our administrators are unlikely to even be aware of your application until the following Monday morning. (There is no harm done if you lose patience and re-apply; although it will not do any good either. A better approach, if you are concerned that your application

is taking a long time to process, is to contact the support team (see Section 6.5) and request an administrator to confirm that your application has been received.)

6.4 Changing Registration Details

At present there is no facility to edit any of the details provided on the application form.

In the particular case of wishing to change your email address, please directly email paleo@gns.cri.nz to discuss how best to proceed with an administrator.

Users with READ access can apply for edit privileges ("ADD" access) by using the registration form again, or, if in doubt, contacting us (see Section 6.5 for details) to discuss your requirements with an administrator.

6.5 Contact Us

We welcome enquiries and feedback from our user community, and provide several mechanisms for this purpose.

There is a "General Inquiries" contact form available here, or you can paste the following URL into your browser:

- https://fred.org.nz/contacts.jsp

Alternatively, you can go to the FRED home page (you do not need to log in) and click on the "Contacts" menu item to the left of the main page. The first "send email" link in the list is for general inquiries; the other links are for contacting specific regional curators (see Section 9.1.3).

Finally, if all else fails, you can get in touch with the FRED support team by emailing paleo@gns.cri.nz.

7 Data Retrieval

Database records can be retrieved by FRED in a number of ways:

- the menu box (Quick Search)
- the Simple Query form
- the Advanced Query form
- the Interactive Map
- ODBC (GNS Science campus only)

7.1 Quick Search

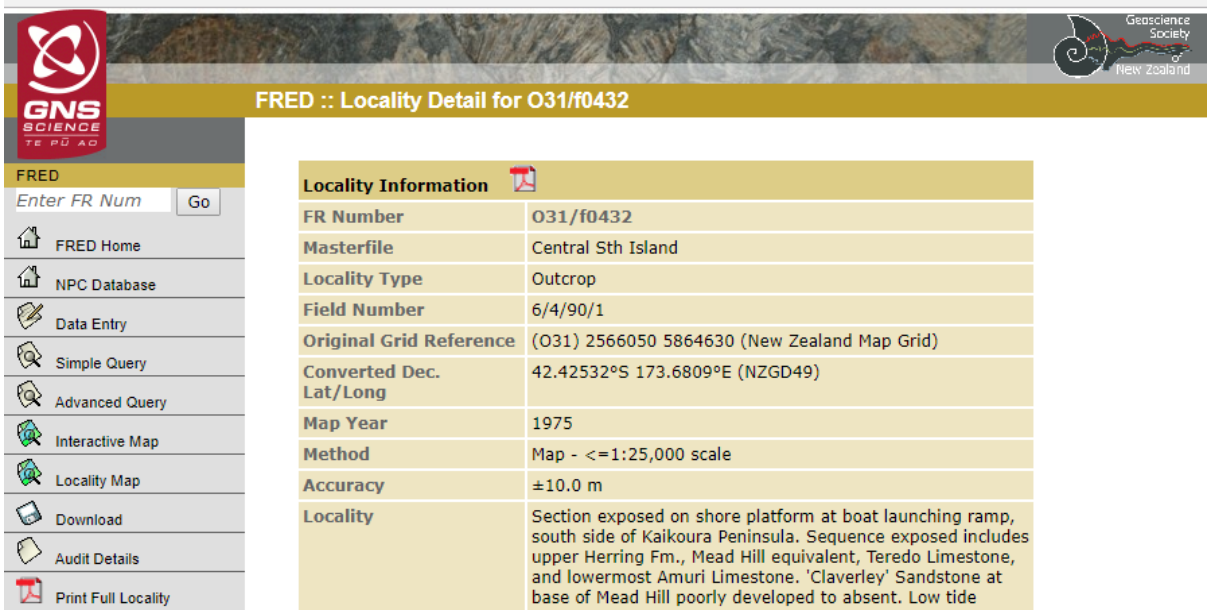
Above the menu at the top left of each FRED page there is a data entry box labelled "*Enter FR Num*" which doesn't have a name but which we'll call the "Quick Search" box in this manual.

The Quick Search box is active even without logging in, although only a very limited set of result data will be displayed to users who are not logged in.

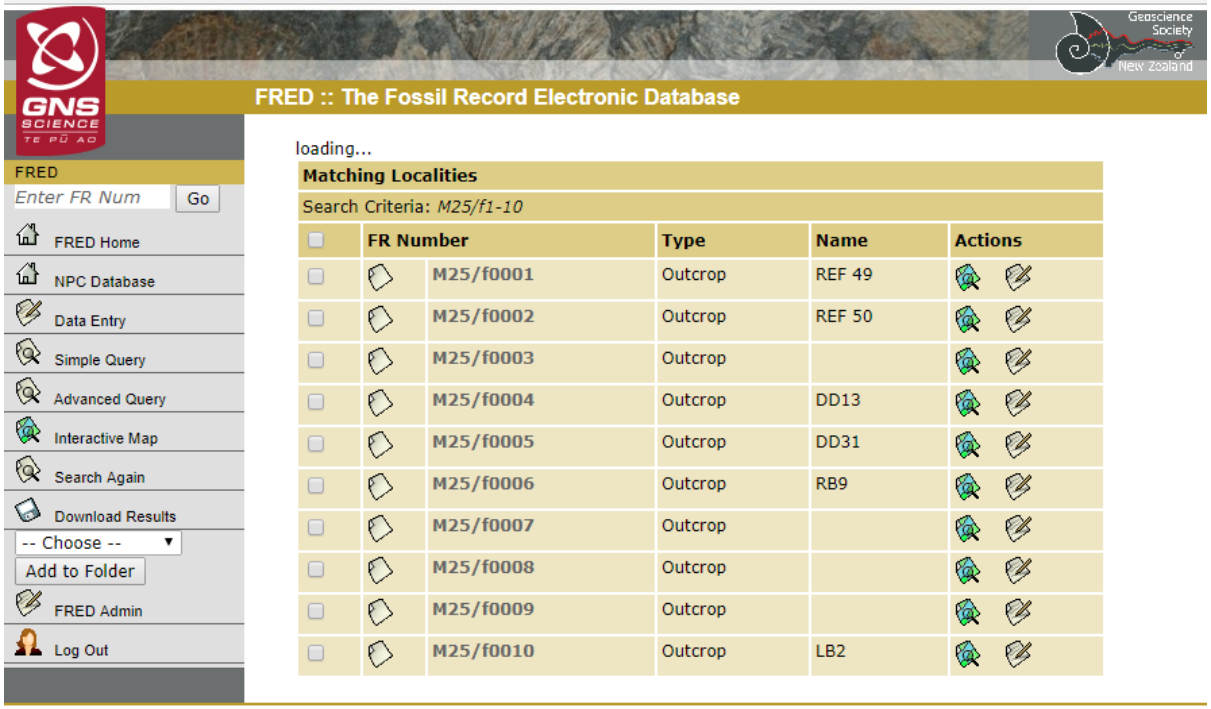
The most straight-forward way to use the Quick Search box is simply to enter a single FRN and press the Go button (or press Enter). Leading zeros in the 'f' number are ignored. For example, O31/f432 and O31/f0432 are treated as equivalent. Note also that the case of the sheet component of the FRN will be ignored, but the current version of FRED is intolerant of other variations: Both the '/' and the 'f' must be present, and the 'f' must be lower case. Thus, for example, O31/f432 and o31/f432 will locate the correct fossil

record, whereas O31/432, O31f432 and O31/F432 will all fail. (A pervasive lack of user-friendliness has been identified as a serious problem with FRED, and is being slowly targeted as time and budget allow.)

Assuming the FRN you have requested exists, the appropriate form will be displayed:



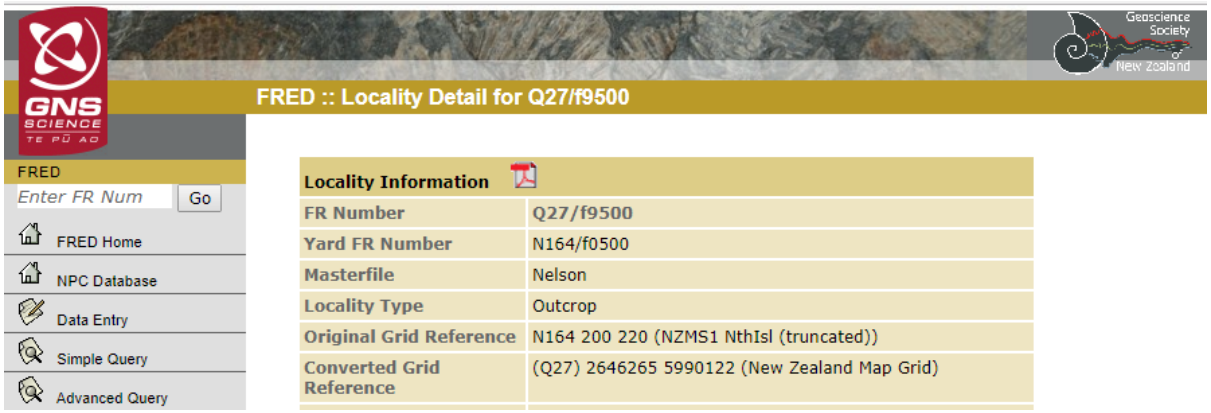
Note that you can enter a consecutive *range* of numbers: M25/f1-10, for example. In this case, rather than displaying any single form, FRED will display a list of the forms in the given range:



After running a query that returns a list of records rather than a single form, you can click on the icon in the Search Results screen to display a full database record. The components of this record can then be extracted in PDF format for printing. The results can also be downloaded to a tab-delimited text file for transfer to a spreadsheet, or selected records sent to a data entry folder for addition of new Paleontology or Adopted Age data (see below).

Clicking on the icon will display 1:50,000-resolution map, together with a location synopsis.

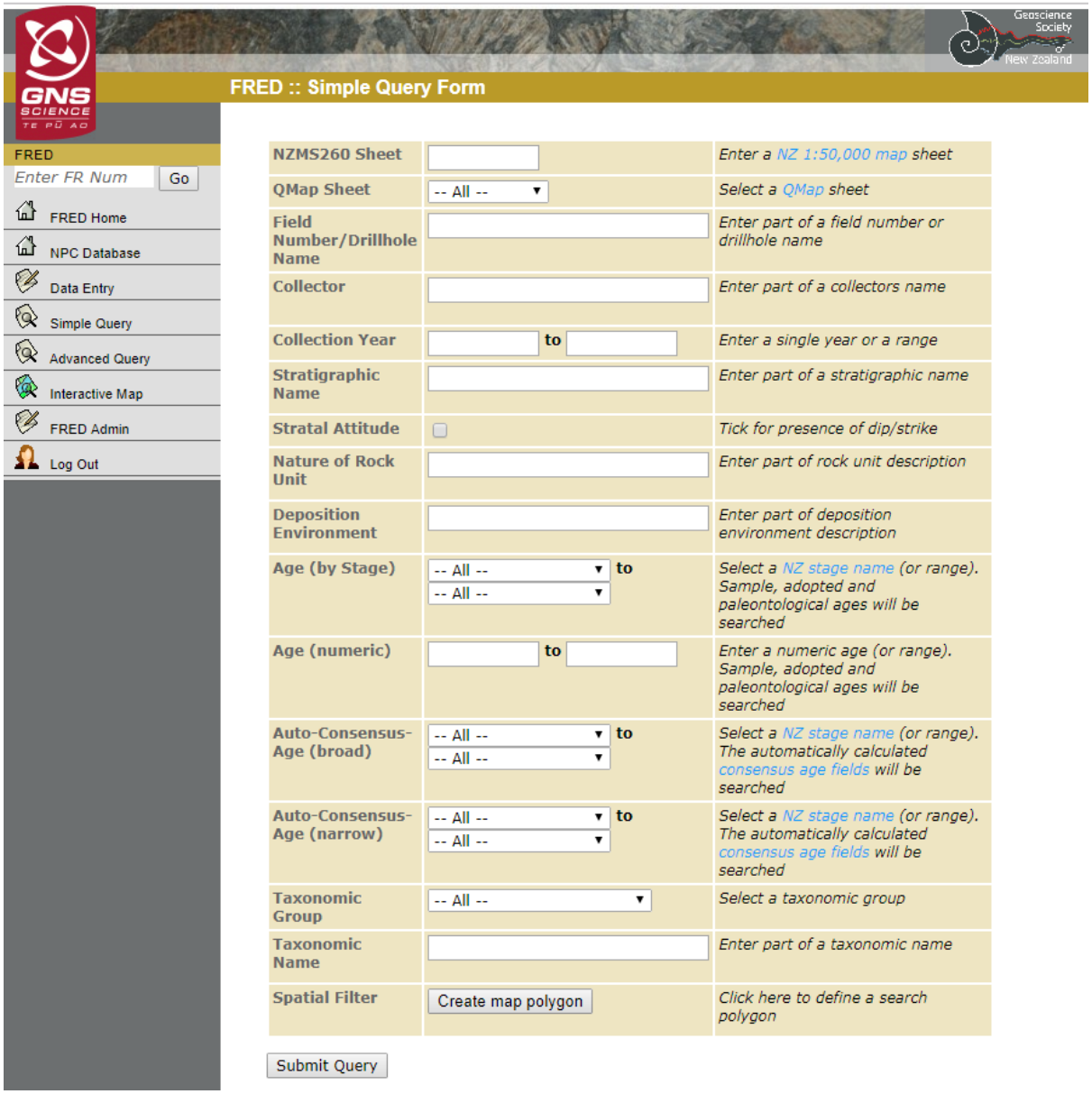
Finally, note that FRNs based on the NZMS1 system can also be entered, e.g. N164/f500. Records converted from the old NZMS1 system will show both FRNs when displayed.



The Quick Search box is visible from most of the web pages within FRED, but it does not work from all of them. It is inactive on the Advanced Query page, for example, although it appears the same. (This is a recognised error which is scheduled to be fixed in due course.)

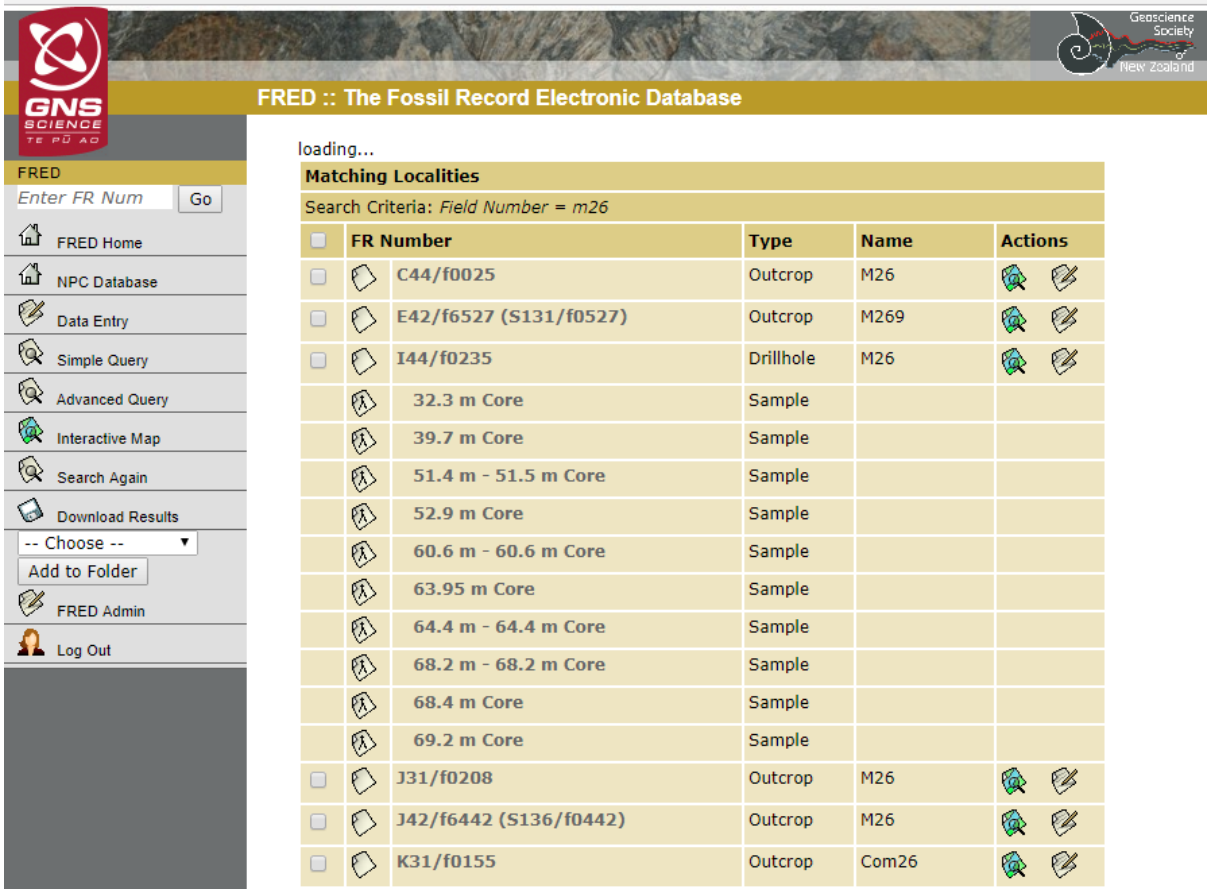
7.2 Using the Simple Query

In the Simple Query form, a further range of search options are available, for example, search using Field Number, Collector Name, Stratigraphic Name, Age, or Taxonomic Name.



Most of the search fields available on this form are quite straight forward: you just enter the criterion you are searching for in the appropriate field. Several of the fields allow you to specify ranges by the entering lower and upper limits of what you are searching for.

This form provides probably the simplest way to search for a drill hole, although some care is required, not least because the same field is used to search for field numbers. We will take the M/26 core as an example. This was the longest of several cores drilled in the wake of the 1979 Abbotsford landslide, near Dunedin. Although the core is listed in most publications as “M/26”, in fact it has been entered into FRED as “M26”, without the slash character. You can find it by entering “M26” (or “m26” – it is not case-sensitive) into the “Field Number/Drillhole Name” search field and clicking on Submit Query. However, the search results will include any sample for which the field number was, or contained, the characters “M26” as well as the records for the M/26 core itself.



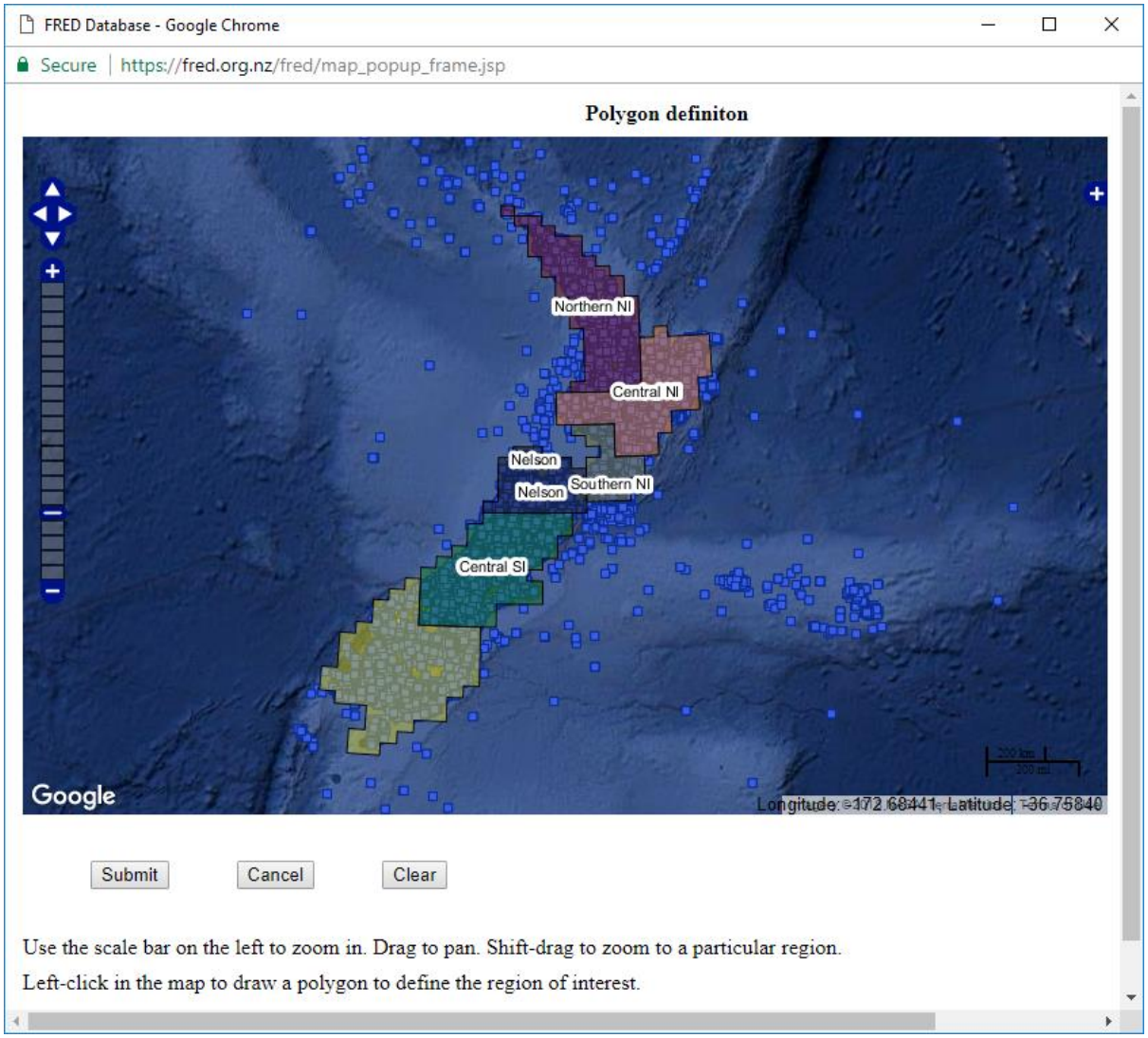
Note the search results describe the drill hole with a header record (third result in the list above) giving the FRN (I44/f0235), the type ("Drillhole"), and the name ("M26"), followed by several further records for each of the samples taken from various depths in the hole. Unrelated samples, but having field numbers including the characters "M26", are scattered before and after the records for M/26.

Note also that the word "loading…" appears at the top while FRED is assembling the results records, but it does not clear away after the records are displayed (a minor bug that is scheduled for fixing but low priority for now). Near the top of the results table, following the words "Search Criteria", is a brief statement of the query used to generate the results. We will later see, when we examine the Advanced Query (section 7.3), how to create these queries directly.

There are three types of age search available on the Simple Query form.

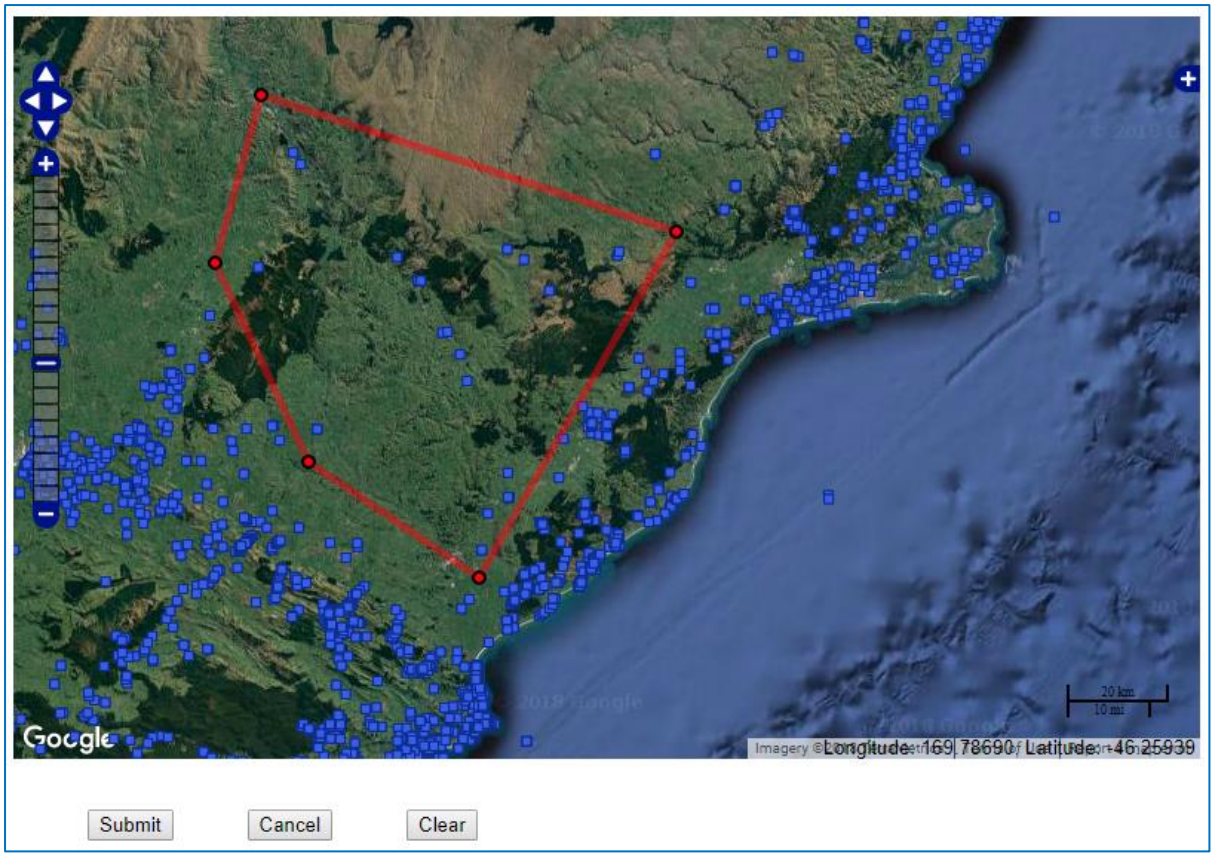
- The first, "Age (by Stage)", allows you to enter the name(s) of a stage or range of stages. Any records which have ages (be they inferred, determined, or whatever) which overlap with the search values will be returned by the query.
- The second, "Age (numeric)", works just the same way, but instead of entering the name of a stage you enter an absolute age range, denominated in Ma.
- Finally, you can search the broad and narrow consensus age fields (see Section 5.5.3).

A quite different method for choosing samples using the simple query facility is by using the spatial filter to mark out a polygon on a map, and choose all of the fossil records falling within it. To use this feature, click on the Create map polygon button. A map like the following will be displayed.

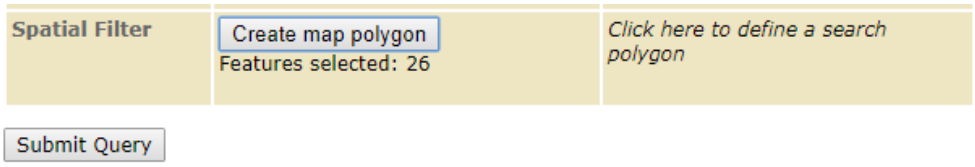


If the map of New Zealand is not surrounded by a cloud of FRED localities, as above, click on the + icon at the top right, and tick the box labelled “FRED samples”. (You may like to experiment with the other overlays, also, but they are not described in this manual.)

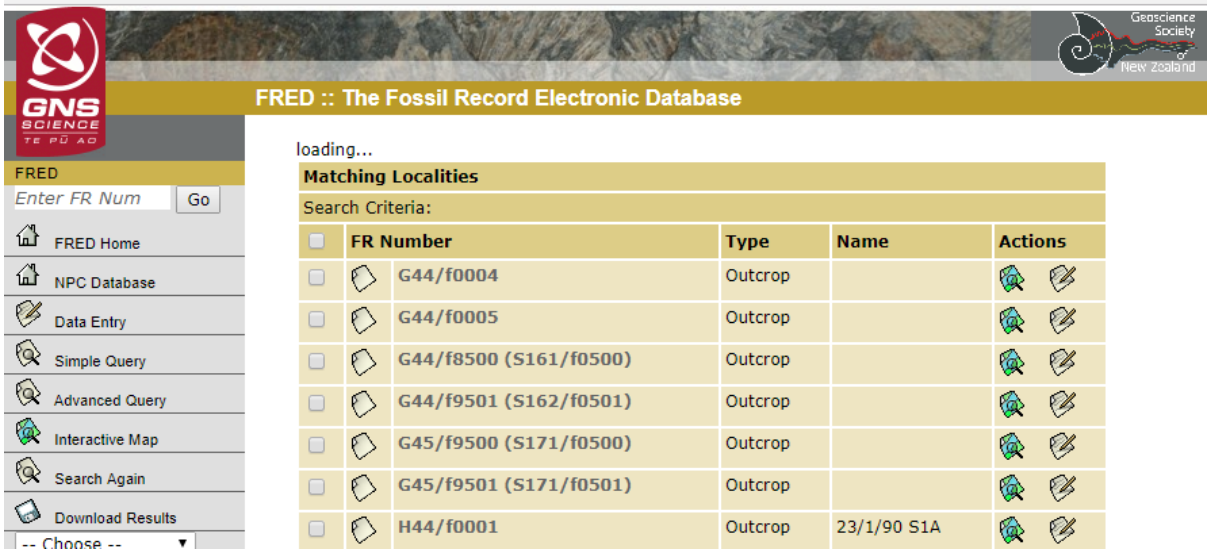
Click on the + icon (top left, at the top of the slider) to zoom in, and the - icon at the bottom of the slider to zoom back out. Click and hold on the body of the map to move around. Once you’ve zoomed in sufficiently to pick out your area of interest, you can delineate a polygon by clicking three or more times on the map.



Press the Submit button once you've surrounded the points you are interested in. The map window will close, and you'll be back at the Simple Query screen. Initially this is disconcerting, because nothing seems to have happened, but if you examine the screen just below the Create map polygon button, you'll see that the points within your polygon have been captured:



Press the Submit Query button to run the simple query and see the list of FRNs you have selected.

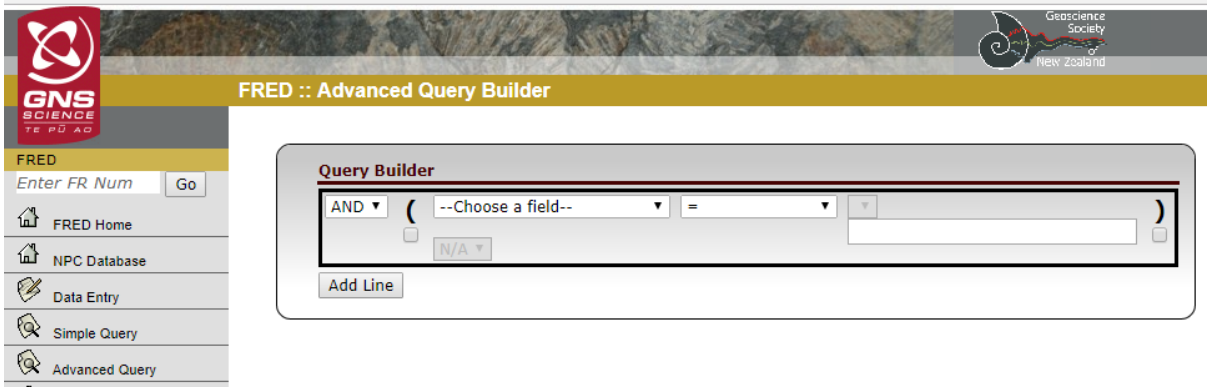


7.3 Using the Advanced Query

The Advanced Query screen allows users to search on almost all of the fields in a fossil record. However, there are still a few limitations which we will describe as we encounter them. (There are plans in place to improve the worst of these.)

The Advanced Query looks very different from the Simple Query because it is not a simple form. Instead, it is a tool to let you *build* a query. Obviously we cannot demonstrate every possible query in a user manual, so we will just describe a couple of worked examples. Users who are experiencing difficulties with this facility are invited to get in touch with the FRED support team for help (see Section 6.5 for contact details).

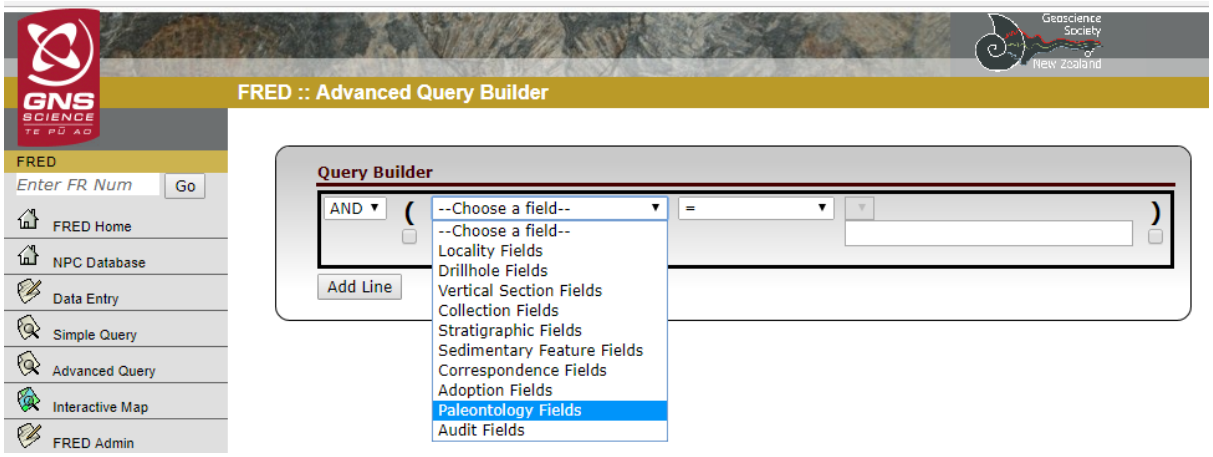
The query builder looks like this:



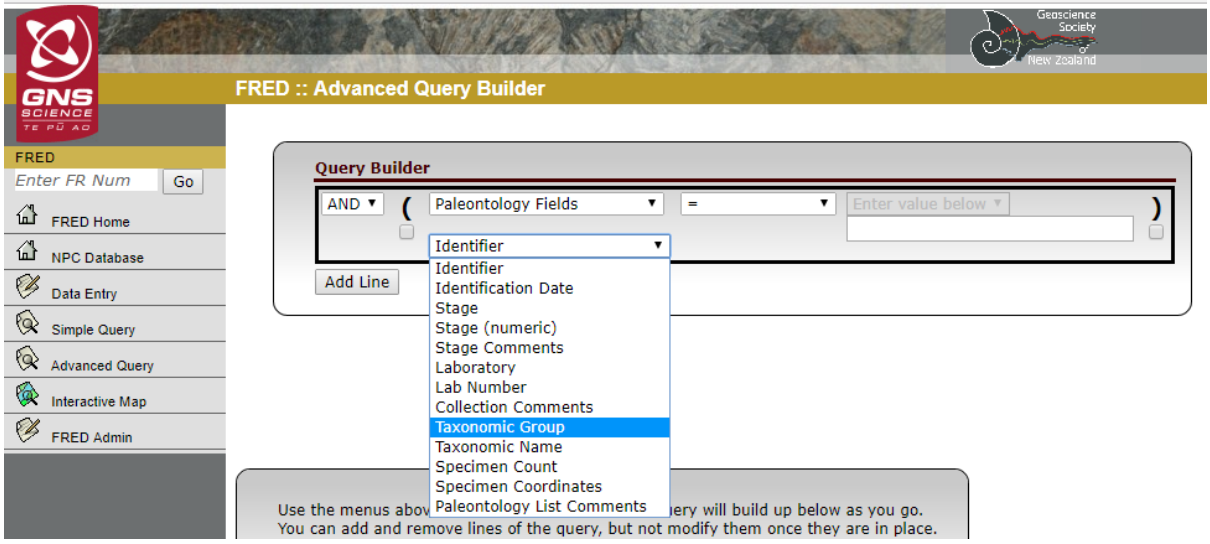
7.3.1 Tutorial 1

For our first worked example, we will do something very simple by searching for fossil pliosaurs. There are only a very few recorded in the database, all from Mangahouanga Stream area and most collected by the late Joan Wiffen and colleagues. (Reproductions of some of these fossils can be seen at the National Aquarium of New Zealand, in Napier.)

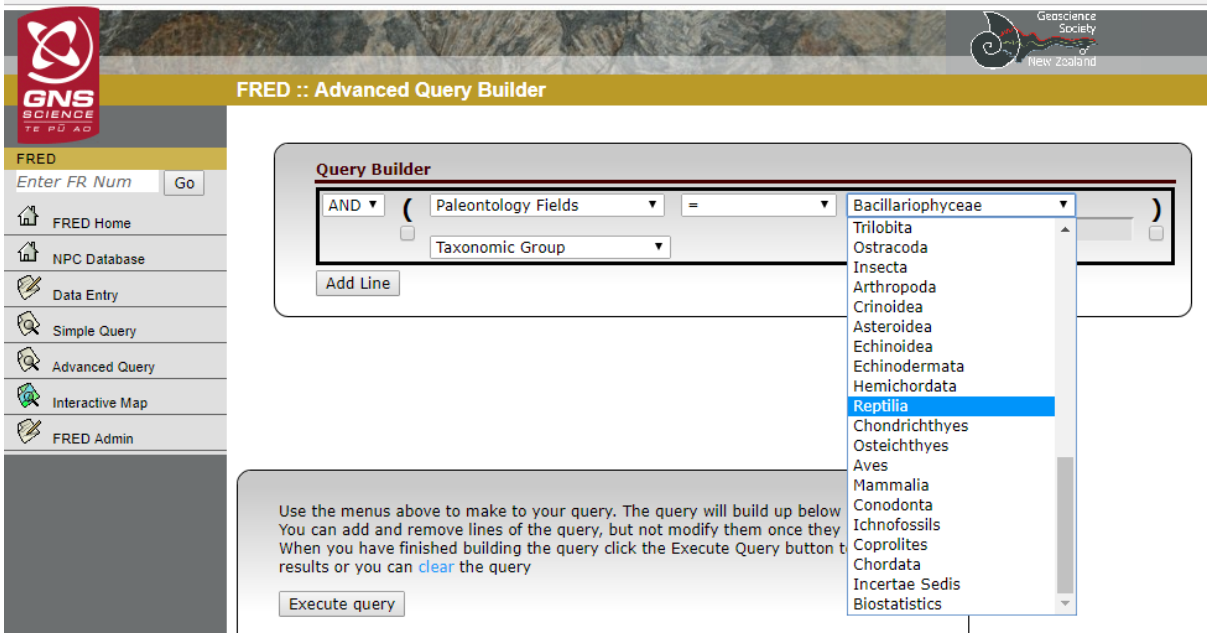
"Pliosaur" is an informal name for a group of extinct marine reptiles belonging to the suborder Pliosauroidea and including the genus *Pliosaurus*. If you click on the "Choose a field" drop-down, however, you will not see anything like this. You *will* see an option labelled "Paleontology Fields" and you would be correct to guess that this is the path to searching for records on the basis of fossil names.



Click “Paleontology Fields” and a further drop-down menu will present itself just below it:



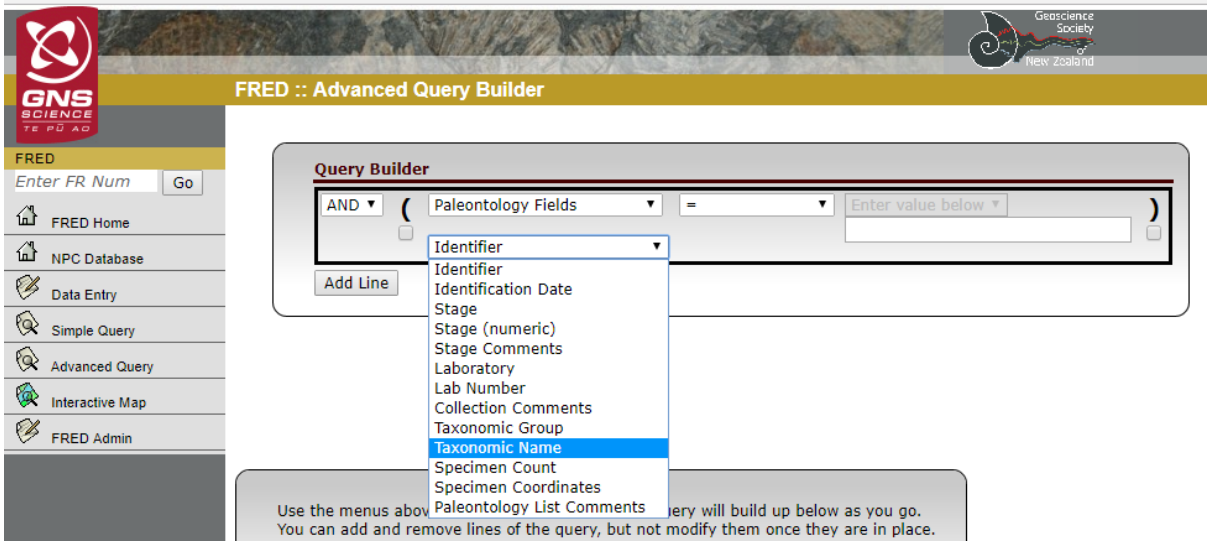
If we select “Taxonomic Group” the drop-down menu on the right hand side will activate and we can search for suitable groups that might contain pliosaurs:



There are only two promising entries – Reptilia and Chordata – both of which will return many more records than we are looking for. You could try using this approach, although it is not recommended because, at present, FRED does not provide any means to refine a search or to search within the results of a previous search.

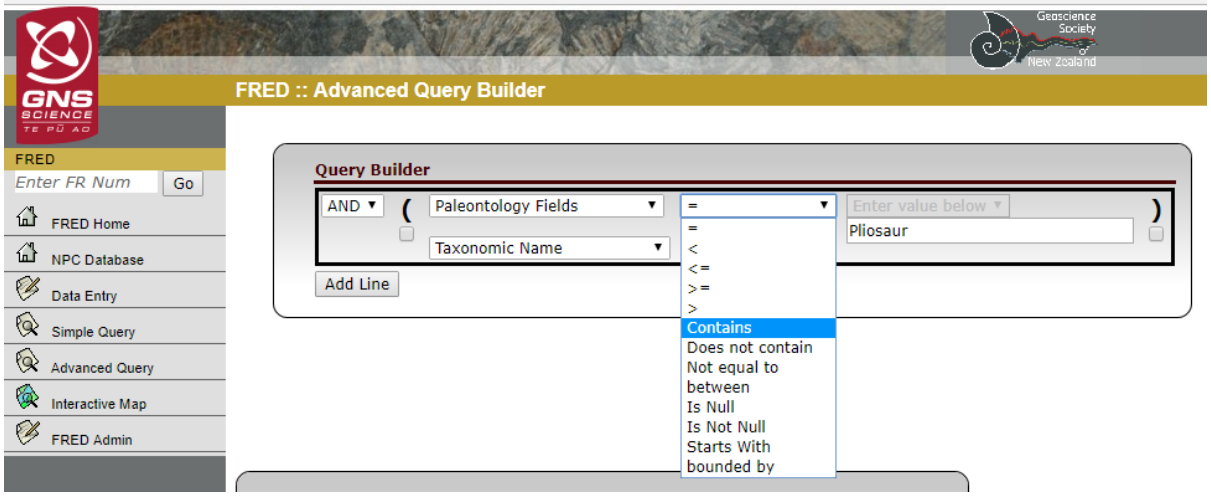
Instead we must think of a way to target pliosaurs more narrowly.

Return to the drop-down menu which currently says “Taxonomic Group” and select the next option in the list – “Taxonomic Name” – instead.



Depending upon the quality of the material, and how diagnostic it is, then most of the material of interest is likely to have been identified as Pliosauroidea, Pliosauridae, possibly *Pliosaurus*, or some variant. More work (and some taxonomic knowledge) will be required to investigate genera with different roots, such as *Liopleurodon*, but, for now, searching the taxonomic name field for records which contain the letters “Pliosaur” should pick up most of what we are looking for.

In the centre of the query builder tool is another drop-down menu currently showing the “=” character. This is the operator field, which allows us to state what kind of relationship we want between our chosen field (“Taxonomic Name” in this example) and our search term (“Pliosaur” in this example). If we just run the “=” query, however, we are unlikely to find anything because neither Pliosauroidea, Pliosauridae, nor any other likely identification exactly equals “Pliosaur”. Instead, we should choose the “Contains” operator, as follows:

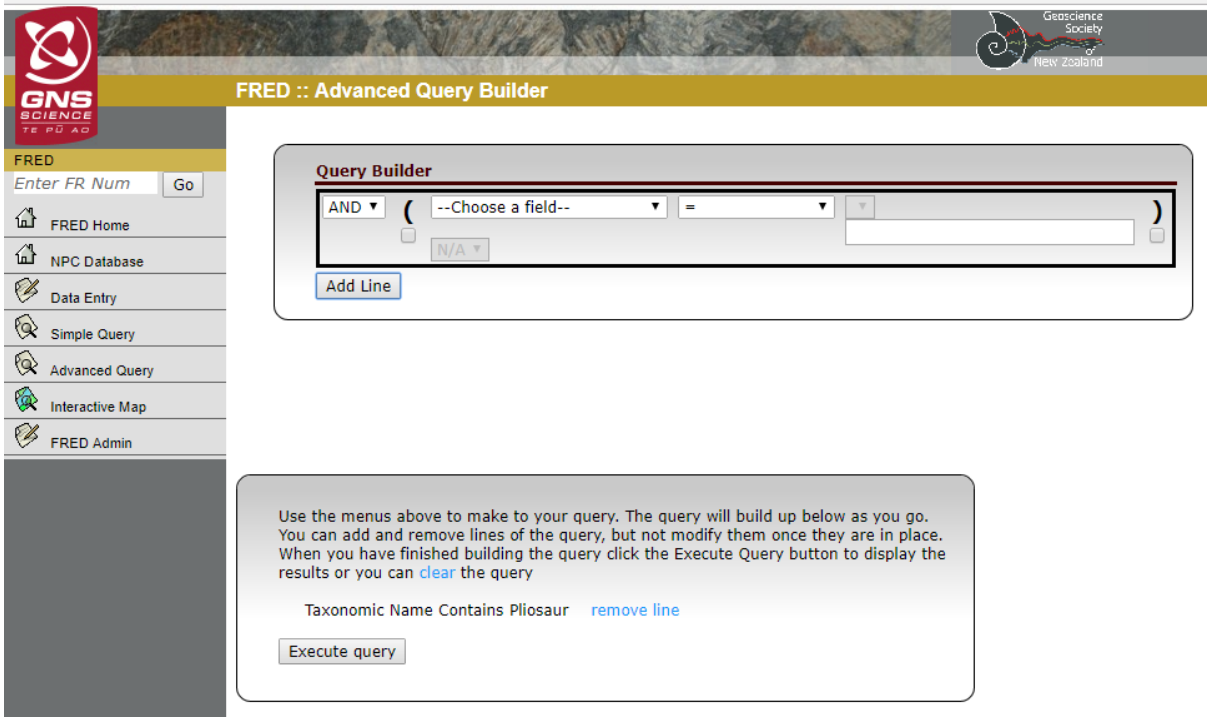


(In this example, the “Starts with” operator would work as well.)

Contains searches the field to see if the search term occurs anywhere within it. It is not case-sensitive.

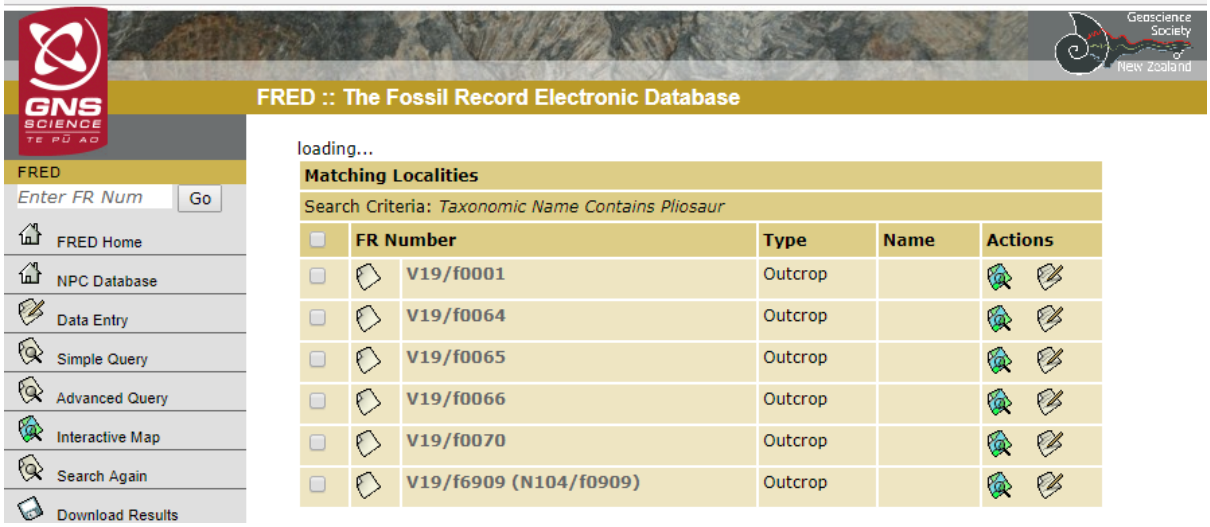
Equals searches the chosen field for an exact match (so trailing spaces can be a problem) and it is case sensitive.

Having selected contains, press the Add Line button.



The query builder reverts to its initial blank state again, and the query you have built is transferred to the panel below it ("Taxonomic Name Contains Pliosaur"). If you notice an error, you can delete the search term by clicking on the blue "remove line" link, and start again.

To perform the search, click on the Execute Query button. After a few moments, the results will be displayed like this:



As we saw above, the "Search Criteria" line just above the results table shows the query that we constructed using the query builder.

The technique just demonstrated – using the contains operator to search for the root portion of a taxonomic name – is an important one. An enhancement planned for the near future is to provide a mechanism for handling taxonomic synonyms. We do not have this facility for the present, however, so, in the meantime, a useful strategy is to search for the root portion of the taxon's specific epithet.

However, this was also an artificially simple example. The same could have been achieved, more quickly, by entering "Pliosaur" into the "Taxonomic Name" field of the Simple Query. The advantages of getting to grips

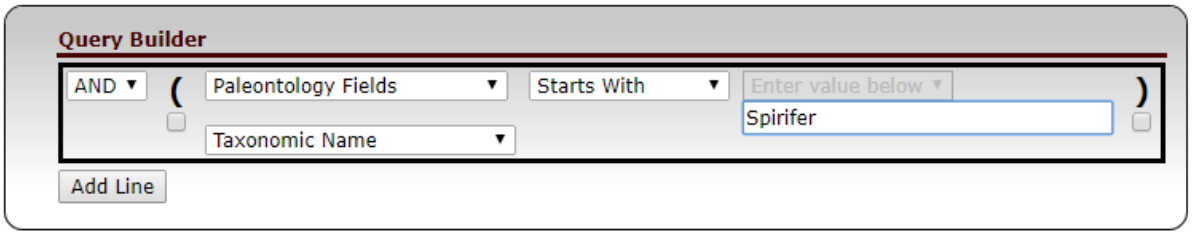
with the Advanced Query are that it provides you with access to more fields, and that it allows you to combine multiple search expressions, as shown in the next example.

7.3.2 Tutorial 2

Suppose you are interested in the distribution of the genus *Spirifer*. We can start in the same way as the previous example, and create a search term like:

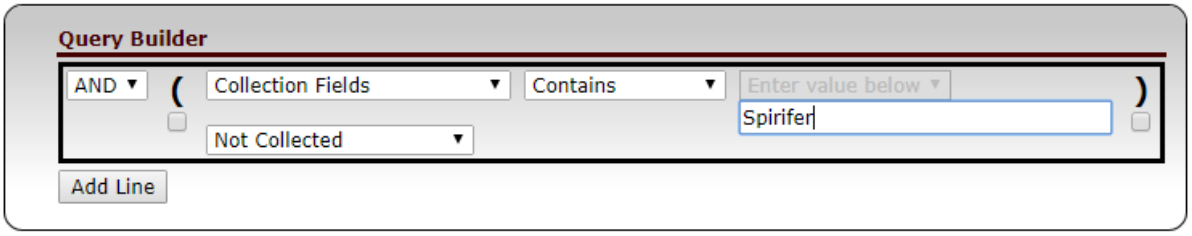
> Taxonomic Name contains Spirifer

However, as we now know, the 'contains' operator will pick up any part of the field that matches the search term, so related genera such as *Acrospirifer*, *Aperispirifer*, *Neospirifer*, etc., will also be retrieved. That may be just what you want, of course, but in case it isn't we can narrow our search down by using the "Starts with" operator instead:



This query retrieves (at the time of writing) ~530 records.

That may not be the end of the story, however. *Spirifer* and related brachiopods – especially the more ancient ones – are often preserved only as casts and are not collectable. You may recall that there is a "seen but not collected" field, where the field geologist can record taxa observed at the outcrop but not brought back to the laboratory for paleontological analysis. The following query will target these:

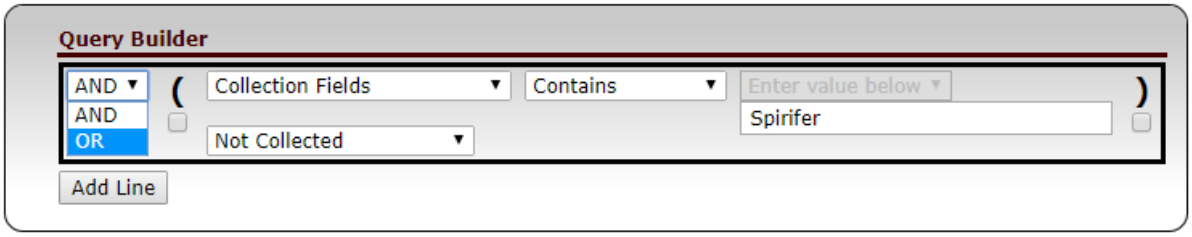


Note that we will have to deal with the consequences of the contains operator. As entered, genera with names containing "spirifer" (*Acrospirifer*, *Aperispirifer*, etc.) will be recovered in the search results, and will have to be weeded out of the final result list manually. Alternatively, you could enter " Spirifer" (with a leading space character) which will exclude them, but it will also exclude records where the name Spirifer occurs only as the first word in the field (because, in that case, there will be no leading space to match). In the absence of a case-sensitive version of 'contains' this is the best we can do.

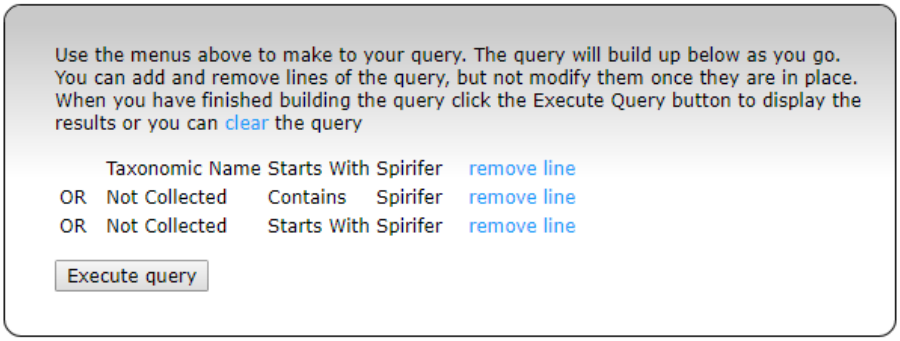
What we want, is a combination search where *any* of these conditions are met:

> Taxonomic Name Starts With Spirifer
>
> Not Collected Contains ␣Spirifer (where I am using the ␣ symbol to denote a space)
>
> Not Collected Starts With Spirifer (no space)

We can achieve this, and get close to a comprehensive search, by combining these three queries using the OR operator. Enter the first search term as described above, and press Add Line. Before entering the second search term, however, change the AND operator (top left corner of the query builder) to OR:



Add the line (press the Add Line button) then enter the third search term, also selecting the OR operator. Add the line and the finished query should look like this:



At the time of writing, this query returns ~541 records, 11 more than the Taxonomic Name query alone.

7.3.3 Tutorial 3

For a more challenging exercise, we will attempt to find all records of *Magadiceramus rangatira* from the Karekare Formation in the Raukumara Ranges area east of Motu (NZMS260 map sheets X16 and Y16).

The first problem is that *Magadiceramus rangatira* was known for many years as *Inoceramus rangatira*, and many of the older records in FRED are likely to record it by that name. So, as in our previous example, we will take advantage of the relative persistence of species epithets and our first search term will be

Taxonomic Name contains rangatira

The stratigraphic unit, Karekare Formation, is easy to look up, as follows:

Stratigraphic Name = Karekare Formation

but this construct relies upon the name of the unit having been entered exactly as “Karekare Formation”, without, for example, the word formation having been abbreviated to “Fm” and with the case exactly as specified, too (remember the equals operator is case sensitive). To avoid these complications, we’ll use the following search term instead:

Stratigraphic Name contains Karekare

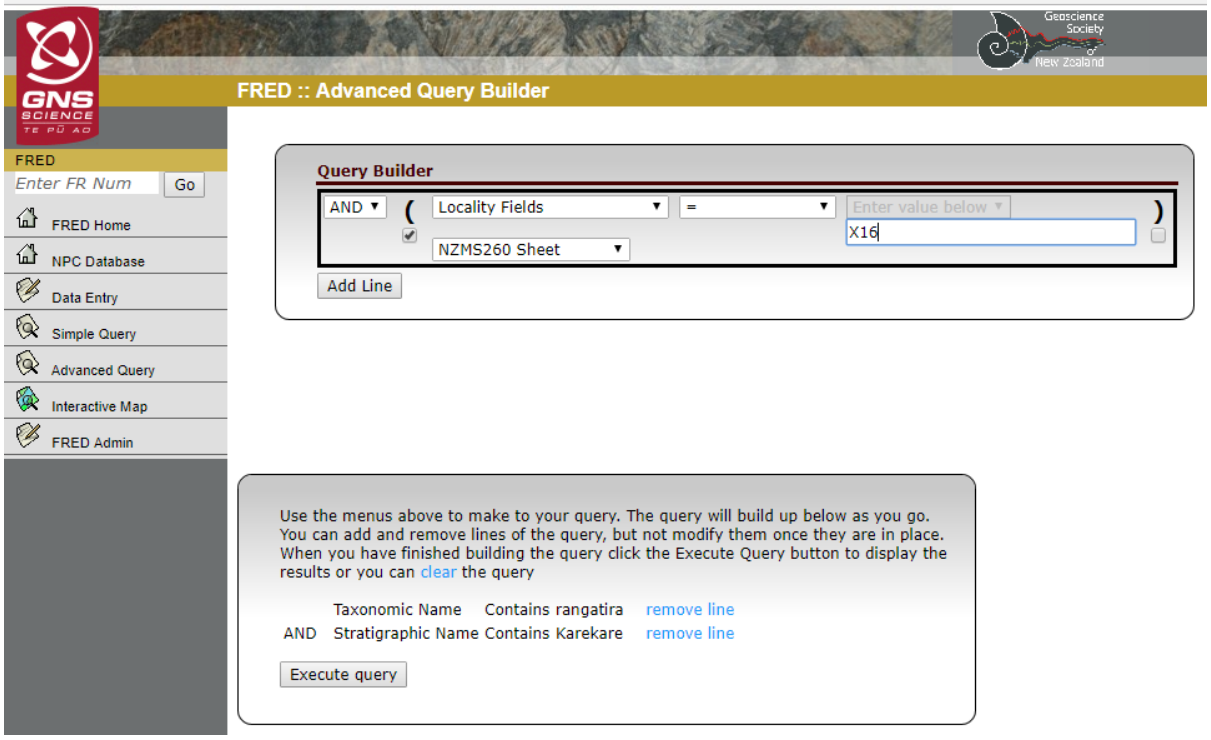
Finally, we need to look for the specific map sheets, either X16 or Y16. It is tempting to try the OR operator, as we did in the previous example. However, if we just enter the following:

	Taxonomic Name contains rangatira
AND	Stratigraphic Name contains Karekare
AND	NZMS260 Sheet = X16
OR	NZMS260 Sheet = Y16

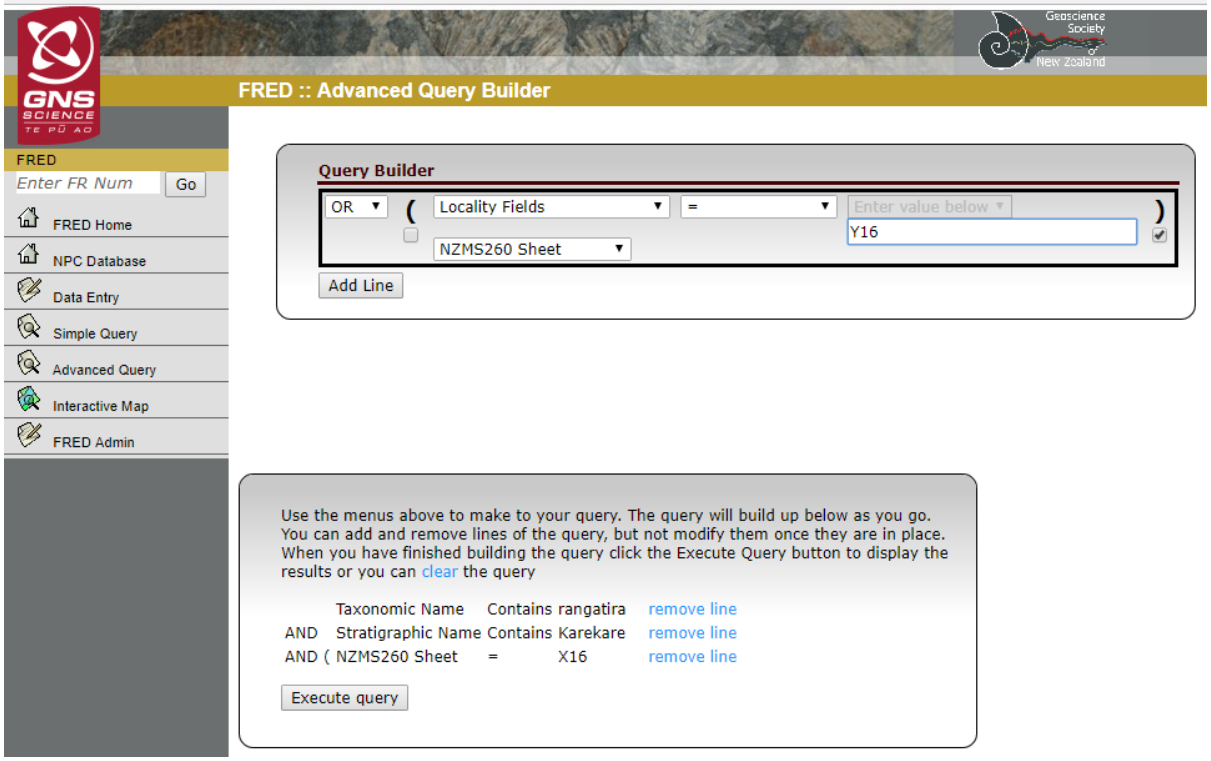
the order of operations will be defined only by the sequence of the search terms. (In this particular case, it will find the ~22 records of Karekare *rangatira* in X16, plus the >1500 records of any sort in Y16.

We need some way to group the last two search terms together into a composite search term, to limit the scope of the OR operator to just those terms. The usual way this is done – both in mathematics and in FRED – is to use parentheses.

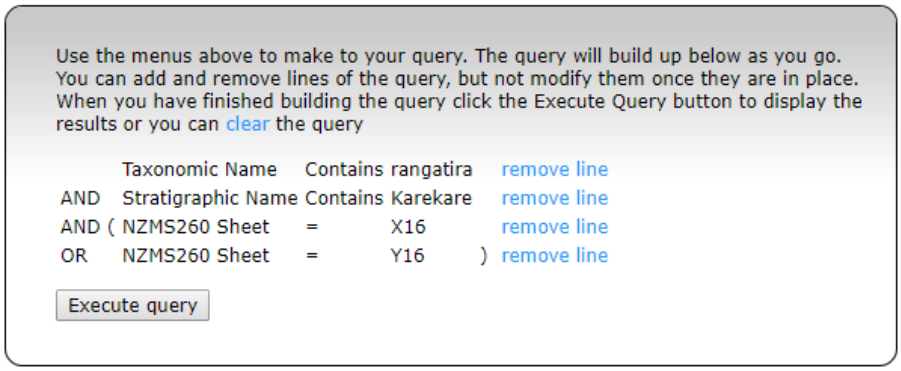
After entering the first two search terms, click on the left parenthesis in conjunction with the third search term, as shown:



Add the line. For the fourth search term, you can now use the OR operator, enter the search criteria, and click on the right parenthesis:



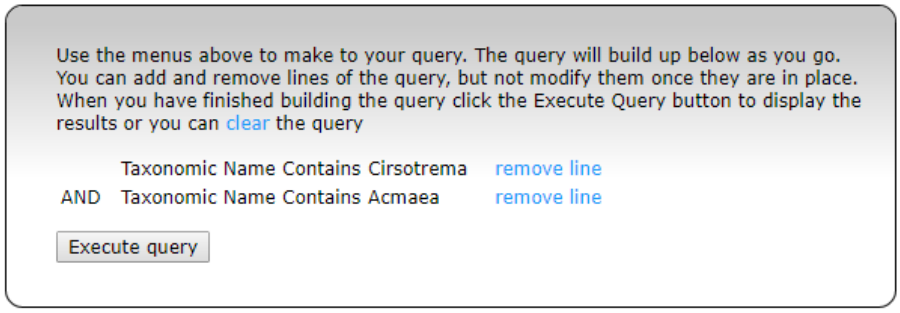
Add the line for the finished query:



This query (at the time of writing) finds 22 records from X16 and just 2 from Y16.

These results are correct as far as they go. You should note, however, that the quality of data in the various stratigraphic unit fields is often quite poor. Many records use informal unit names which have never been published in the Stratigraphic Lexicon and, of course, many of the older names have fallen into disuse.

Another important caveat to note, particularly for researchers interested in paleoecology, that it is *not possible* to find co-occurrences of two or more different taxa using the Advanced Query (or any other existing facility in FRED). A query like the following:

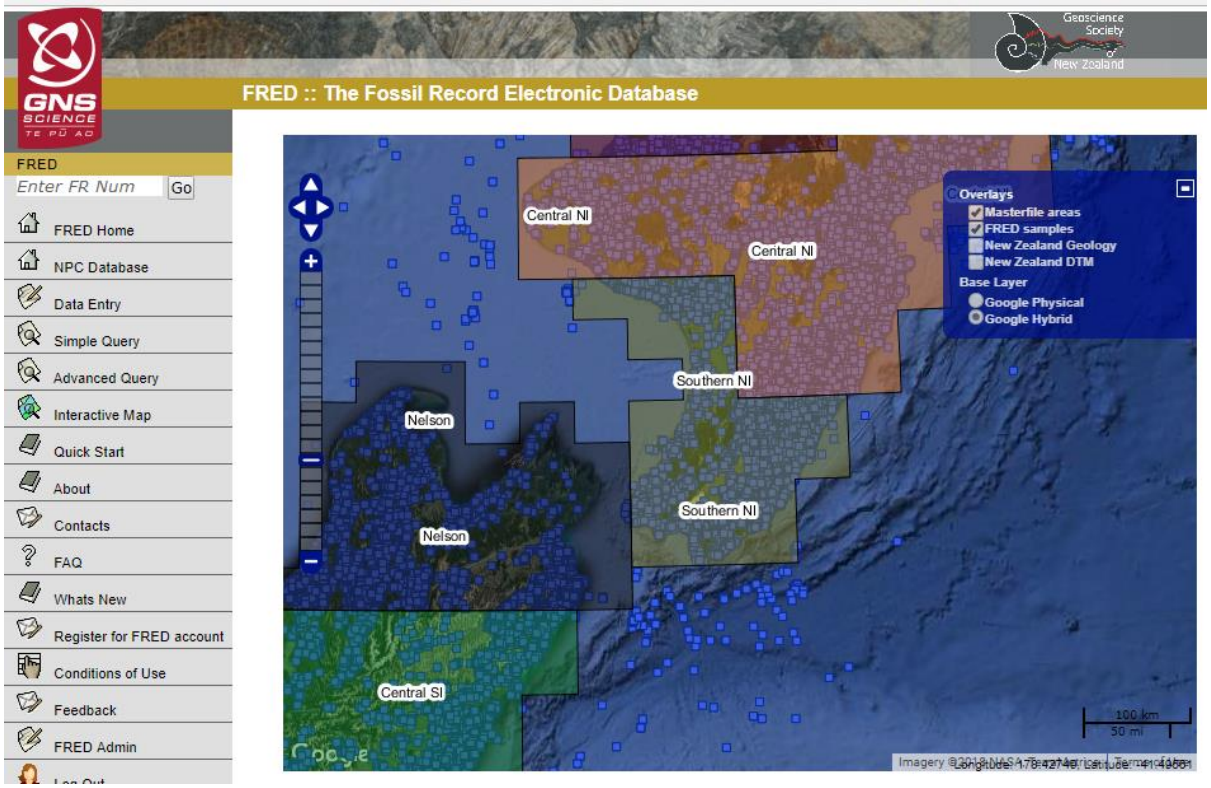


will always return zero records. (The reason is because the Advanced Query is searching for a single taxonomic record which contains both genus names, whereas each taxon is in fact held in its own, separate, record. There is no one record which holds both taxa.) If you need to perform a search like this, you must search on each taxon separately, download the results to spreadsheets, and use the spreadsheet functionality (e.g., VLOOKUP) to find Fossil Record Numbers that are common to both lists. We understand that searching for co-occurrences is a common requirement, and a more elegant solution to this problem is under consideration.

That is really all there is to using the Advanced Query. Once you have worked out where to find the fields of interest in the query builder, and their groupings are reasonably intuitive, then a little imagination is all that is required to formulate successful search strategies.

7.4 Using the Interactive Map

The two main controls for the Interactive Map are the zoom bar on the left, which allows you to zoom in and out on the map, and the overlay toolbox on the right, that controls which data layers are visible. (If the toolbox is not displayed, click on the + button just below the top right corner of the map.)



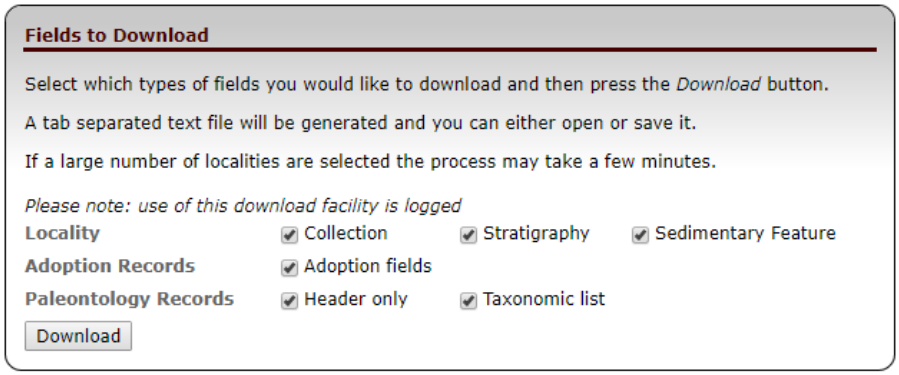
Fossil localities show as blue squares. If none are visible, check the "FRED samples" box in the overlay toolbox.

Clicking on any of the blue squares will display a pop-up box including the Fossil Record Number, the type of locality (mostly either "outcrop" or "drill hole", but see section 5.4 for a description of all types), and a brief textual description of the locality. The Fossil Record Number is a link which will open a new browser tab with full details of the fossil record.

7.5 Downloading Results

Having run a query, you will typically have a list of search results on the screen. (In the event that you query has returned only a single record, then the record will be displayed immediately rather than showing you a list of one search result.)

In either case there will be an item in the left hand menu saying Download or Download Results. Clicking on this menu item will display the following option panel:



Each check box allows you to include the indicated data types (see Section 5.5).

The data will be provided in CSV format which Excel or any spreadsheet should be able to display for you. If you use R or similar analytic software, that will also be able to read the CSV file directly, although you may first wish to inspect the file with a spreadsheet to understand how the data are formatted.

Click on the Download button to download the data. Where it gets stored, and whether it is automatically opened by your spreadsheet application, are going to be dependent on your specific browser, operating system, and security settings. This manual does not attempt to cover such material, and the FRED support team will probably not be able to help much either. You will have to ask your local IT support for assistance if you run into difficulties here.

8 Data Entry – Initial Operations

Before you can enter any new data into FRED, you will need to create a data entry "folder".

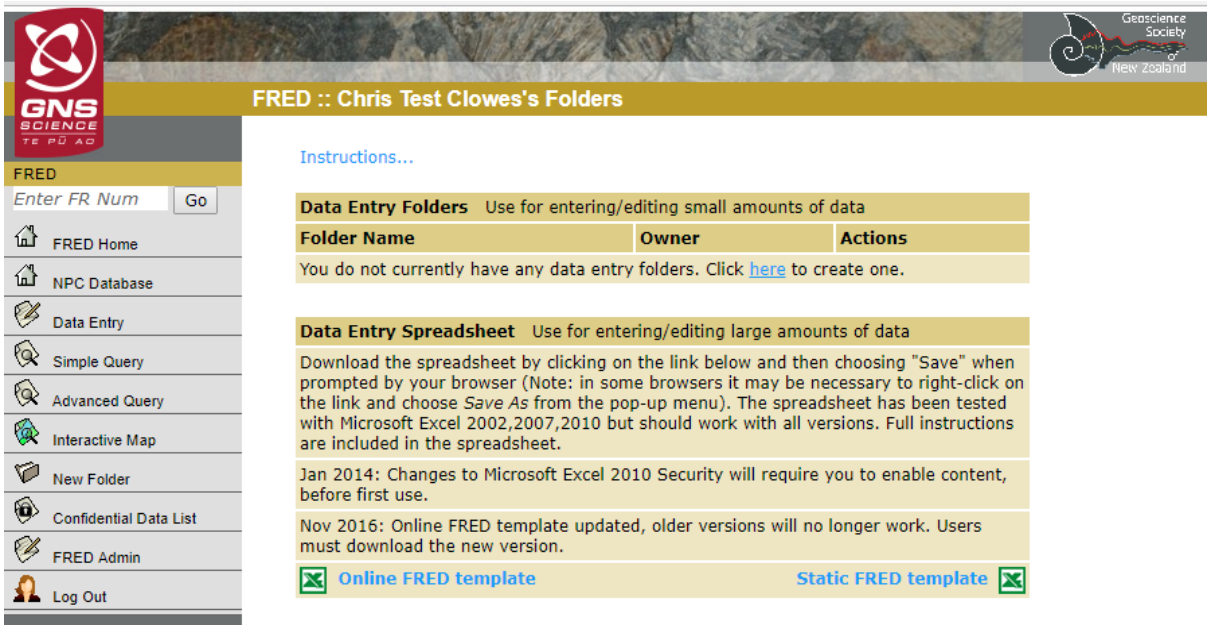
Note that this is not a "real" folder in the usual sense that your computer stores files in folders: it does not need a disk drive letter or anything like that. You can create any number of folders, and they are simply names which allow you to group together collections of data that you are working on, perhaps for different research projects. You will require at least one folder, and although there is no particular limit, it is not recommended that you create so many that they become unwieldy. Most active researchers known to us use two to perhaps six or eight.

You can make your folder(s) visible to other registered FRED users if you are working collaboratively with another researcher. You may also need to add existing records to your data entry folder to modify them; e.g., to add a taxonomic list.

The following sections describe these basic operations.

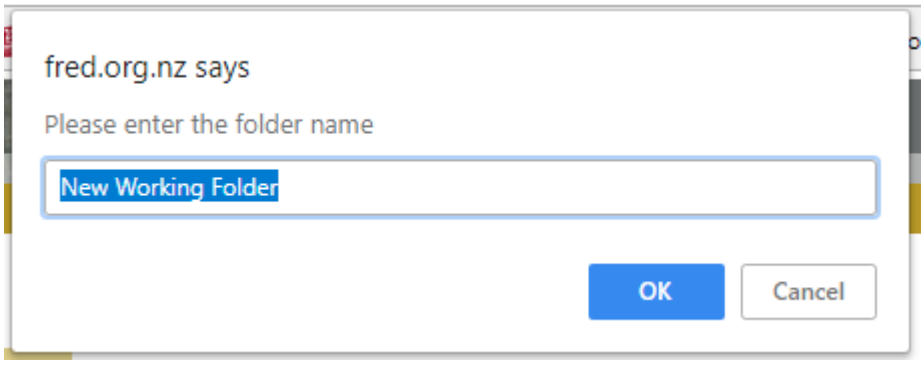
8.1 Create a Data Entry Folder

Click on the Data Entry menu option on the left hand side of the screen. If you do not have any folders at all you will be prompted to create one, as follows:



For now, ignore the panel headed "Data Entry Spreadsheet". The spreadsheets are intended for the bulk upload of data, which we will cover below, and the "online" template is presently being replaced in any case. (Instructions for using the new spreadsheets will be provided in a later edition of this manual.)

Click where is says "Click here" to see the pop-up:

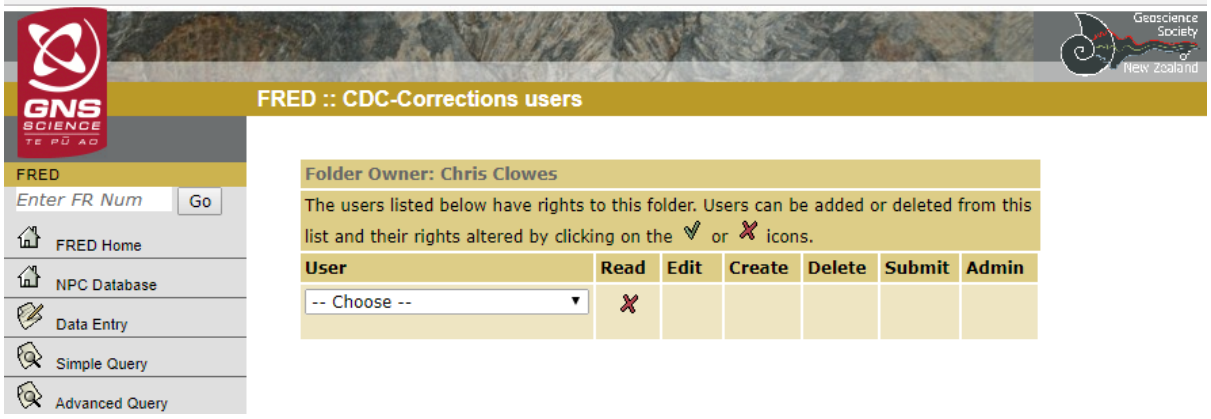


If it does not appear, you may have a pop-up blocker operating. Please check this first, but if you continue to experience difficulty, then contact us. Enter a name for your folder. Avoid symbols and spaces. (At any given time, FRED might accept unusual characters, but there is no guarantee it will always do so, and they are best avoided.) Click the OK button when finished.

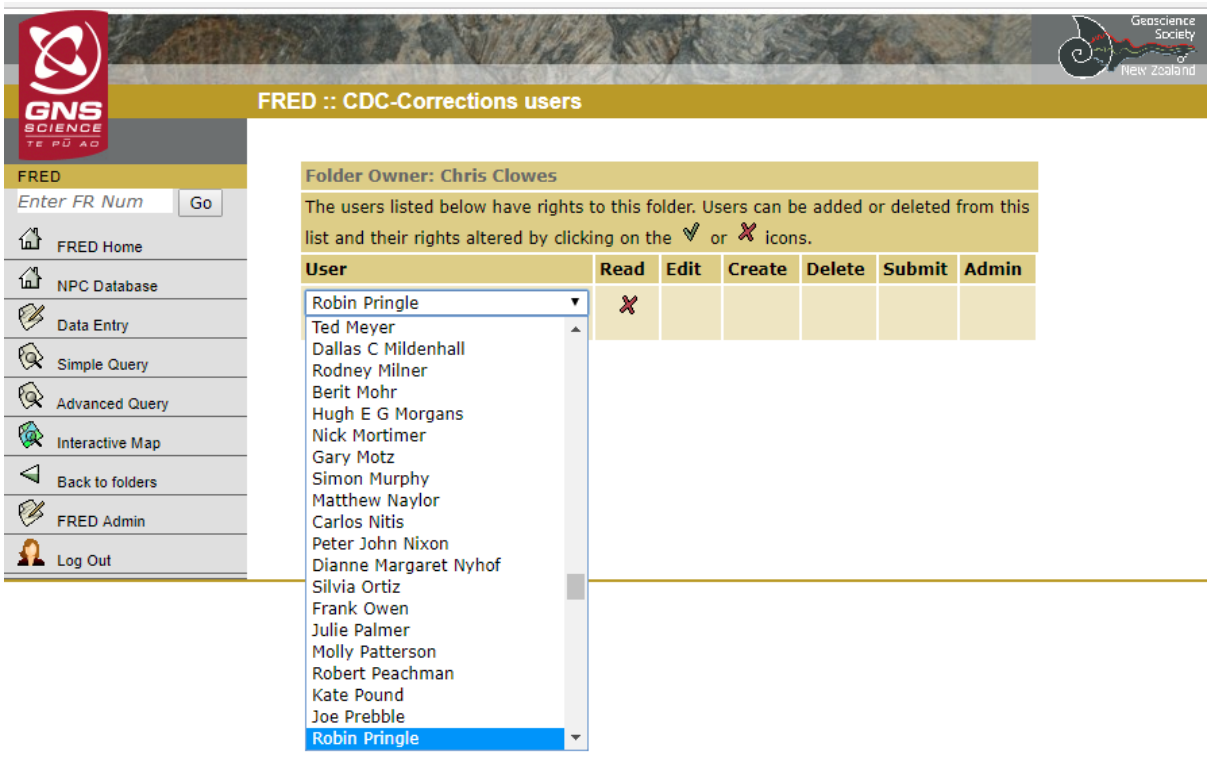
The new folder will appear in your folder list. There are two options available in the 'Actions' column. The first, denoted with the icon, allows you to give other users access to this folder (see Section 8.2). Because the newly created folder is empty, you will also see a second option, denoted with the little trash-can, which will delete the folder if you click it. (Folders with contents do not show the icon; you cannot delete them, accidentally or otherwise.)

8.2 Giving Others Access Rights to your Data Entry Folder(s)

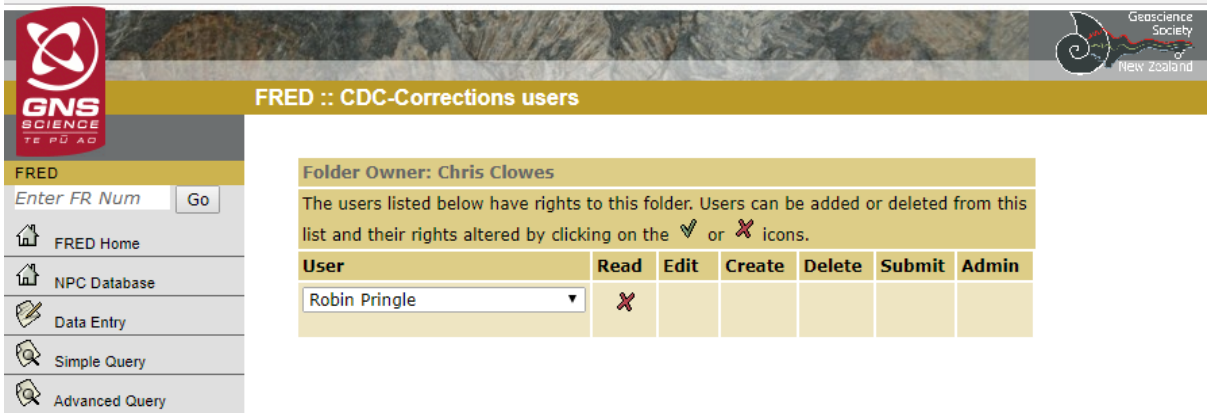
Click on the little icon out to the far right of the folder name. You'll see this screen:



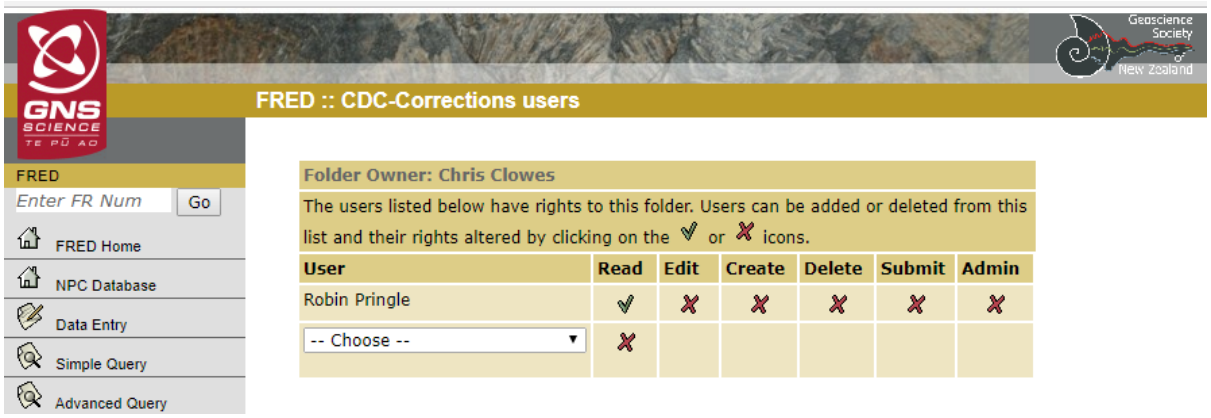
Click inside the drop-down (labelled "—Choose –") and start typing the name of the person to whom you want to extend access rights. This can be a bit difficult because the names are listed in alphabetical order by surname, whereas you have to start typing a person's first name to find them. You'll get there if you persist.



When you've selected a person, the screen will look something like this:



In order to “activate” the icons which change the access rights for this person you must click on the ✗ icon. This is somewhat unintuitive (hence this manual) but once you do it you should see something like the following, and the procedure is fairly obvious from there on:



Click on the crosses to turn them into ticks to grant rights; click ticks to turn them to crosses to remove rights.

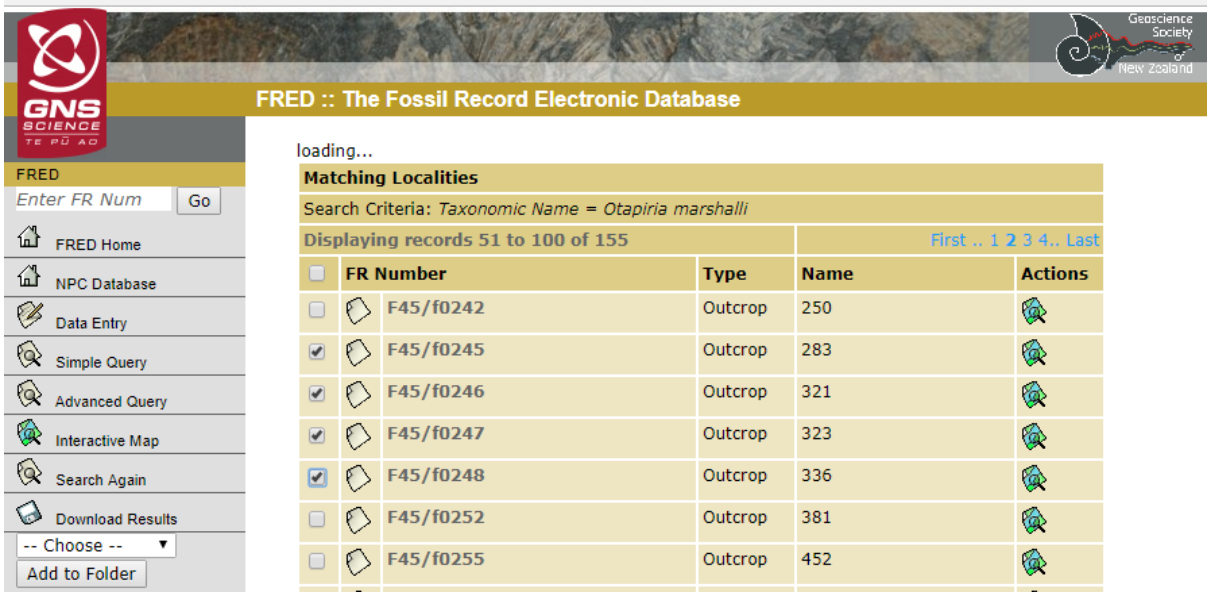
8.3 Add Localities to the Data Entry Folder

To add localities to the data entry folder, begin by searching for the appropriate record(s) using any of the methods described above.

If you have located a single record, it will be displayed in the full screen mode. You can add this record to your folder by selecting the folder you want to use in the drop-down at the left of the screen …

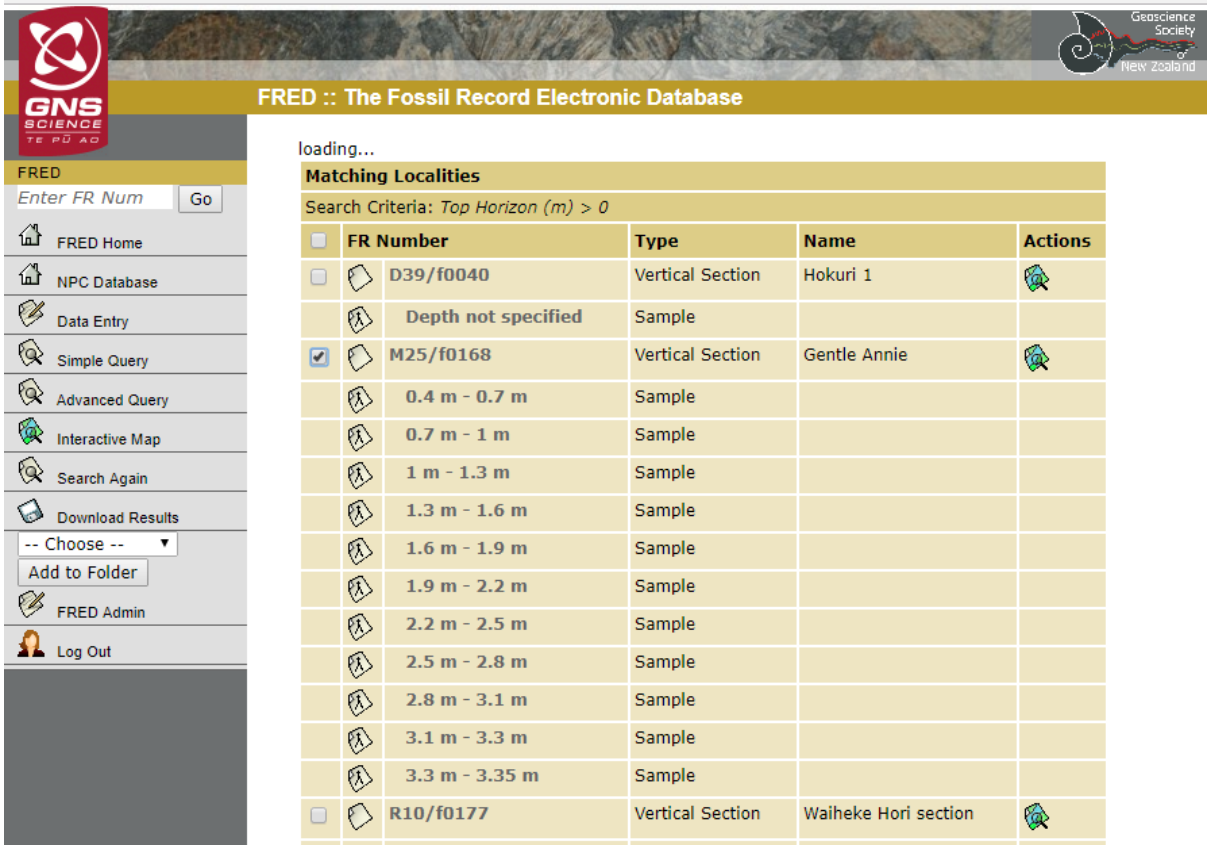
… (you have to do this even if you have only one folder defined) and then press the Add to Folder button.

On the other hand, if you have recovered a number of records, you will have a search list rather than a single record displayed. Note that outcrop records (as in this example) each have a check box to the left of the FRN. To select one or more records, click in the check box to tick it. (A second click removes the tick.)



Add the selected records to your folder by selecting the folder you want to use in the drop-down at the left of the screen and then press the Add to Folder button.

In the case of drill holes and vertical sections, only the "header" record for the entire hole/section will have a check box, as shown below. This is true even if the search results retrieve only a single record.

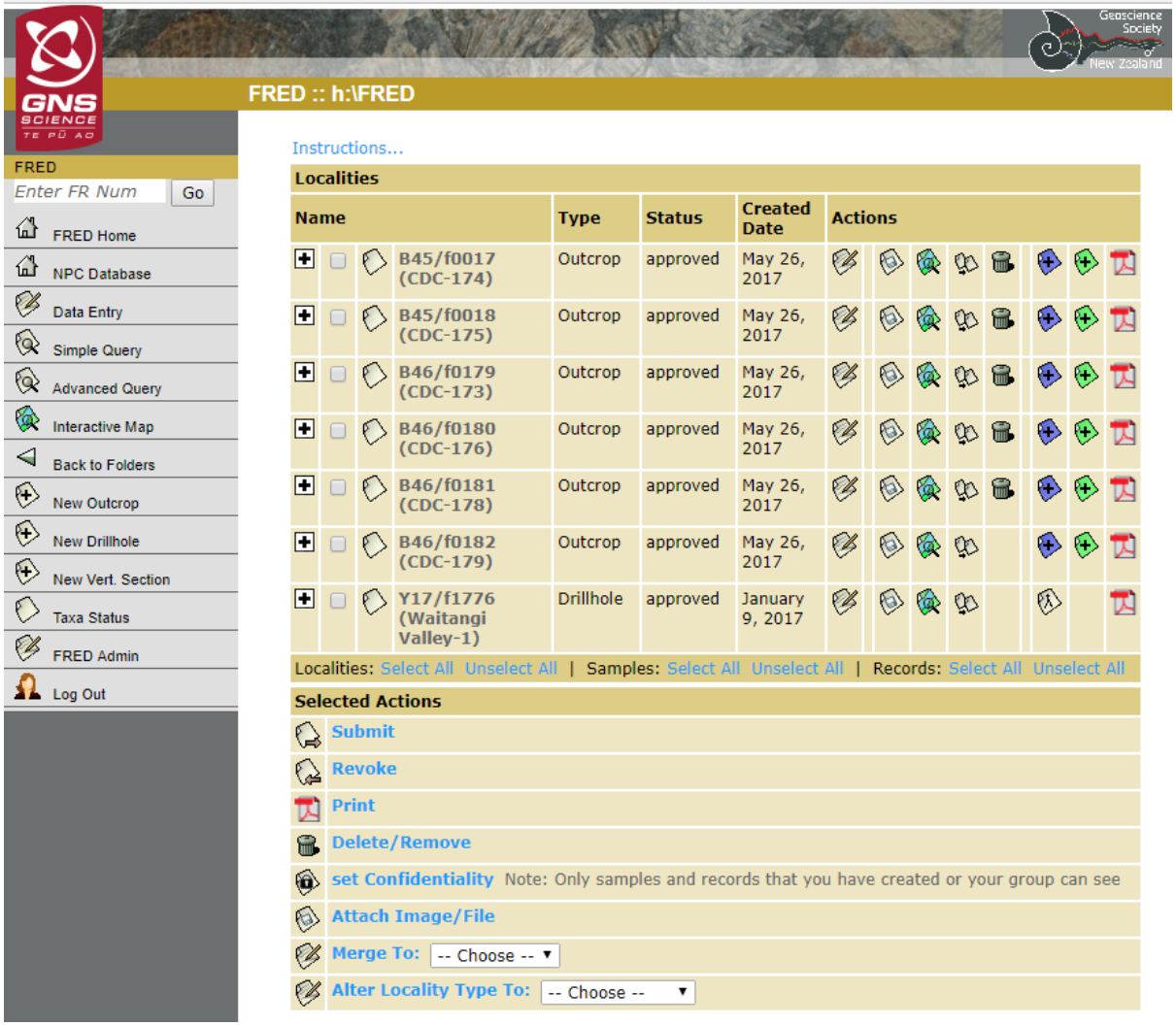


If you fill in the folder name and click the Add to Folder button without checking at least one box, nothing will be added to the folder. There is no error message.

On the other hand, if you have selected something and click on the Add to Folder button, a pop-up message advises that it is done. Click Ok.

You can repeat this process as often as required to populate your folder. However, you will need to choose the folder again each time you add records to it, because your folder selection is cleared each time you click on the Add to Folder button. [There are some obvious usability improvements we can make here, though they will take time.]

Click “Data entry” in the left column menu, then click on the name of your data entry folder to see its contents.



9 Data Entry Using Forms

Usage note: To find things on the data entry forms, please note that CTRL-F doesn't bring up the usual browser search window you may be expecting. However, you can still bring it up by clicking Edit → Find (Internet Explorer) or ⋮ → Find (Chrome) instead.

9.1 Locality (Outcrop/Drill hole/etc.) Data

9.1.1 Creating a New Locality Record

To add a completely new locality to the FRED database, follow these instructions:

1. Click on Data Entry in the left hand menu.
2. Click on the name of the folder you wish to use.
3. Click on 'New Outcrop' (or 'New Drill hole' etc., as appropriate).
4. Fill in the form (see below, Section 9.1.2).
5. When finished, click on the 'Save' link at the bottom of the form.

   If there is an error which prevents the form from being saved, you will be taken to a new screen with a simple (and usually uninformative) error message.

   Stop!

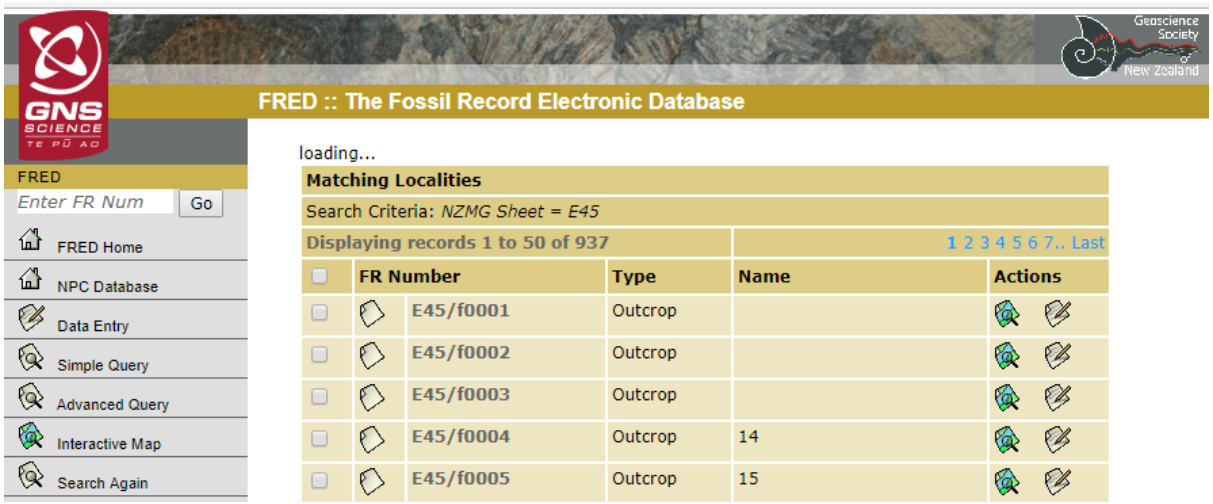
   As long as you haven't done anything else first, you should be able to use the 'back' function on your browser to return to the data entry form, find and fix the error, and try to save again. This technique isn't guaranteed, but the writer has found it to work successfully on a number of previous occasions. It is certainly worth trying, anyway.

   Recognising the error may be difficult, especially if you are new to FRED. If you really cannot find what is causing your problem, get in touch with the FRED support team for help (see Section 6.5 for contact details).

9.1.2 Editing a Locality Record

If you are creating a new record, as outlined above, then the record editing form will be open in front of you.

On the other hand, if you are resuming a previous edit session, then you will have to "open" a record for editing. Do this by going to the appropriate folder (click Data Entry in the left hand menu and choose your folder from the list), find the correct record…



… and click on the icon. The data entry form will open. In the case of a new record (see Section 9.1.1) the form will be completely blank, like the following:

In the data entry form, type information into the boxes, or use the drop-down lists where applicable. Fields with red labels are mandatory.

When entering coordinates, note that up to 6 decimals places can be entered. For lat/long coordinate systems, enter only degrees (with decimal places rather than separated minute and second components). Do not place a letter 'S' after the number; use a leading negative sign unless you really are entering a record for the Northern Hemisphere.

You cannot use double quotes or ampersands in the Locality Description field, and there may be similar limitations for some other fields, as well (FRED was not well-documented in the past). In any event, it is best to avoid quotes in any text fields. If you (or somebody else) downloads the data to a spreadsheet, the quotes can cause Excel to misalign columns.

Fields can be copied from another FRF as long as it is in the data entry folder. This is useful when entering a group of new forms – perhaps from a section – where much of the information is the same for all samples. Click inside the field you wish to populate, then click on the Copy From option in the left hand menu, and select the form you wish to copy from in the pop-up window which appears. The field will be populated from the corresponding field in the selected form.

(Another way to do this is to copy an entire form, using the icon in the folder listing, and then modify the copied form.)

Some fields have a builder button ( ) associated with them. Builders assist you to enter complexly formatted data. Click on the button, and a pop-up window will prompt you for the data required to populate the field. Most often, builders are used where the field calls for multiple items to be entered, such as the "Sent To" field. It is best to use the builders for a start, although the resulting text can be edited directly in the main window once you understand the correct format.

You can also use the icon in the folder listing to attach an image file, such as a photograph of the locality, or a scanned sketch map or column.

You can save the form using either the Save option in the left hand menu, or the Save link at the bottom of the page. You can save partly completed forms and return to them later (as described above) to add or amend data. You can save partly completed forms, even if they are missing data in some of the mandatory fields, but they cannot be "submitted" (see below).

9.1.3 Submitting the New Locality Record

When you are satisfied with what you have recorded, you must "submit" it for approval by a curator before it will appear in the FRF. There are three ways to submit a form:

1. You can click on the icon in the folder listing.
2. While editing, there is a Submit button in the left hand menu you can use.
3. There is also a Submit link at the bottom of the data entry form.

These options will be greyed out or unavailable if there are obvious deficiencies with the form, such as missing mandatory fields, but the presence of a submit button does not guarantee your form will be accepted. Once submitted, it will be examined by a human curator (there are several, at various institutions) who will check it manually. This may take a few days, depending upon the availability of the curator.

(There are no formal service levels to guide our expectations of how quickly a curator will process a form. Nor are there "deputy" curators to cover periods of illness or leave, so the turn-around time can vary. If you are experiencing an unreasonable delay or are concerned for some other reason, get in touch with the FRED support team; see Section 6.5 for contact details.)

Once approved by the curator, a new FRN is created and you will be notified by email that the new locality has been approved (or, if not, then there will be a brief explanation so you can fix it and try again) and what the FRN is.

Approval takes effect immediately the curator has pressed the 'approve' button but the email telling you that your form(s) has been approved is generated by a batch process which runs at approximately 5 a.m. the following morning, so you will not know until the following day. This means that, unless you have declared your new FRF to be confidential (not covered in this version of the manual), then it will become visible to all registered users of the database as soon as it has been approved and issued with a FRN, i.e., even before you have been sent your notification email, much less read it.

After approval, although your form will remain in your data entry folder, you will no longer be able to edit it.

If you have paleontological data or Adoption comments to add, you can do so immediately (see Section 9.2 for paleontological data; adoption is not covered in this version of the manual).

Otherwise, use the icon to "delete" the record from your data entry folder. You will be prompted to ask if you are sure you wish to delete the locality. The word "delete" is unfortunate in this system message, because it carries the connation of destroying data. If your record has been approved, however, then all this operation does is to remove the item from your data entry folder.

(If the record has not been submitted, however, then whatever data you had entered into it will be lost.)

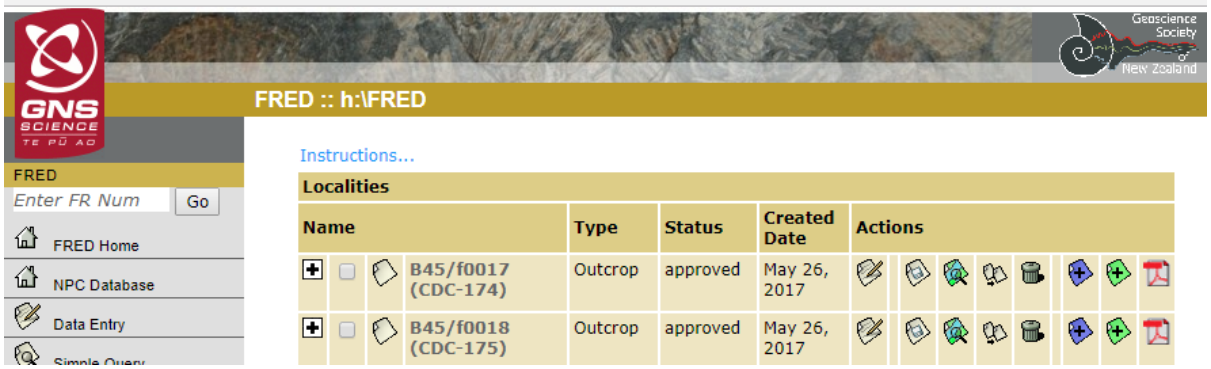
Once all items have been removed from a folder, and it is empty, then the folder itself can be deleted if you wish. Choose the Data Entry option from the left hand menu and click the trash can icon in the Actions list:

9.2 New Paleontological Analysis

9.2.1 Creating a New Paleontological Record

Paleontology records must be attached to a saved locality record. However, the locality record does not have to be submitted or approved: you can begin entering the paleontological data as soon as you have saved the locality record.

The "parent" locality record needs to be available in a data entry folder. If it is not in one already, follow the procedure in Section 8.3.

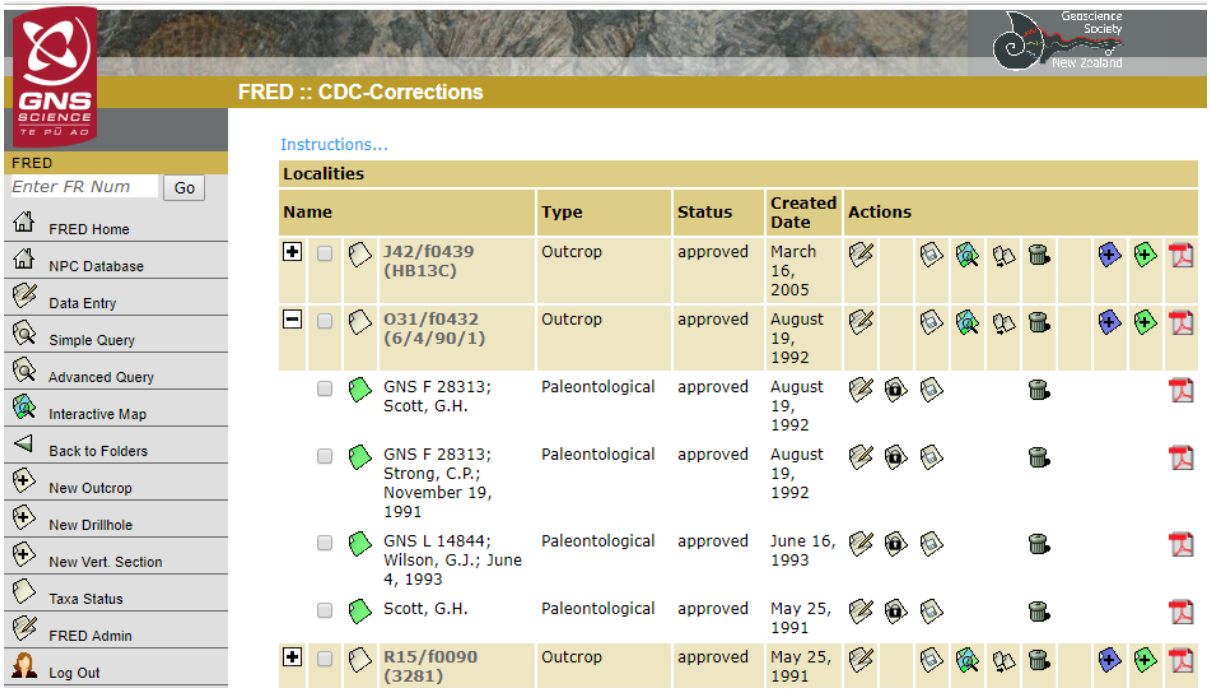


Add a new paleontological analysis by clicking the *green* + icon ( ) in the Actions list for the record.

9.2.2 Editing a Paleontological Record

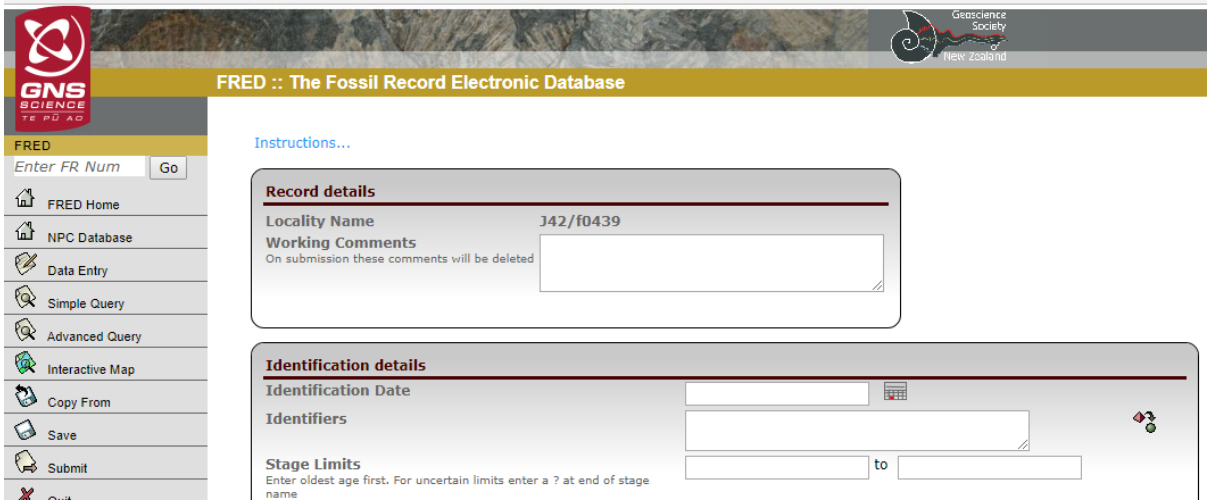
If you are creating a new record, as outlined in the previous section, then the record editing form will already be open in front of you.

On the other hand, if you are resuming a previous editing session, then you will have to "open" a record for editing. Do this by going to the appropriate folder (click Data Entry in the left hand menu, choose your folder from the list), find the correct locality record, "expand" it by clicking the ⊞ icon to see the associated paleontological record(s)…



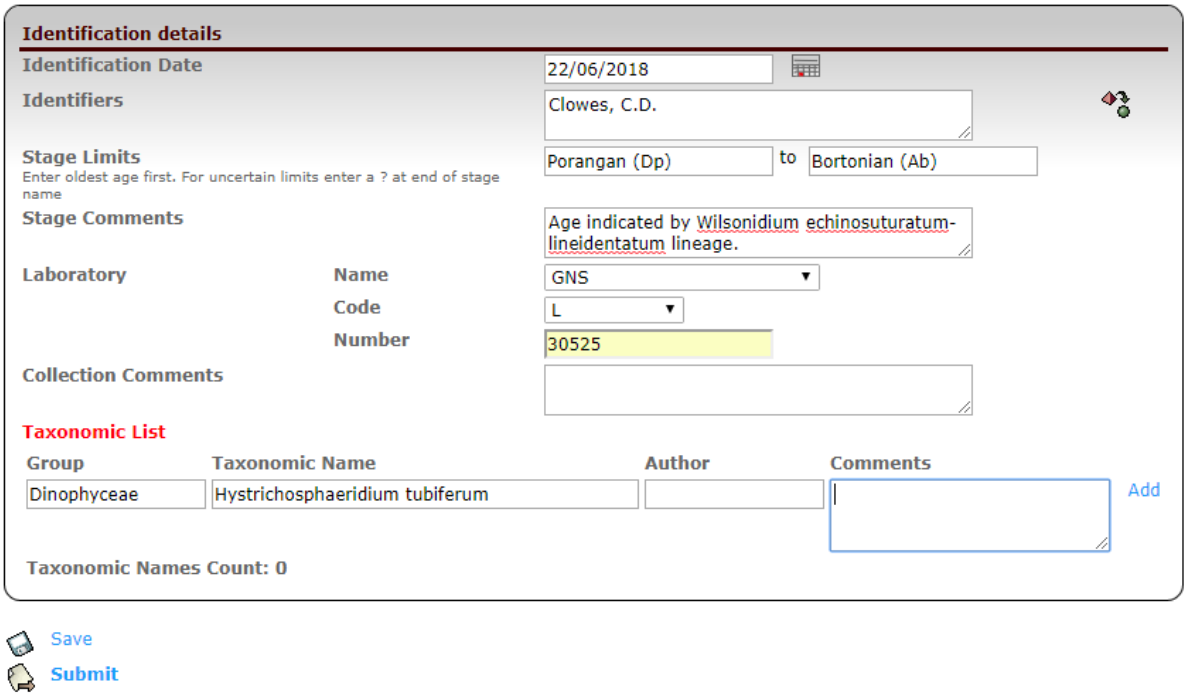
… then use the icon to begin editing the paleontological record.

The data entry form will open. In the case of a new record the form will be completely blank, like the following:



As with locality records, the fields are a mixture of text boxes, drop-down menus, and "builders", and mandatory fields are identified by red labels (see Section 9.1.2).

When you reach the Taxonomic List, you will be presented with four columns:



The first column specifies the taxonomic group you are studying. There is a prescribed list of these; you cannot add new ones. If in doubt, choose the most restrictive one you can find. For example, if you wish to record the presence of the bivalve *Dosinia*, then choose Bivalvia rather than Mollusca for the Group.

Enter the taxonomic name in the second column. As soon as you begin to enter something, a drop-down list will appear. The list will become more refined as you type further characters. In general, you should find the name you are entering in the list; you can either type it yourself or select it from the drop-down.

However, this list will allow you to enter a name which does not occur in the list. Such "new" names will be sent to a curator for approval before your record is accepted into the FRF. The purpose of this mechanism is to minimise typographical errors; not to regiment taxonomic practice in any way. In fact, anyone who is entering historic data is strongly encouraged to enter taxonomic names precisely as they appear in the data source; please do not *try* to "bring it up to date" by using a newer taxonomy.

Record indeterminate specimens within a major group as "gen. indet." or, for example "*Belemnopsis* sp. indet.".

The "new name" concept also permits the entry of manuscript names. Identify these by placing single quotes around the unpublished part of the name, such as '*Fenestridium*' *clathrodermum* or *Chione* 'northland'.

Informally named taxa such as "*Belemnopsis* spp.", "*Belemnopsis* sp.a" or "gen. A sp. b", are also acceptable.

When entering a published name that does not already exist in the drop-down list, please enter the original author of the name (if you know it) in the third column. Otherwise you can ignore this column. (The author field is generally poorly-populated in the FRED database. This is something we would like to improve, but is relatively low-priority for the present.)

The Comments field can be used to describe the taxonomic concept or for other notes. Census counts and slide coordinates can be entered using specific formatting (to be described in a future version of this manual; please contact us for further information in the meanwhile; see Section 6.5 for contact details).

Once having entered the taxonomic line, click on the Add link to the right.

The line of data will move down to a list below the active data entry boxes, and the Name through Comments boxes will clear, ready for the next entry. Note also that there is a counter at the bottom left, stating how many taxa have been entered (sometimes useful if you are entering taxa from a printed list).

You can re-edit a line by clicking on the Edit link to the right. This action will remove the line from the lower list, and return it to the editing boxes. *Regardless of whether you change the line or not, you will have to click the* Add *link to put it back into the list.*

(Alternatively, you can delete a line entirely by clicking on the Remove link to the right.)

Once you are satisfied with your taxonomic list, you can click Save to return to the data entry folder, or click Submit to submit the paleontological record (including the species list) immediately.

As noted above, taxonomic names not already in the online Thesaurus are (automatically) sent to a curator for approval before a paleontology record is accepted into the database. As part of the submission process, the panel that approves new names for the relevant fossil group is notified by email. Once names are approved, the submission proceeds automatically. You do not need to do anything further unless the "new" name is rejected.

9.2.3 Correcting Taxonomic Names that have been Rejected

If you pick a taxonomic name from the Thesaurus (i.e., from the drop-down list) it will be accepted automatically. However, there are many reasons why a user might legitimately wish to enter a "new" name which isn't there already, and FRED allows them to do so.

These new names are scrutinised by one of our curators, chosen for their expertise in the specific taxonomic group. If the name is (or ever was) an existing published name, it should always be accepted. Similarly, manuscript and some informal names will normally be accepted also.

Sometimes they will rejected, however, and you will receive an email explaining which one(s) was rejected and why. Normally it will be because you have misspelled a published name or because an equally acceptable entry already exists in the Thesaurus (for example, a curator will not allow you to add "*Discoaster* sp." if "*Discoaster* spp." already exists).

If you receive a rejection email, re-locate the species list, copy it into a data editing folder if it is not already in one, and open it for editing (Section 9.2.2). Correct the issue, remembering to Add the item from the editing boxes back into the list, and re-submit.

10 Data Entry Using Spreadsheets

This function is being redeveloped. Full user instruction will be introduced when the new modules become available.

Please contact the FRED administrators (see Section 6.5 for contact details) in the meantime.

11 References

Raine, J.I. 1992: “FRED”, Fossil Record Electronic Database using BASIS. Institute of Geological & Nuclear Sciences science report 92/10: 1-107.

12 Appendices

12.1 Data Items Guide to Entry

12.1.1 Locality Data

Field Name	Meaning/Guidance
Field Number	Outcrop records only This field is intended to record the collector's field number for this sample/collection. If you are using the spreadsheet data entry mode, be careful if your collection numbers even remotely resemble dates (e.g., 2-3), because Excel may try to be "helpful" by converting them into true dates which are likely to be imported into FRED as something totally unrecognisable. It is often helpful to prepend your initials to numeric field numbers, to prevent this from happening.
Drillhole Name	Drill hole records only Enter the name of the drill hole. Usual practice is to use mixed case.
Section Name	Vertical section records only Enter a name for the vertical section. Because vertical sections are completely informal, these can be made up as required, just like a field number.
Registration Area	All locality types When new locality records are added to FRED, they are manually checked by a human curator prior to being allocated Fossil Record Numbers and accepted into the database. The 'registration area' is used, in conjunction with the actual locality indicated by the coordinates, to divide up the workload among multiple curators. Most often the value will be "Mainland NZ" although FRED recognises a total of 22 registration areas available in the drop-down menu.
Recollection of	Outcrop records (and vertical section records, but see below) If this is a re-collection of a previous collection which has been issued a Fossil Record Number, enter the Fossil Record Number of the earlier collection here. Otherwise, leave this field blank. The data entry form for vertical sections also provides this field. However, it is not completely clear how this field is supposed to be used (in fact, it has only ever been used in this situation twice) so it is recommended you do not use it for vertical sections.
Sidetrack of	Drill hole records only If the hole you are registering is a side track of an existing hole, enter the name of the existing hole.
Working Comments	All locality types You can use this field for temporary notes while you are working on entering the data. However, it is not imported into the FRF and once you have submitted your data and deleted the entry from your folder, it will be lost.

Field Name	Meaning/Guidance
Coordinate System (labelled as “Coord Type”)	All locality types Before it can accept a grid reference or lat/long coordinates, FRED needs to be told which coordinate system you are using. The most commonly used systems are NZMG, NZTM, NZTopo50 (if you are reading a grid reference from a map), and NZGD2000 (for GPS coordinates). However, numerous older systems have been retained in the drop-down menu for backward compatibility with historic records, including the old pre-metrication yard grids. Most GPS units are set up to use one of WGS84 or NZGD2000.
Easting	All locality types Enter the easting in whatever coordinate system you have chosen above. Up to 6 decimals places can be entered. For Lat/Long coordinate systems, enter only degrees (with decimal places rather than separated minute and second components). Do not place a letter ‘E’ after the number.
Northing	All locality types Enter the northing in whatever coordinate system you have chosen above. Up to 6 decimals places can be entered. For Lat/Long coordinate systems, enter only degrees (with decimal places rather than separated minute and second components). Use a leading minus sign (unless you really are entering a record for the Northern Hemisphere). Do not place a letter ‘S’ after the number.
Map Year	All locality types If you are determining the coordinates by reading off a map, enter the may year in this field. Otherwise, leave it blank.
Method	All locality types This field records the method by which the coordinates were established. Most often, these days, the location is established either by direct GPS measurement (“GPS – Field”) or by interpolation between these (“GPS – Differential”) but sometimes locations must be established by examining map coordinates. The drop-down gives a choice of map scales, GPS, and other options.
Accuracy (m)	All locality types This field will default to 10 m if you leave it blank. If your coordinates are more or less accurate than 10 m, you should enter the accuracy here.
Locality Description	All locality types Enter a description of the locality in sufficient detail that another party could, at least in principle, make a re-collection. Obviously there is not much one can say about off-shore drill holes, but on-shore localities can usually be described quite well.
Country	All locality types Enter a country name (most often “New Zealand”). The drop-down can be frustrating if you are a slow typist: too long a pause between the ‘N’ and the ‘E’ and you’ll be looking at East Timor. The secret is to type “new” really fast (that will get you as far as New Caledonia) and then just use the down arrow to get to New Zealand. Don’t worry about upper and lower case: the drop-down doesn’t care.

Field Name	Meaning/Guidance
Coordinate Comments	All locality types Use this field if you wish to record something relating to the locality coordinates.
Locality Comments	All locality types Use this field to enter any further comments about the collection site that are not directly concerned with its geographic location (e.g., rivers prone to flooding, etc.)

The following additional fields are required for drill holes only:

Field Name	Meaning/Guidance
Operating Company	Enter the name of the operating company (i.e., the company performing the drilling; not the exploration company)
Spud Date Completion Date	Enter the spud and completion dates of drilling.
License Area	Enter the license area code.
Datum Elevation	Before we can specify kick-off and termination depths, it is necessary to establish the datum from which they are measured. Allowed options are rotary table, Kelly bush, and Seafloor. The second component of this field asks for the height of the datum relative to “asl” (use mean sea level).
Kick-off Depth Termination (TD)	Enter the kick-off depth and TD relative to the datum specified above.
Depth Unit	This “field” is a radio button allowing you to specify whether the kick-off depth and TD are specified in metres or feet.

The following additional fields are required for vertical section only:

Field Name	Meaning/Guidance
Section Collector	Enter the name of the person(s) making the sample collections from the vertical section.
Sampling Start Date Sampling Completion Date	Enter the start and completion dates of sampling.
Datum Elevation	Before we can specify top and bottom horizon elevations, it is necessary to establish the datum from which they are measured. The field has two components: The first specifies whether the datum is to be the top or the bottom of the section, and the second component of this field asks for the height of the datum relative to “asl”. Use sea level for beach sections. This is not useful for inland sections (e.g., on a river or road cutting). In such cases, use the river or road level instead, and make a note in the Locality Comments about what datum you have chosen. For river sections, please also record whether the river level is atypical (e.g., high after rain). This somewhat ambiguous construct is a known difficulty, which we hope to attend to in due course.

Field Name	Meaning/Guidance
Top Horizon Base Horizon	If the Datum chosen above is the section top, then measurements are interpreted as depths. Where the Datum is the section bottom, measurements are interpreted as heights.
Depth Unit	This "field" is a radio button allowing you to specify whether the horizon depths are specified in metres or feet.

12.1.2 Collection Data (Outcrop Localities Only)

Instructions specific to drill holes and vertical sections will be provided in a future edition of this user manual.

Field Name	Meaning/Guidance
Collection Date	If you are entering data for a new collection, an exact date is expected. However, this information is not always available for historical data. In these cases, please contact an administrator (see Section 6.5).
Collectors	Enter the name of the person(s) making the sample collection from the outcrop. Enter the name(s) of the collector(s) in the format: surname comma initials and click Add. Repeat as necessary for multiple collectors. Names in FRED have traditionally been written with full stops between initials. Unless you know that a particular name has never been entered in FRED before, it is best to stick with this convention, to avoid creating synonyms of people's names. In the particular case of drill holes, note that the "collector" is the *person who sub-samples the core/cuttings for the purpose of making a paleontological analysis*. Sometimes this may be the on-site geologist who bags the cuttings. However, in general it is *not* the exploration company or the rig operator.
Fossils In Place	Use this field to describe whether the fossils are in situ or not (e.g., river float). In addition to 'yes' and 'no', FRED also allows users to enter 'almost' which may be useful for displaced blocks on a scree, for example.
Sent To	This field describes who the collected material has been sent to (a person's name and institution), and what for (normally a broad discipline, like "microflora"). If the "Not Collected" field (see below) is empty then this field is required; otherwise it is optional. A single "sent to" destination comprises four elements: [1] a broad indication of the kind of study intended, [2] a person's name (in surname-comma-initials format), [3] the name of a recognised institution, and [4] an optional comment. Multiple destinations may be entered. A builder is provided to simplify entering data in the correct format.
Not Collected	Use this field to specify fossils seen in the field but not collected. Note that this is a "free text" field. There is no data validation or checking of taxonomic names so your ability to search this field subsequently is necessarily limited.
Significance/Comments	Optionally use this free text field to enter any further comments about the significance of the collection.

12.1.3 Stratigraphy Data (Outcrop Localities Only)

Instructions specific to drill holes and vertical sections will be provided in a future edition of this user manual.

Field Name	Meaning/Guidance
Stratigraphic Name	This field is available to record the name of the stratigraphic unit collected. Ideally, this should be a published stratigraphic name (e.g., as recorded in StratLex; https://data.gns.cri.nz/stratlex/search.jsp) although informal unit names are accepted also. Avoid abbreviations (e.g., write "Mudstone" rather than "Mst").
Inferred Stage Limits – from Inferred Stage Limits – to	Use these two fields to record the Stage/Age range *inferred* from all available evidence at the time of collection. The field accepts chronostratigraphic rather than geochronologic units (e.g., Lower Haumurian rather than Early Haumurian). Only formally published stage names are recognised; you will not be able to enter informal subdivisions such as "lower Teurian". You can, however, bring up the correct value in the drop-down menu by entering the stage abbreviation.
Known Stage Limits – from Known Stage Limits – to	As above, but use these two fields to record the *known* stage range for the collection/sample. This knowledge may come from stratigraphic interpolation, lithostratigraphy, or from location on a geological map, and possibly from field assessment of the fossils themselves, provided there is no possibility that they are reworked.
Samples Nearby	Enter one or more sample references, separated by semicolons. A sample reference can be: 1. An existing Fossil Record Number 2. Another collection/sample from *your data entry folders*, referenced by the Field Number. Unfortunately, a known bug in the FRED software can cause difficulties if the field number is not unique across the entire FRED database, so it is best to avoid the second option for the present. The bug is scheduled to be fixed, though it may take some time. When the bug is fixed it will be advised in the appropriate future edition of this manual. There is a builder provided for this field; the previous warning still applies however.
Sample Relationships	The format for this field is quite simple but requires care. A single "sample relationship" comprises four elements: [1] an optional modifier, either 'c.' or '?', [2] a distance denominated in metres (e.g., '1.0 m') which may also be expressed as a range (e.g., '1.0 m - 1.1 m'), [3] a stratigraphic preposition, either 'above' or 'below', and [4] a sample reference. As above, a 'sample reference' may be another sample from *this* spreadsheet, referenced by the Field Number. Multiple sample relationships may be entered, separated by number symbols (#). In principle, this field can be typed in. However, it is highly recommended you use the builder, at least until you have become completely comfortable with the format. Unfortunately, this field suffers from the same bug as 'Samples Nearby' – please read the caution discussed above.

Field Name	Meaning/Guidance
Stratigraphic Relationships	The format for this field is quite simple but requires care. A single "stratigraphic relationship" comprises four elements: [1] an optional modifier, either 'c.' or '?', [2] a distance denominated in metres (e.g., '1.0 m') which may also be expressed as a range (e.g., '1.0 m - 1.1 m'), [3] relation to a stratigraphic reference horizon, either 'above top', 'above base', below top' or 'below base', and [4] a stratigraphic unit. Ideally, the stratigraphic unit should be a formally published unit (e.g., as recorded in StratLex) although informal unit names are accepted also. Multiple stratigraphic relationships may be entered, separated by number symbols (#). In principle, this field can be typed in. However, it is highly recommended you use the builder, at least until you have become completely comfortable with the format.
Column/Map	If available, enter a reference where a map or column of the collection site may be found, ideally reference to an entry in the New Zealand Measured Section database which is accessible via PBE at: https://data.gns.cri.nz/pbe/index.html?map=GeolSetting).
Dip	Enter the dip in degrees (0 for horizontal strata).
Dip Direction	Enter one of the eight cardinal or intercardinal compass directions ('N', 'NE', 'E', 'SE', 'S', 'SW', 'W' or 'NW').
Strike	Enter the strike direction in degrees true (leave blank for horizontal strata).
Facing	Enter one of 'Normal' or 'Overturned'.
Stratigraphy Comments	This free text field is available to record any other brief observations about the stratigraphy.

12.1.4 Lithological Data (Outcrop Localities Only)

Instructions specific to drill holes and vertical sections will be provided in a future edition of this user manual.

Field Name	Meaning/Guidance
Grain Size (Primary) Grain Size (Secondary)	Use these two fields to record the primary and secondary grain size.
Comparator Used	Enter 'Yes' or 'No' to record whether a grain size comparator was used to determine the primary and secondary grain size values above. Leave blank if grain sizes were not entered.
Stratification Thickness	Use this field to record the scale of stratification.
Stratification Features (two fields, for primary and secondary Features)	Use these two fields to record any stratification features. Place the most prominent feature in the first field.
Weathering	Describe weathering of the sample you have taken (not the outcrop generally) in this field.
Hardness	Describe hardness of the sample in this field.
Carbonate	Use this field to distinguish between non-calcareous, calcareous, and limestone samples.

Field Name	Meaning/Guidance
Shade Colour (Primary) Colour (Secondary)	Use these three fields in conjunction to describe the shade and colour of the sample.
Wet/Dry	State whether the colour was determined when the sample was 'wet' or 'dry'.
Additional Features	The additional features field has a builder: it is best to use this facility, at least until you are completely comfortable with the permitted formatting of the data. It allows the recording of sedimentary features such as burrowing, concretions and glaucony.
Inferred Environment: • drop-down • text box	There are two fields following the 'Inferred Environment' label: a drop-down menu and a text box. Use the drop-down menu to enter one of "Marine" or "Non-marine". Use the box to enter any free-text to add any further details you wish to record (such as fluvial, lacustrine, etc.)
Nature of Rock Unit	Use this field for any additional notes on the nature of the unit. You can enter anything you like. The following example is from A44/f0005: Fining upwards cycles, sandstone or conglomerate up to carbonaceous siltstone or mudstone up to lignite.
Correspondence, Cross-references	Use this field to reference any correspondence, publications, or other information source.

12.1.5 Paleontological Analysis Data

Field Name	Meaning/Guidance
Working Comments	You can use this field for temporary notes while you are working on entering the data. However, it is not imported into the FRF and once you have submitted your data and deleted the entry from your folder, it will be lost.
Identification Date	If you are entering data for a new collection, an exact date is expected. However, this information is not always available for historical data. In these cases, please contact an administrator (see Section 6.5).
Identifiers	Enter the name of the researcher who is identifying the fossils. Enter the name(s) of the collector(s) in the format: surname comma initials Multiple entries can be made if required. Use the Enter key to write each name on a separate line (or use the builder). Please see the guidance given above ('Collectors' field) for entering names.
Stage Limits	Use these two fields to record the beginning and end of the Stage/Age range *indicated by the taxonomic analysis*. Do not use other knowledge (e.g., stratigraphic relationships or the results obtained from the study of a different taxonomic group) here. FRED provides a different mechanism (Adopted Age) for synthesised age determinations. Use chronostratigraphic rather than geochronologic units (e.g., Lower Haumurian rather than Early Haumurian). Use only formally published stage names; avoid informal subdivisions such as "lower Teurian". Append a question mark if the stage is uncertain.

Field Name	Meaning/Guidance
Stage Comments	This is a free text field for any comments regarding the stage/age determination.
Laboratory: • Name • Code • Number	Use these three fields to record the institution, curatorial series (catalogue number prefix or similar code), and sample number of the material being examined. Note that, despite the label, the "Number" field *does* allow for the inclusion of alphabetic characters.
Collection Comments	This is a free text field provided to capture any comments about the collection (sample) as a whole.

12.1.6 Taxonomic List

Field Name	Meaning/Guidance
Group	Enter the major taxonomic group you are studying, such as Bivalvia, Foraminifera, Pollenites, etc.; see Appendix 12.2 for a full list. You must enter an existing group in this field. (FRED will allow you to enter something different, but it force a change before the record can be saved.) The groups recognised by FRED owe at least as much to historical accident as they do to phylogeny. They are drawn from multiple taxonomic ranks, and some such as "algae" are not true taxa at all. Moreover, they are not mutually exclusive. For example, Ammonoidea and Nautiloidea are subsets of Cephalopoda, which together with Bivalvia, Gastropoda and Scaphopoda, is a subset of Mollusca. In general, you should enter taxa under the most narrow (least inclusive) group heading you can find. Pick-lists of valid groups are provided for both the forms and spreadsheet data entry modes. Contact the FRED administrator if you believe you have a taxonomic group which is not already represented in this list.)
Taxonomic Name	Enter the binomial of the taxon. It is not required or expected that all binomials will necessarily reflect currently accepted combinations. In fact, it is preferred that anybody entering historical data should use the combination indicated by the original identifier, even if it is no longer considered correct. Names are checked against a thesaurus and all those that are found will be accepted immediately. Names that do not occur in the thesaurus will be sent to an appropriate expert in the particular group for manual acceptance (or rejection). Be careful to avoid typos; they can waste a lot of time. Currently, FRED fails to compensate for trivial errors such as trailing spaces, or two spaces between the genus and species epithet. This shortcoming is scheduled for correction; for the present, users are asked to take care to avoid such errors.
Author	Optionally, you can enter the original author of the binomial in this column. Note, however, that it is ignored unless this is the first time the binomial is being entered into FRED. (So do not spend time entering authors for existing taxa.)
Comments	In this field, enter any comments about occurrences of the particular taxon in the present sample (i.e., not morphological or other observations about the taxon in general). This field can also be used to accept specific structured data (most commonly microscope slide coordinates and census counts) using keywords and pre-defined formatting. This will be described fully in a future manual edition.

12.2 Taxonomic Groups Recognised by FRED

FRED organises individual taxa into the following taxonomic groups:

Acritarcha	Cnidaria	Nautiloidea
Algae	Coleoidea	Osteichthyes
Ammonoidea	Conodonta	Ostracoda
Annelida	Coprolites	Plantae
Archaeocyathina	Crinoidea	Pollenites
Arthropoda	Dinophyceae	Polyplacophora
Asteroidea	Echinodermata	Porifera
Aves	Echinoidea	Prasinophyceae
Bacillariophyceae	Foraminifera	Protozoa
Bivalvia	Fungi	Radiolaria
Brachiopoda	Gastropoda	Reptilia
Bryozoa	Hemichordata	Rhizopoda
Calcareous Nannoplankton	Ichnofossils	Scaphopoda
Cephalopoda	Incertae Sedis	Siliceous Nannoplankton
Chlorophyceae	Insecta	Sporites
Chondrichthyes	Mammalia	Trilobita
Chordata	Mollusca	Xanthophyceae

In addition, there is a “pseudogroup”, Biostatistics, which has previously been used to identify revisions of prior analyses being used for special projects, usually CONOP studies. These will be removed in the future and should be ignored for the present.

It can be seen immediately that there are some difficulties with these groups, insofar as they are not mutually exclusive. For example, Ammonoidea and Nautiloidea are subsets of Cephalopoda, which together with Bivalvia, Gastropoda and Scaphopoda, is a subset of Mollusca. In general, you should enter taxa under the most narrow (least inclusive) heading you can find.