PPDM Association

Stratigraphy

Reference Guide

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Table of Contents

About This Document

This reference guide has been prepared to help managers, analysts, DBAs, programmers, data managers, and users understand how the Data Model is intended to be used. Readers at many levels, from managerial to technical implementers will benefit from reading this document. General, high-level business information is contained at the beginning of the document, with each section becoming progressively more technical and detailed.

Sometimes the terms we use in this and other PPDM documents need to be defined. We provide definitions in a separate Glossary, which you can obtain from PPDM.

This reference guide contains the following sections:

Introduction

> Provides an executive overview of the PPDM Model as it pertains to Stratigraphy.

Business Process Overview

> Summarizes Stratigraphy and provides examples of related business processes.

Integration

> Discusses how Stratigraphy is integrated with the other PPDM Business Modules and provides information about related references guides.

Model Overview

> DIscusses the use of Stratigraphy Module tables in the PPDM Data Model.

Tables and Columns – Stratigraphy

> Identifies the data model tables for the Stratigraphy Module, what they contain, and how they should be used. This section is intended to be used in conjunction with the PPDM Table Report available for download from the PPDM Web Site (www.ppdm.org).

Implementation Considerations

> Discusses issues related to implementing the PPDM model, architectural methodologies used in design, or special considerations for implementation that are not related to a specific table.

Frequently Asked Questions

> Addresses technical and business questions about the Stratigraphy Module.

Appendix A – Sample Queries

Provides example queries with the appropriate SQL scripts that should assist in the query process when testing the accuracy of data stored in the module.

Appendix B – Changes to the Model

Identifies the changes in the Stratigraphy Module from the latest version to the newest release version of the PPDM model.

Introduction

Stratigraphy is a complex subject, dealing as it does with the occurrence of rocks in the earth's crust and the problems associated with identifying both the characteristics and relationships of the various rock units encountered in the field. Thus, to develop a model to handle the many aspects of stratigraphy it is necessary to have an understanding as to its nature as described in this document.

The components that comprise the model are designed to accommodate the internationally accepted means of classifying and categorizing the stratigraphic rock units, the identification of these units as to how and where they occur, and the means of correlating their occurrence.

The data model allows the user to query the manifold attributes of stratigraphy as captured by the model. In addition the data can be used to support mapping and other geological modeling applications, as well as to supply stratigraphic interval information as a means of extracting other related data within the overall PPDM model.

How well the model meets the business needs of the user will be a critical measure of its success.

Business Process Overview

Purpose

Data models provide a means of capturing and storing data so that it can be accessed for analysis, interpretation, reporting and manipulation. Good data models must manage data in a manner than takes into account the very nature of the data it has to capture. Consequently, an understanding of the elemental essence and make up of the subject is paramount. This is especially true of stratigraphic data, which has many attributes, is highly interpretive, and subject to qualification.

Secondly the model has to allow data to be accessed and queried as to its attributes, including presence, quality, source, etc., to satisfy the needs of the user.

Finally the model has to accommodate functions that relate to the actual use of the data as input material for analytical, manipulative, and modeling processes.

Definition

Stratigraphy is the science dealing with the description of all rock bodies forming the Earth's crust—sedimentary, igneous, and metamorphic—and their organization into distinctive, useful, mappable units based on their inherent properties or attributes. Stratigraphic procedures include the description, classification, naming, and correlation of these units for the purpose of establishing their relationship in space and their succession in time.

Stratigraphic Data

In a number of respects stratigraphy is to the subsurface what geography is to the surface. It provides the geoscientist with a global, as well as local, means of reference and the necessary conventions for ***categorizing*** and ***identifying,*** the rocks that constitute the earth crust, ***interpreting*** their physical presence in the field, and ***correlating*** their occurrence.

Stratigraphy recognizes the uniqueness of the actual occurrence of rocks in a region that typically constitute the local “geologic record”, and which in turn represent the physical expression of its geologic history. This history may not only include deposition and intrusion, but also indicates the absence of strata by erosion or non-deposition, and the multiple occurrence of units, or the inversion of their normal sequence of occurrence as a result of tectonic events. The geologic record thus identified may represent the actual interpretation of the strata found in a wellbore, or at a surface exposure at a field station. It may indeed represent a conceptualized version of the stratigraphic section for a region used as a reference and displayed graphically as a “stratigraphic column”.

The model has been designed to capture all the above significant attributes and features of stratigraphic events, and to allow the model to be queried to answer questions related to the nature, occurrence, and capture of the data. However a major use is to map the structure and thickness of stratigraphic units in a defined area and to identify stratigraphic intervals of interest against which other down hole data types can be cross-referenced, queried, and extracted.

In essence, the data model has been constructed to accommodate all the important aspects of stratigraphic use and to meet the business needs identified in the business requirements document.

Categorization

Significantly, rocks and the strata in which they occur have different properties. Therefore different categorization procedures have been adopted to match these properties. However, the changes in one set of properties may not match the changes in another set. Consequently, the boundaries between units will not necessarily coincide with that of a different set and may in fact transgress and cut across each other. Given this, it is not possible to assign these varying differences in properties to a single category. The various categories and their reference to the geological time scale are given below.

Geochronology

Inasmuch as space is the primary domain of the geographer, or more precisely the cartographer, for whom the latitude and longitude grid provides the spatial reference, the stratigrapher operates in an additional domain of geologic time or *geochronology*.

The geochronological time scale has been subdivided into units of geologic time that serve as a frame of reference for relating the age of occurrence of all rock strata in the earth's history. Thus the geochronological time scale provides a unifying basis of reference for all categories of stratigraphy.

Note however, geochronological units are *not* stratigraphic units, as they represent time, a property that can neither be seen nor touched. The tangible, physical stratigraphic units that correspond to the time units are defined below as *chronostratigraphy*.

Chronostratigraphy

Chronostratigraphy is that component of stratigraphy that deals with the organization of strata into units based on their relative age of occurrence and duration of formation. Consequently, according to an internationally adopted convention, the sequence of rocks, dating from the very oldest to the most recent have been grouped by age relative to the *geochronological* time scale and identified accordingly.

In other words, rocks laid down during the time that correspond to the sequence and hierarchy of geochronological units are grouped into corresponding *chronostratigraphic* units.

Lithostratigraphy

Lithostratigraphy is that element of stratigraphy that applies to the actual lithological characteristics of strata; it identifies, groups, subdivides and defines associations and parent/child relationships accordingly.

Lithostratigraphic units are recognized on the basis of lithologic characteristics only. Consequently, while certain lithostratigraphic units may physically comprise a chronostratigraphic sequence or system or rocks, boundaries between units may be transgressive and overlap chronostratigraphic boundaries. Thus while it may be convenient to sequence stratigraphic units according to age, more realistically it may be more appropriate and accurate to assign a simple *sequence number* to designate the relative sequential association. Both these options are available within the data model.

Biostratigraphy

Biostratigraphy is that aspect of stratigraphy that organizes strata into units based on their fossil content, on specific fossil assemblages, or the range of individual or collective fossil occurrence, etc.

The same comments apply to biostratigraphic units as to lithostratigraphic units re relationships and sequencing.

Sequence Stratigraphy

Sequence stratigraphy consists of the identification and correlation of unconformities and conformable surfaces that have low diachroneity. The main sequence stratigraphic units are a sequence and its two component system tracts, the transgressive system tract and the regressive system tract.

A sequence is a stratigraphic unit bounded by subaerial unconformities, or ravinements, which have eroded through the subaerial unconformities, and by correlative conformable transgressive surfaces. A maximum flooding surface within a sequence allows the sequence to be subdivided into a transgressive systems tract below, and a regressive systems tract above.

(After Ashton Embry, PhD. Geological Survey of Canada.)

Other

There are other categories of stratigraphic classification identified in the International Stratigraphic Guide published by the IUGS and the GSA. These can be accommodated, provided the modeling rules are observed.

Geologic Time
Equivalent Geochronologic Units
Eon Era Period Epoch Age Chron

Geologic Record	
Stratigraphic Categories	Stratigraphic Units *
Chronostratigraphic	Eonothem Erathem System Series Stage Chronzone
Lithostratigraphic	Group Formation Member Beds Marker **
Biostratigraphic	Biozones: Assemblage Range Acme Interval (Other)
Sequence Stratigraphic	Sequence Regressive Systems Tract Transgressive Systems Tract
Other Categories	Zone (with appropriate prefix)

- *Sub and super may be used as appropriate for additional ranking.*

** *Marker is not a unit strictly speaking, but is in common usage to note the presence of a significant feature of no measurable thickness.*

Figure 1: *A generalized diagram comparing methods of stratigraphic classification. Modified from Table 1, International Stratigraphic Guide.*

Identification

Identification covers nomenclature; that is, the naming of units, their membership of various suites (name sets) assembled by different sources (vendors, oil companies, etc.), lexicon references, and aliases. Particular stratigraphic information covers the stratigraphic position and range of occurrence, "equivalencies" to other units, hierarchical classification, topological juxtaposition with other units, association to specific regions, and constituent units of conceptualized stratigraphic columns. The model provides for the capture of this data to meet the client needs.

Interpretation

This covers the observation as to the actual physical occurrence (or absence) of a stratigraphic unit and the point or depth at which it was encountered and whether or not the unit was located in normal stratigraphic sequence, and if not, why not.

The model meets the need to store the stratigraphic interpretations according to the preferences of the user, and the interpretations can be assessed as to the degree of certainty or the quality of the interpretation, method of interpretation, sources and versions.

Correlation

Correlation is a process of identifying the corresponding presence of analogous stratigraphic units within (usually) nearby wells and/or field sections. These correlations are therefore applied to actual ***specific*** physical occurrences of these units and are based on identity, or similarities of character or stratigraphic position.

However, correlation is used in a ***general*** sense when it is applied to "correlation charts". These correlation charts contain idealized stratigraphic columns representing the theoretical sequence of units in a given basin. Placing these columns together in juxtaposition relative to a geochronological time scale implies certain correlations between the units in the different basins.

The four types of correlation accepted by the model are as follows:

Between Wells/Field sections

The most common form of correlation is done between well or field sections. The process identifies formation tops on a given well or field section, with respect to criteria supplied by a reference well or field section. The current table design recognizes and allows for this.

Inter- and Intra-Basin (sub-basin)

The use of the term in this instance refers to identifying specific stratigraphic units existing in different basins, or in different parts of the same basin (e.g., sub-basins). Here an explicit correlation may be warranted to indicate some definite similarity in stratigraphic position (not necessarily age), which goes beyond simply expressing "stratigraphic equivalence". This is the sort of correlation shown on a stratigraphic (inter-basin) correlation chart (where correlations are implied but not specifically stated).

Specific Localized Zone

In this instance, a particular zone having some generic facies property (such as porosity) and occurring throughout a specific *depth interval* within a well section, is deemed to correlate with a similar interval within another well. One problem, however, is that a zone in one well may split into two or more zones in another well.

Associative

This relationship indicates a correlation between a unit of one stratigraphic type and a unit of another type, where the occurrence of one type is associated with the occurrence of the other. In certain circumstances this could be unidirectional, and this would have to be indicated. An example would be where a certain faunal zone is always associated with and occurs throughout a lithostratigraphic zone (but the occurrence of the lithostratigraphic zone does not necessarily indicate the presence of the faunal zone). Another example might represent the case where the presence of certain fauna gives rise to, and indicates the presence of a porous zone.

Stratigraphic Information Processes

The creation and use of stratigraphic information involves the selection or generation of a stratigraphic model and the application of this model to specific occurrences or interpretations. A stratigraphic model describes the relationships and characteristics of stratigraphic units in the area of interest, and is a conceptual version of the actual geologic record. The graphical expression of the model is referred to as a "stratigraphic column". The relationship of the model to other stratigraphic models (or columns) can be represented by arranging all the columns alongside each other into a stratigraphic correlation chart. A chart of this type provides a frame of reference from which to apply interpretations to actual occurrences of stratigraphic units in wellbores or field sections within and between adjacent geologic regions (basins).

Building a Frame of Reference

The correlation chart places the stratigraphic columns for the area(s) of interest in juxtaposition within its own frame of reference, which consists of a geological time scale defined and subdivided by a recognized, and generally accepted, global chronostratigraphic convention. The stratigraphic columns can represent models created by different authors, or expected occurrences in different areas.

Construction of a correlation chart as a framework for stratigraphic interpretation is a complex process requiring detailed stratigraphic knowledge and analysis. The stratigrapher's task is to assimilate a globally or regionally known stratigraphy into the uncertain stratigraphy of the area of interest. This process evolves stratigraphic understanding from an initial vague or indefinite preliminary perception towards a fuller awareness, and may involve a number of stratigraphic scenarios (different stratigraphic models) in the process. As stratigraphic knowledge evolves, stratigraphers create stratigraphic columns that tie the new knowledge into the framework, thus linking past knowledge to a new understanding.

The initial stage of populating the *stratigraphy data model* is to describe the reference framework of generally accepted stratigraphic nomenclature, characteristics, and relationships. This requires:

loading information on all the data types identified in Figure 2 that refer to the various stratigraphic categories.

loading information on the stratigraphic units that the user is expected to encounter, such as stratigraphic name sets, stratigraphic relationships (ages, sequencing, aliases, etc.), and stratigraphic columns.

Adding Interpretations

Having built the framework, the user can now add data representing the interpretations as to the actual physical presence of the various stratigraphic units to the requisite tables (see Figure 2). That is, the various entities used by the geologist to describe and interpret the occurrence of stratigraphic units in the field or in the subsurface, and their position in the actual geologic record, can then be captured.

Usage of Stratigraphic Information

When the frame of reference has been built and the initial interpretations loaded, the user is in a position to perform tasks typical of manipulating and managing stratigraphic information; namely:

Data Query

Queries may be related to specific attributes of the data itself, such as its origin, quality, source, etc., or more likely it will relate to questions as to its occurrence and association in a geological or stratigraphic sense. In this latter form, queries would identify wells penetrating a certain stratigraphic unit or horizon, or identify well or field sections where certain stratigraphic units occurred in conjunction with one another. The user may wish to query what units are likely to be encountered in specific regions or named areas, or examine the correlative nature between certain units. The results of a query may be a number, a statement, a list, a file for export, or a map.

Modify & Edit

The interpretative nature of stratigraphic information demands that revisions will take place from time to time. As such, the data will be subject to errors of commission as well as omission, resulting in inconsistencies with respect to sequence and actuality of occurrence.

Extended Functionality

This refers to extensions beyond the query stage that result in some manipulation being performed on the data, or a further selection process than that implied by the query stage. An example might include the creation of a mappable data set that represents the stratigraphic equivalent of a given horizon or the first occurring horizon subcropping at an erosional surface. Another could include the definition of a stratigraphic interval for which an isopach thickness is derived and/or against which a search is made for other down hole data (e.g., formation test, cores, etc.) occurring wholly or partially within that interval.

Subject	**Items**	**Tables**
Categorization	Stratigraphic Categories	STRAT AGE STRAT FLD INTERP AGE STRAT WELL INTERP AGE STRAT COL UNIT AGE STRAT DESCRIPTION STRAT UNIT
Identification	Name Sets Sources Lexicons Strat Position Sequence Equivalencies Aliases Strat Columns	STRAT ALIAS STRAT EQUIVALENCE STRAT HIERARCHY STRAT HIERARCHY DESC STRAT NAME SET STRAT TOPO RELATION STRAT UNIT
Interpretation	Well Section Tops Top Picks Pick Quality Repeat Horizons Out Of Sequence Ind Version Source Method Correlation	STRAT COLUMN STRAT COL UNIT STRAT COL XREF STRAT WELL SECTION STRAT FIELD SECTION STRAT INTERP CORR

Figure 2: *A generalized diagram illustrating which components of the model provide various types of business functionality.*

Integration

Integration is the key to managing the Stratigraphy module and its components properly. While information about stratigraphic units is stored in the Stratigraphy Module, data about usage of these units is normally stored in the appropriate business module and referenced through foreign key relationships.

Support Modules

AFE: Application for Expenditure or Cost Center. Capture information about the cost centers or AFE's used through the life cycle.

Areas: Business, regional or project areas associated with business objects

Bibliography: Used to create bibliographic references to information contained in the model. Detailed author and page references are captured here and referenced as needed. Commonly used to reference scientific literature.

Business Associates: Track detailed information about partners, service providers and other people, companies and regulatory agencies that you do business with.

Entitlements: Information about the rights that you have to any type of data and what you are able to do with it.

Instruments: Describes a right you have to a land holding or the physical body of a legal instrument.

PPDM Units of Measure: Capture the default stored unit of measure for any measured value in the database.

Work Order: Captures requests for work to be completed with some summary information about what was done and the data affected by the work order.

Business Modules

Contracts: Contracts formed to support and govern relationships between business associates.

Facilities: Describe facilities that are involved in the management or transportation of hydrocarbons, such as pipelines and storage or processing facilities

Geodetic and spatial: Uuse this module to reference any positional information to geodetic or cartographic information.

Interest Sets: Describe partnership information for the ownership of seismic sets or products of those sets.

Land Rights: Land rights describe the rights you have to land, whether obtained through purchase or agreement.

Lithology: Describe rock characteristics as created by lab analysis.

Obligations: Used to describe requirements to perform work or pay monies, usually as defined by a contract or legislation.

Production: Track production volumes and movement of volumes between production entities.

Projects: Track work projects of any type. Often used by service companies to track fulfillment of work orders.

- Records Management: Track the physical location of digital and hard copy products, circulation, retention, etc.
- Restriction: Capture details about environmentally sensitive areas where access is limited.

Seismic: Describe seismic acquisition, processing, interpretation and divestiture throughout the life cycle.

Stratigraphy: Make use of subsurface stratigraphic definitions that can be shared among all modules.

- Support facility: Describe marine vessels used for marine acquisition.
- Wells: Capture information about wells, including header information, logs, tests, cores, surveys and interpretation.

Contact PPDM to inquire about the status and availability of reference guides for these modules.

Model Overview

Data Diagrams

The diagram on this page is the legend for the tables discussed later in this document. Note that some or all of these elements may be present in data diagrams provided by the Association. Some elements are removed from final products to reduce file size:

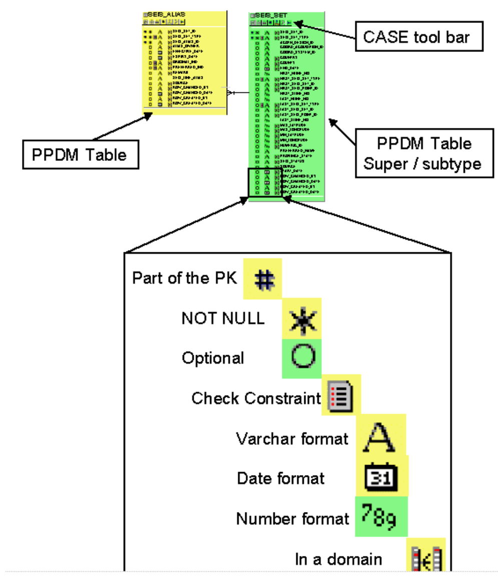

Figure 1: *This illustration shows the functions of each icon used in the data diagrams provided with PPDM version 3.7.*

The data diagrams for the electronic information and product management module are not provided in this reference guide because of their very large file size. Data diagrams can be obtained from the PPDM Association as part of the final model documentation or as a set of PowerPoint diagrams. The PowerPoint diagrams will provide the best resolution for printed quality.

Categorization

PPDM has been constructed to allow lexicon descriptions to be captured and reproduced. Each STRAT_UNIT may be thought of as an individual stratigraphic occurrence that has been identified and described by some scientific authority (PPDM 3.4 named these "*FORMATIONs*").

Description and Age

The STRAT_UNIT_DESCRIPTION table is used to fully capture the lexical characteristics of the Stratigraphic Unit, such as lithologic characteristics or a description of the type locale in which it is located. The vertical structure of this table provides users with flexibility to support many different types of descriptive characteristics. Age information should *not* be loaded into this table.

STRAT_UNIT_AGE, STRAT_COLUMN_AGE, STRAT_WELL_INTERP_AGE and STRAT_FLD_INTERP_AGE are used to describe the age of each unit in chronological, ordinal, or measured age. STRAT_UNIT_AGE describes the age of the stratigraphic unit in general terms, within the context of the Name Set in which it is found. The other three tables may be used to capture more specific interpreted ages when desired. Usually, this should only be done if radiometric or other age determining analysis has been performed.

Ordinal ages are handled in the STRAT_UNIT table; these are used to support relative sequencing of units by age in geographic areas where the geology supports its use.

The four AGE tables allow you to input ranges of ages (average, upper max, upper min, lower max, and lower min) for each stratigraphic unit, and to support each age with margins of error. At each range, either or both of the measured age or a relative age can be indicated. In general, it is preferable to measure the age of a lithostratigraphic unit in chronological (relative to a chronostratigraphic unit) or ordinal terms, rather than as a measured age, unless detailed studies (such as radiometric) have been undertaken for that specific stratigraphic unit.

Multiple age interpretations can be handled by PPDM; the PREFERRED_IND can be used to flag the age interpretation that should be used by default. The SOURCE_DOCUMENT column in the AGE tables supports bibliographic references for each interpretation.

Relationships between stratigraphic units are captured in four ways:

Aliases

The STRAT_ALIAS table provides a mechanism for translating names that mean the same thing in multiple Stratigraphic Name Sets. Usually, these are simply alternate names or identifiers for a stratigraphic unit. This table may be used to support conversion of formation names or codes from those provided by a data vendor to the names authorized for use at an E&P company.

Equivalence

The STRAT_EQUIVALENCE table may be used to establish age equivalence between stratigraphic units as required. Use of this table is optional, based on your business needs.

The Muskwa (a lithostratigraphic unit) is equivalent in age to the Frasnian (a chronostratigraphic unit); the %REL_STRAT_UNIT_ID columns in the four AGE tables are used to capture this relationship. This relationship should *not* be captured in the STRAT_EQUIVALENCE table.

STRAT_UNIT_AGE may also be used to *derive* age equivalencies, assuming it has been correctly populated. In some cases it may, however, be helpful to use STRAT_ EQUIVALENCE to capture equivalencies of age between lithostratigraphic units to improve performance.

Topological relationships

PPDM allows you to gather information about how stratigraphic units are topologically related to each other in two ways:

how you expect them to be related, in a general sense. Usually, these predictions are made within a geographic context, such as *"in the Northeast Plains of Montana, I expect that the Dakota formation will usually overly the Kootenai formation*". These relationships are captured in STRAT_TOPO_RELATION.

how they do relate topographically, in an actual occurrence. These are captured as interpretations in the STRAT_WELL_ SECTION and STRAT_FIELD_SECTION tables.

Hierarchical structures

As you have read in the Business Overview section of this guide, every stratigraphic classification system is based on a hierarchy of types in which each child type is a sub-component of a parent type. For example, in the lithostratigraphic classification structure, Beds are parented by Members, Members by Formations, and Formations by Groups.

These hierarchical structures are defined by the user in the STRAT_HIERARCHY table. The vertical structure is provided to enable different sites to classify to the level of granularity required by their business practices. For example, some sites may prefer to sub-categorize Group into two components (Group and Sub-Group), and others may prefer not to.

The table STRAT_HIERARCHY_DESC may be used to define a generalized stratigraphic hierarchy; this can be used as a reference for populating your data and for development of queries that need to traverse a hierarchy.

Interpretation

Information about interpretations has been extended to allow users to track a great deal of contextual or reference information about how an interpretation was made. You can link interpretations to Projects, so that you can see who made the interpretation, when it was done, and what other data was included in the project. If you wish, you can identify how each pick was made (using cores, logs, seismic, etc.) and even provide an explicit link to each relevant well core, log, or an interpretation file stored at your data warehouse.

Interpretations are permitted at three levels in PPDM.

Stratigraphic Columns

These generalized interpretations provide an interpreter with a high-level picture of the stratigraphy in a given area, and are often created by stratigraphers working at a regional level. Stratigraphic columns provide important information about what stratigraphic units can be expected to occur in a region, the types of topological relationships that may be encountered, and sometimes refine the age definition of each stratigraphic unit that is included in the interpretation.

Stratigraphic columns are described in PPDM using the STRAT_COLUMN and STRAT_COLUMN_UNIT tables. STRAT_COL_UNIT_AGE may be used to refine the age of the stratigraphic unit; in this case, care should be taken to ensure that the refined age is fully encompassed within the age range provided at the STRAT_UNIT_AGE level. Stratigraphic columns may be referenced against each other using the table STRAT_COLUMN_XREF.

Stratigraphic Well Sections

These are commonly referred to as picks, or well tops. The STRAT_WELL_SECTION table incorporates and combines the information in the PPDM 3.4 WELL_FORMATION and WELL_FAULT tables. This table allows you to capture the order of stratigraphic units in terms of depth, order of deposition, or ordinal sequence (as encountered by the drill bit).

Since interpretations can change over time, this table allows you to capture the interpretation version, the application used to create the interpretation, and to indicate which interpretations are preferred (i.e., those that should appear on maps or reports).

In the case where a radiometric analysis of a test sample is taken, the STRAT_WELL_INTERP_AGE table allows you to capture the precise measured age of each stratigraphic unit.

Stratigraphic Field Sections

STRAT_FIELD_SECTION allows you to capture interpretation information about locations that are not wells. These may be measured sections, test holes, or some other type of field interpretation. With this table, it is no longer necessary to “dummy” values into the well table in order to capture an interpretation.

Structurally, this table is nearly identical to STRAT_WELL_SECTION, and provides the same capability.

Correlation

In previous versions of PPDM, correlations could be made based on congruity of formation names or depths only. PPDM allows you to explicitly correlate interpretations based on specific characteristics. The work group has imposed a specific limitation on using STRAT_INTERP_CORR by requiring any correlated interpretations to have been interpreted the same way (e.g., lithologic interpretations can only be correlated to other lithologic interpretations).

Stratigraphic Field Stations

Recognizing that not all the important stratigraphic analysis is done in a wellbore, PPDM includes capability to create a field station and describe it. You can capture the location of the field station using STRAT_FIELD_NODE. Interpretations created for a field station (STRAT_FIELD_SECTION) can be referenced in well interpretations or included in correlations, as desired.

Bibliographic References

Identification of the scientific authority (bibliography) of interpretations and analysis is an important part of stratigraphic interpretation. A tiny new module, expanded from the R_SOURCE_DOCUMENT table in PPDM 3.4, has been created to support this requirement.

A referenced document in PPDM is called a SOURCE_DOCUMENT. The authors of this source document are captured in SOURCE_DOC_AUTHOR, and the bibliographic references contained by each SOURCE_DOCUMENT can be captured in SOURCE_DOC_BIBLIO.

This module is widely referenced in the Stratigraphy Module to permit full referencing of data, as desired. In addition, the source document module is connected to the Records Management module; this permits you to determine where a source document has been stored and capture information about its circulation.

Tables and Columns: Stratigraphy

The following tables exist in the Stratigraphy module of PPDM version 3.6. Each table is described in the following section; you can jump to a table description by clicking on the hyper-linked table name below. Note that for detailed content descriptions for each table, you should refer to the PPDM version 3.6 table documentation.

Stratigraphic Descriptions

STRAT_NAME_SET

Think of a STRAT_NAME_SET as a bucket that holds a set of STRAT_UNIT names; the name set defines who owns that set of names, and describes the set in general terms. For example, a data vendor may create a STRAT_NAME_SET that contains all the formation names they use; if they work internationally, they may create a name set for each geographic region—one in the North Sea, one in North America, and so on. STRAT_NAME_SET_ID is part of the primary key of STRAT_UNIT; this was done to allow members to retain unique identifiers they have established internally and also manage external data sources.

Name sets can also be created to keep track of the names used by a project geologist, or the names that were part of a project.

Back to the list of table names

STRAT_NAME_SET_XREF

Relationships between STRAT_NAME_SETS may be created to group all the name sets owned by a vendor. You can use it to capture the relationship of a name set that is a subset of stratigraphic units to the parent name set or to capture the relationship between a defunct name set and the name set that replaced it.

[Back to the list of table names]

STRAT_UNIT

Business requirements articulated during the design phase provided the impetus to combine FORMATION and FAULT into a single integrated table that can describe any type of stratigraphic unit. These stratigraphic units can have a thickness (or not) or be defined based on an event (such as a fault or unconformity).

The primary key for this table consists of the STRAT_UNIT_ID and the STRAT_NAME_SET_ID to support loading of multiple name sets into a repository.

[Back to the list of table names]

STRAT_UNIT_AGE

Use this table to track the age of a stratigraphic unit. You can indicate the age relative to the age of a chronostratigraphic unit (the age of the TOAD lithostratigraphic unit is the LADINIAN stage), the geologic age (the TOAD is between 230 and 237 MYO), or the ordinal age (the 24^{th} lithostratigraphic unit that was deposited in this area).

[Back to the list of table names]

STRAT_UNIT_DESCRIPTION

Lexical descriptions, such as lithology or type locales can be entered into this table. Typical examples include color description, type local categorization, and so on. Some lexicons allow codified entry of these descriptions; this is supported by PPDM.

[Back to the list of table names]

Stratigraphic Relationships

STRAT_ALIAS

Alternate names, identifiers, or codes for stratigraphic units may be captured in this table. The most common use for this table will be to capture relationships between names used by different vendors, projects, suppliers, etc.

Each alias in this table must be defined as a stratigraphic unit in the STRAT_UNIT table before the relationship can be defined.

[Back to the list of table names]

STRAT_EQUIVALENCE

Equivalencies are defined when a stratigraphic unit in one place is defined to be the *same age* as a stratigraphic unit in another place, even when the stratigraphic units are separated by space.

[Back to the list of table names]

STRAT_HIERARCHY

The relationships between stratigraphic units defined at various positions in a definition hierarchy can be captured here. The relationships are explicit, and must be made between stratigraphic units that are rows in the STRAT UNIT table.

Populate this table based on your preference for query type.

- If you can handle syntax such as Oracle's "Connect By", a simple hierarchical structure in which a child row is only related to its direct parent can be created. Note that your ability to join multiple tables will be severely restricted if you use this option.

- If you prefer to use simple SQL statements, explicit relationships between a child and all its parents, grand parents, etc., must be created.

[Back to the list of table names]

STRAT_HIERARCHY_DESC

Use this table to create an outline of the hierarchical structures that you use. Any type of stratigraphic hierarchy can be defined, from chronostratigraphic to lithostratigraphic. Fully populated, this table may assist you in preparing queries against the STRAT_HIERARCHY table or to validate the quality of data input.

[Back to the list of table names]

STRAT_TOPOL_RELATION

This table is used to capture topological relationships between formations outside of the context of a specific well or field station interpretation. You can use it to indicate that within an area (or in a stratigraphic column) the red overlies the yellow and the blue is interfingered with the red.

[Back to the list of table names]

Stratigraphic Acquisition

STRAT_ACQTN_METHOD

This table may be used to capture the method(s) used for stratigraphic interpretation without actually identifying the specific logs, cores, etc., used in interpretations.

Back to the list of table names

STRAT_COLUMN_ACQTN

Lists of the specific wells, cores, tests, logs, seismic lines, projects used to create an interpreted value (in STRAT COLUMN UNIT) can be created using this table. If preferred, the STRAT_ACQTN METHOD table can be used to list the methods that were used without resorting to creating FK connections to the specific data used.

Back to the list of table names

STRAT_FIELD_ACQTN

Lists of the specific wells, cores, tests, logs, seismic lines, projects used to create an interpreted value (in STRAT FIELD SECTION) can be created using this table. If preferred, the STRAT_ACQTN METHOD table can be used to list the methods that were used without resorting to creating FK connections to the specific data used.

Back to the list of table names

STRAT_WELL_ACQTN

Lists of the specific wells, cores, tests, logs, seismic lines, projects used to create an interpreted value (in STRAT WELL SECTION) can be created using this table. If preferred, the STRAT_ACQTN METHOD table can be used to list the methods that were used without resorting to creating FK connections to the specific data used.

Back to the list of table names

Stratigraphic Columns

STRAT_COLUMN

The STRAT_COLUMN table and its subordinate tables STRAT_COLUMN_UNIT and STRAT_COL_UNIT_AGE are used to capture interpretations of theoretical or generalized stratigraphic columns (such as test sections, or the columns that appear in stratigraphic correlation charts). In some cases, these columns are used as an aid to interpretation or as a reference guide.

Back to the list of table names

STRAT_COLUMN_XREF

Use this table to define relationships between stratigraphic columns. Newer stratigraphic column definitions may replace older definitions, or a very generalized stratigraphic column that covers a broad geographic area may be delineated more specifically in localized stratigraphic columns.

Back to the list of table names

STRAT_COLUMN_ACQTN

Back to the list of table names

STRAT_COLUMN_UNIT

The stratigraphic units that appear in the stratigraphic column can be listed in order of occurrence in this table. Functionally, this table is similar to the STRAT WELL SECTION and STRAT FIELD SECTION tables.

Back to the list of table names

STRAT_COL_UNIT_AGE

Back to the list of table names

Stratigraphic Field Stations

STRAT_FIELD_ACQTN

Back to the list of table names

STRAT_FIELD_GEOMETRY

The Geometry tables were created to support integration with a spatial engine such as SDE or SDC. This table provides a relationship between the areal description of the stratigraphic field study area and the complex line or polygon in the spatial engine. For more information about how to implement this table, please refer to the Spatial Reference Guide on the PPDM Website.

Back to the list of table names

STRAT_FIELD_NODE

The positions of surveyed locations of the field station are captured in this table. The locations may be perimeter points, points along a line, or depth positions.

Back to the list of table names

STRAT_FIELD_SECTION

Similar in structure to STRAT WELL SECTION, this table is used to capture interpretation information about field stations.

Back to the list of table names

STRAT_FIELD_STATION

Information about measured sections or other types of field analysis stations are captured in this table.

Back to the list of table names

STRAT_NODE_VERSION

This table can be used to track alternate locations for a stratigraphic field station node (using UTM, polyconics, etc.)

Back to the list of table names

STRAT_FLD_INTERP_AGE

Back to the list of table names

Stratigraphic Interpretations

STRAT_COLUMN_UNIT

Back to the list of table names

STRAT_COL_UNIT_AGE

This table may be used to qualify the age of the stratigraphic unit as it occurs within the stratigraphic column. Business rule requires that this age be a valid subset of the age in STRAT_UNIT_AGE.

Back to the list of table names

STRAT_FIELD_SECTION

Back to the list of table names

STRAT_FLD_INTERP_AGE

This table may be used to qualify the age of the stratigraphic unit as it occurs within the stratigraphic field interpretation, only if it is a subset of the age in STRAT UNIT AGE.

Back to the list of table names

STRAT_INTERP_CORR

Correlations between interpretations can be made in this table, provided that each of the source interpretations were made using the same technique (lithostratigraphic interpretations may only be correlated to other lithostratigraphic interpretations). You may correlate well interpretations with other well interpretations or with field station interpretations.

Back to the list of table names

STRAT_WELL_INTERP_AGE

This table may be used to qualify the age of the stratigraphic unit as it occurs within the stratigraphic well interpretation. Usually, this table will only be used if radiometric analysis has been conducted to determine the age quite precisely within the well interpretation. The qualified age should be fully contained by the age in STRAT UNIT AGE.

Back to the list of table names

STRAT_WELL_SECTION

This table replaces WELL_FORMATION and WELL_FAULT in PPDM version 3.4. It allows storage of picks, also called well tops. Added functionality allows you to include picks of surfaces such as faults, to version interpretations and indicate which version is the preferred one, and to indicate what application or method was used to create the interpretation. Picked stratigraphic units can be ordered by depth, age, or order of occurrence in the well.

Back to the list of table names

Implementation Considerations

Constraints in PPDM

It is essential that anyone who is considering using PPDM version 3.7 review the Constraints Reference Guide first. Improper use or population of constrained columns in PPDM can compromise the quality of your data and the reliability of your queries. This document may be obtained from the PPDM Association or downloaded from the PPDM web site at www.ppdm.org.

Check Constraints

PPDM Version 3.7 makes use of check constraints in rare cases where the values that may be input for a column are known at design time and will not change over time. Two types of uses are observed in PPDM 3.7.

- Where the column name is %_IND, the column is an indicator field, and the values may only be Y, N, or null.
- Super-sub type implementations use check constraints to enforce the integrity of the super-sub type relationship. Currently these relationships are in use for Seismic, Business Associates, Records Management, Support Facilities, Production Entities and Land Rights.

  Let's use Seismic Sets as an example. This structure consists of a parent table (SEIS_SET) and several sub-type tables (SEIS_3D, SEIS_ACQTN_SURVEY, SEIS_INTERP_SET, SEIS_LINE, SEIS_PROC_SET, SEIS_SEGMENT, SEIS_SET_PLAN and SEIS_WELL). Each of the tables has a two-part primary key: SEIS_SET_ID and SEIS_SET_TYPE.

  SEIS_SET_ID is assigned by the user and can have any value as long as it is unique for that type of seismic set. SEIS_SET_TYPE was designed to maintain the integrity of the super-sub type structure and can only have the values assigned to it by check constraints; these values are the table names of the eight valid sub-types. In SEIS_SET, the SEIS_SET _TYPE can have any of the table names, but in each of the sub-types, it can only have the name of the table it is owned by.

Use of Stratigraphic Units in PPDM

The Stratigraphy Module is widely referenced in PPDM for identification of subsurface events, activities, granted rights, interpretation, and more. Throughout the Well and Production Modules, the stratigraphic unit is often provided by data vendors "as reported" to a regulatory body or agency. The Land and Contracts Modules make use of the Stratigraphy Module to define subsurface areas where permission to explore or produce has been granted for exploration activities or where an agreement is to be upheld.

Units of Measure

Relational databases, powerful as they are, are not good at certain types of query and retrieval. Any query that requires the database to retrieve all the rows in a large table and perform some calculations on the data before returning results to a user is likely to perform very poorly. This assumes, of course, that the person constructing the query is aware that a calculation is necessary when writing the query. Data management strategies for such tables recommend that requirements for on-line conversions such as this be eliminated if at all possible. The PPDM strategy for handling units of measure falls into this category.

Every column in the data model that references a Unit of Measure (such as a depth, temperature, length etc.) should be stored using a single, common unit of measure. For example, in one PPDM instance, all the total well depths should be stores as meters or as feet. Storing some depths as meters and the rest as feet creates problems for the data base and adds confusion to the user (who may not be aware that the numbers in the depth column are not all meters).

The original unit of measure (the unit in which the data was originally received) can be stored in the data table. For example, the WELL table captures FINAL_TD and FINAL_TD_OUOM. These columns capture the value of the final total depth of the well and the units that the depth was originally captured in.

The ***stored unit of measure*** is captured in the PPDM meta model, PPDM_COLUMN. This table captures the default unit of measure for a column and the name of the column where the original unit of measure is stored. The following illustration provides an example:

WELL

UWI	DRILL_TD	DRILL_TD_OUOM
SMITH12F	1250	FEET
JONES44	1560	METERS
12345	1400	FEET

PPDM_COLUMN

TABLE_ NAME	COLUMN_ NAME	UOM_ COLUMN	OUOM_ COLUMN	DEFAULT _ OUM_ SYMBOL
WELL	UWI			
WELL	DRILL_TD		DRILL_TD_OUOM	M
WELL	DRILL_TD_OUOM			
WELL_CEMENT	CEMENT_AMOUNT	CEMENT_AMOUNT_UOM	CEMENT_AMOUNT_OUOM	

Figure 9: *The method for storing and tracking units of measure is illustrated here.*

Note that in the example, the Drilling TD is stored in meters, but was originally received as feet.

In some cases, it is not possible to ensure that all the rows in a column are stored as a single unit of measure – this is common in cases where the unit of measure is dependent on some other factor. For example, substance measurements may depend on the substance being measured; gases are stored as MCF, liquids as BBL etc. In these cases, the unit of measure is stored directly in the business table.

PPDM GUID

The Global Unique Identifier (GUID) has been added to every table in PPDM. Applications that are designed to take advantage of this column should implement the DDL set PPDM37.GUID. This procedure will alter the PPDM_GUID column to be NOT NULL and to add a Unique Index to each column.

Audit Columns

Each table contains five columns: SOURCE, ROW_CHANGED_BY, ROW_CHANGED_DATE, ROW_CREATED_BY, and ROW_CHANGED_DATE. These columns satisfy a data-auditing requirement to identify the user and date of database transactions.

Use the “CREATED” columns when you are inserting new data rows and the “CHANGED” columns when you are updating a data row. The ROW_CHANGED / CREATED_BY columns are usually populated using the system login id in use. ROW_CHANGED / CREATED_DATE is usually set to the system date of the insert or update operation.

To populate the SOURCE column, specify where you obtained the data. If you receive the data from Vendor A, and Vendor A received the data from Regulatory B, you should set the SOURCE to Vendor A. In some cases (such as for interpreted picks), data is created by an application. In this case, the source may be set to identify the application that created the data.

Identifying Rows Of Data That Are Active

Maintaining information about how a business object has changed over time is an important business requirement for all these modules. To support this, mechanisms for allowing versioning have been added to many tables.

Every table in PPDM version 3.7 contains a column called ACTIVE_IND. The values for this column may be one of Y, N, or null. When more than one row of data (such as a spatial description or a status) has been created for a business object, use the ACTIVE_IND to indicate which row is currently active (note that in some cases, more than one row may be active simultaneously).

This provides implementers with two benefits. First, when populating EFFECTIVE_DATE and EXPIRY_DATE it will not be necessary to populate EXPIRY_DATE with a false future date to indicate that the row of data has not expired yet. Second, queries can explicitly search only for rows that are active.

If this column is used for queries, as recommended (such as “find me the currently active status for this land right”), you should implement procedures to ensure that this column is always populated as either Y or N and maintained appropriately. If the column is left blank (NULL), the query will not be consistent or reliable.

For example, you could default the value to N if the expiry date is filled in and has already happened. Make it Y if the expiry date is empty *or* if the expiry date contains a future date.

Modifying PPDM 3.7

Subsetting PPDM

The PPDM data model is designed to allow users to implement portions that support their business without needing to manage modules that are not required. Good data management practices are also supported; this means that data redundancy is reduced in the Model whenever possible.

All information about Seismic will be found in the seismic module; information about contracts is stored in the Contracts module, details about objects that are retained for long term use are stored in the Records Management module and so on. Depending on your business requirements, you can implement all or some of the modules.

PPDM version 3.7 is released with a dataset that is populated with information grouping tables into modules (PPDM_TABLE_GROUP). You can use this information to create a subset DDL if you wish.

In general, it is usually simplest to install the entire PPDM data model and simply restrict usage to the portions that are useful to you. Additional tables can be implemented as your business requirements expand, or as your data and processes are able to support capture in a data model. Architectural guidelines for subsetting PPDM are contained in the PPDM Architectural Principles Document. This document can be obtained from the PPDM Association or downloaded from the PPDM web site at www.ppdm.org.

Expanding PPDM

As a consequence of the PPDM Design process, which actively solicits and incorporates business requirements from Industry, many users find that the model is quite complete. However, individual implementations may find that additional columns are needed, or that some denormalization will help their performance.

The Association provides documentation about how to expand the data model to accommodate your specific requirements. This document can be obtained from the PPDM Association or downloaded from the PPDM web site at www.ppdm.org. Tables or columns that have been added should be so marked in PPDM_TABLE.EXTENSION_IND, PPDM_COLUMN.EXTENSION_IND or PPDM_CONSTRAINT.EXTENSION_IND.

Feedback to PPDM

Much of the growth of the PPDM model can be attributed to Industry feedback. All implementers are requested and encouraged to provide feedback to the Association about changes they have made for implementation. Feedback can be submitted to changes@ppdm.org.

Business Rules

Correlations may only be made between stratigraphic units of similar types (lithostratigraphic, biostratigraphic, etc.) that were interpreted based on the same method (sonic log analysis, sample analysis, etc.).

A type of correlation can exist that captures the relationship between biostratigraphic units and lithostratigraphic units. This correlation can be observed on stratigraphic charts provided by many agencies. As this correlation is used to define the age of a lithostratigraphic unit in terms of a biostratigraphic unit (such as the ABC formation is the age of the Frasnian), this information is captured in the STRAT UNIT AGE table (in the column DEFINING STRAT UNIT ID).

The general age of a stratigraphic unit may be defined in the STRAT UNIT AGE table. In some cases, the age of a stratigraphic unit in a stratigraphic column, well interpretation, or field station interpretation may be fine tuned using various analytical techniques (such as radiometric analysis). The age defined in STRAT WELL INTERP AGE, STRAT COL UNIT AGE, or STRAT FIELD INTERP AGE must be contained within the age in STRAT UNIT AGE.

Frequently Asked Questions (FAQ)

Describing Stratigraphic Units

How do I capture the relationship that the base of the Y is equivalent to the top of the X?

This generalized type of relationship is usually true within the context of a geographical area, and is captured in the STRAT TOPO RELATION table.

Create a row in STRAT UNIT for both the top and the base formations. Then add a row to the STRAT TOPO RELATION table that associates the two, and use the STRAT TOPO RELATION column to define the type of relationship between the two units (such as 'SU1=BASE SU2').

I would like to convert the formation names used by my vendor to a set of preferred formation names used by my company. How do I do this in PPDM? Some companies call these "crossover tables".

The relationship between the formation (stratigraphic unit) names used by different vendors can be captured in the STRAT ALIAS table simply by creating an association between two values in the STRAT UNIT table and defining the type of alias it is (such as "VENDOR").

How can I cross-reference one stratigraphic type with another, particularly chronostratigraphic with lithostratigraphic?

This type of relationship is usually used to define the age of a lithostratigraphic unit in terms of a chronostratigraphic unit and is captured in the %_AGE tables (STRAT UNIT AGE, STRAT COL UNIT AGE, STRAT WELL INTERP AGE, STRAT FIELD INTERP AGE).

Interpretation

How do I capture multiple interpretations for a well or field section?

Use the column VERSION OBS NO to reference each individual interpretation version.

How do I indicate repeat occurrences of the same stratigraphic formation in my interpretation?

Use the column REPEAT STRAT OCCUR NO to reference each occurrence in order. The column REPEAT STRAT TYPE can be used to indicate the type of repeat you have encountered. There are many reasons why you may pick the same formation, from folded formations to deviated well bores.

Can I indicate that I expected to find a pick for this formation in a well, but was not able to?

The STRAT WELL SECTION table is used to capture interpretations (picks) for wells. If you expected a stratigraphic unit to be present, but were unable to pick it, use the PICK QUALIFIER column to indicate this (such as “MISSING”). The PICK QUALIF REASON column can be used to indicate why you think the pick is missing (such as “BAD LOGS”), and the PICK QUALITY column can be used to indicate how confident you are that the STRAT UNIT is not there.

How do I correlate my picks?

You have several options here. First, and most common historically, you can infer that there is a correlation between picks on the basis of commonality of STRAT UNIT name. However, this does not give you the ability to correlate stratigraphic units that have similar porosity or even rock color or fossil content.

This type of correlation can be captured explicitly in the STRAT INTERP CORR table. In this table you can capture information such as the type of interpretation you did, the type of stratigraphic unit you are dealing with, the degree of confidence you have in the correlation, and the criteria you used for the correlation.

Correlations can be captured between well picks and well picks, between field station picks and well picks, or between field station picks and other field station picks.

Appendix A: Sample Queries

General Notes

Most of the "area" questions can be addressed through a geographical (lat/long) type of search or via the NAMED AREA module (assuming that an area has been defined and used). For convenience, we use NAMED AREA for area searches.

There are usually a few ways you can tackle any question. It really depends on how you have populated your database and what you want to do. The examples we provide are just samples of how you could handle a question.

Most of the queries we have provided will give a result with the PPDM database, but the data may not make good "geological sense". We have taken many liberties with existing wells and data to make them respond to various types of queries. The volume and quality of the data we have varies; with time, the quality will improve.

We used natural identifiers for most columns, especially unique identifiers (primary keys). This allows us to avoid joining back to the reference table or stratigraphic unit table for the value name (so it makes queries shorter and easier to understand). If you choose to use numbers, etc., for primary keys, you will need to join to other tables to get the names, etc.

All of these queries need to be modified to use STRAT_NAME_SET_ID; this will be done as time permits.

Queries

What formation (Strat unit) names are used by IHS Energy?

```
select      SNS.STRAT_NAME_SET_ID, SNS.STRAT_NAME_SET_NAME,
            SNS.BUSINESS_ASSOCIATE, SU.STRAT_UNIT_ID,
            SU.LONG_NAME
  from      STRAT_NAME_SET SNS, STRAT_UNIT SU
 where      SNS.BUSINESS_ASSOCIATE = 'IHS'
   and      SNS.STRAT_NAME_SET_ID = SU.STRAT_NAME_SET_ID
order by    SU.LONG_NAME
```

What stratigraphic unit names were created by Joe for his project "JOE'S PROJECT"?

```
select      STRAT_UNIT_ID, SHORT_NAME, EFFECTIVE_DATE,
            EXPIRY_DATE
  from      STRAT_UNIT
 where      STRAT_NAME_SET_ID = 'JOES PROJECT'
```

What are the global stages in the Mesozoic as defined in the vendor stratigraphic name set "IPL"?

```
select        DISTINCT SH.PARENT_STRAT_UNIT_ID, SH.CHILD_STRAT_UNIT_ID
  from        STRAT_HIERARCHY SH
 where        STRAT_HIERARCHY_TYPE = 'CHRONO'
   And        PARENT_STRAT_NAME_SET = 'IPL'
connect by prior     CHILD_STRAT_UNIT_ID = PARENT_STRAT_UNIT_ID
start with    PARENT_STRAT_UNIT_ID= 'MESOZ'
```

Note: For this query, note that the connect by syntax does not allow table joins. To add information to this query, you will need to use a procedural language such as PL*SQL

Note: If you wish, all levels of the relationships can be explicitly populated, eliminating the need for the "*connect by"* syntax. The data you return from this query is different in presentation, because the data captures all levels of the hierarchy explicitly. Using this method, you should use STRAT_HIERARCHY_DESC to produce the order in the hierarchy correctly.

```
select        PARENT_STRAT_UNIT_ID, SUP.STRAT_UNIT_TYPE,
              CHILD_STRAT_UNIT_ID, SUC.STRAT_UNIT_TYPE
  from        STRAT_HIERARCHY SH, STRAT_UNIT SUP, STRAT_UNIT SUC
 where        STRAT_HIERARCHY_TYPE = 'CHRONO FULL'
   and        PARENT_STRAT_UNIT_ID = 'MESOZ'
   and        PARENT_STRAT_NAME_SET = 'IPL'
   and        PARENT_STRAT_UNIT_ID = SUP.STRAT_UNIT_ID
   and        CHILD_STRAT_UNIT_ID = SUC.STRAT_UNIT_ID
```

What formations comprise the Rundle Group in Central Alberta?

Note: As with the question about the chronological hierarchy, you can populate to support the connect by syntax, or to support pure SQL queries. In this case, you should be aware that the model requires both parent and child have the same STRAT_TYPE (litho, chrono, etc.).

```
select        DISTINCT PARENT_STRAT_UNIT_ID,CHILD_STRAT_UNIT_ID
  from        STRAT_HIERARCHY
 where        STRAT_HIERARCHY_TYPE = 'LITHO'
   and        PARENT_STRAT_NAME_SET = 'IPL'
connect by prior CHILD_STRAT_UNIT_ID = PARENT_STRAT_UNIT_ID
start with PARENT_STRAT_UNIT_ID= 'MANN GP'
```

What alternate names are used by VENDOR A for the Upper Mannville?

```
select        SA.STRAT_NAME_SET_ID, SA.STRAT_UNIT_ID,
              SA.ALIAS_STRAT_NAME_SET_ID, SA.ALIAS_STRAT_UNIT_ID,
```

```
              SA.STRAT_ALIAS_TYPE, SA.SOURCE
  from        STRAT_ALIAS SA, STRAT_UNIT SUNIT, STRAT_NAME_SET SNS
 where        SA.STRAT_UNIT_ID = 'U.MANN'
   and        SA.STRAT_UNIT_ID = SUNIT.STRAT_UNIT_ID
   and        SA.STRAT_NAME_SET_ID = SUNIT.STRAT_NAME_SET_ID
   and        SUNIT.STRAT_NAME_SET_ID = SNS.STRAT_NAME_SET_ID
   and        SNS.BUSINESS_ASSOCIATE = 'VENDOR A'
```

In what order do the formations in UWI ABC occur in order of penetration for the interpretation made by Shell on December 7, 2001?

```
select        UWI, STRAT_UNIT_ID, REPEAT_STRAT_OCCUR_NO,
              PICK_DEPTH, ORDINAL_SEQ_NO
  from        STRAT_WELL_SECTION
 where        UWI = '100043408813W600'
   and        INTERPRETER = 'SHELL'
   and        PICK_DATE = '07-Dec-2001'
   and        VERSION_OBS_NO = 1
order by      ORDINAL_SEQ_NO
```

Note: It will be convenient for population if the ordinal sequence numbers are assigned with spaces during the load. For example, assign them as 10, 20, 30, etc., rather than as 1, 2, 3. This will give you room to insert new formations without having to reorder the seq_no.

In what order do the formations in UWI ABC occur by age for the interpretation made by SHELL on December 7, 2001?

```
select        SWS.UWI, SWS.STRAT_UNIT_ID, SWS.REPEAT_STRAT_OCCUR_NO,
              SWS.PICK_DEPTH, SWS.ORDINAL_SEQ_NO,
              SUA.MAX_AGE
  from        STRAT_WELL_SECTION SWS, STRAT_UNIT SU,
              STRAT_UNIT_AGE SUA
 where        SWS.UWI = '100043408813W600'
   and        SWS.STRAT_NAME_SET_ID = SU.STRAT_NAME_SET_ID
   and        SWS.STRAT_UNIT_ID = SU.STRAT_UNIT_ID
   and        SU.STRAT_UNIT_ID = SUA.STRAT_UNIT_ID
   and        SU.STRAT_NAME_SET_ID = SUA.STRAT_NAME_SET_ID
   and        SWS.INTERPRETER = 'SHELL'
   and        SWS.PICK_DATE = '07-Dec-2001'
order by      SUA.MAX_AGE
```

In what order do the formations in UWI ABC occur by depth for the interpretation made by Joe on July 14, 2001?

```
select      SWS.UWI, SWS.STRAT_UNIT_ID, SWS.REPEAT_STRAT_OCCUR_NO,
            SWS.PICK_DEPTH, SWS.ORDINAL_SEQ_NO
  from      STRAT_WELL_SECTION SWS, STRAT_UNIT SU
 where      SWS.UWI = '100043408813W600'
   and      SWS.STRAT_NAME_SET_ID = SU.STRAT_NAME_SET_ID
   and      SWS.STRAT_UNIT_ID = SU.STRAT_UNIT_ID
   and      SWS.INTERPRETER = 'SHELL'
   and      SWS.PICK_DATE = '07-Dec-2001'
order by    SWS.PICK_DEPTH
```

What stratigraphic units does the Granite Wash underlie in Northwest Alberta?

```
select      STRAT_NAME_SET_ID_1, STRAT_UNIT_ID_1,
            STRAT_TOPO_RELATION, STRAT_NAME_SET_ID_2,
            STRAT_UNIT_ID_2, AREA_ID, AREA_TYPE
  from      STRAT_TOPO_RELATION
 where      STRAT_UNIT_ID_1 = 'GRNW'
   and      STRAT_NAME_SET_ID_1 = 'IPL'
   and      STRAT_TOPO_RELATION = 'UNDERLIES'
   and      AREA_ID = 'WEST CAN'
   and      AREA_TYPE = 'GEOGRAPHIC'
```

Calculate the isopach for picks between BLDN and BLSK for all wells.

```
select      BLDN.UWI, BLSK.UWI, BLDN.STRAT_UNIT_ID,
            BLSK.STRAT_UNIT_ID,
            BLDN.PICK_DEPTH -  BLSK.PICK_DEPTH
  from      STRAT_WELL_SECTION BLDN, STRAT_WELL_SECTION BLSK
 where      (BLDN.UWI = BLSK.UWI
   and      BLDN.STRAT_UNIT_ID = 'BLDN'
   and      BLSK.STRAT_UNIT_ID = 'BLSK')
```

Note: You may be able to short cut the join to the column STRAT NAME SET ID if you are confident that the STRAT UNIT ID are unique in your dataset. If they are not unique, you will need to add this column to the query.

Have any stratigraphic columns been defined in the Western Canada area?

```
select      STRAT_COLUMN_NAME, AREA_ID, AREA_TYPE
  from      STRAT_COLUMN
 where      AREA_ID = 'WEST CAN'
   and      AREA_TYPE = 'GEOGRAPHIC'
```

What stratigraphic units have been defined in the NORTHWEST PLAINS stratigraphic column? How are the stratigraphic units topologically related (are any interfingered with or bounded by another?). Show the stratigraphic units in the order they occur in the stratigraphic column.

Note: You can add a flag to STRAT COLUMN UNIT to indicate that there are more descriptive rows in STRAT TOPO RELATION.

```
select      STR.STRAT_NAME_SET_ID_1, STR.STRAT_UNIT_ID_1,
            STR.STRAT_TOPO_RELATION, STR.STRAT_NAME_SET_ID_2,
            STR.STRAT_UNIT_ID_2, SCU.ORDINAL_SEQ_NO
  from      STRAT_TOPO_RELATION STR, STRAT_COLUMN_UNIT SCU
 where      STR.STRAT_COLUMN_ID = 'NORTHWEST PLAINS'
   and      SCU.STRAT_COLUMN_ID = 'NORTHWEST PLAINS'
   And      SCU.STRAT_NAME_SET_ID = STR.STRAT_NAME_SET_ID_1
   and      SCU.STRAT_UNIT_ID = STR.STRAT_UNIT_ID_1
   and      SCU.STRAT_TOPO_RELATION_IND = 'Y'
order by    SCU.ORDINAL_SEQ_NO
```

What is the age of the Hanson as defined in the "IPL" stratigraphic name set? What is the range of error for the age? Give the age in both MYO and related chronostratigraphic age.

```
select      STRAT_UNIT_ID, AVERAGE_REL_STRAT_NAME_SET,
            AVERAGE_REL_STRAT_UNIT_ID,
            MAX_AGE, MAX_AGE_ERROR_PLUS, MAX_AGE_ERROR_MINUS,
            MIN_AGE, MIN_AGE_ERROR_PLUS, MIN_AGE_ERROR_MINUS
  from      STRAT_UNIT_AGE
 where      STRAT_UNIT_ID = 'HANSON'
   and      STRAT_NAME_SET_ID = 'IPL'
```

What formation names were originally provided by the vendor for this well? Which stratigraphic name set did they use?

Note: Some members populate the STRAT WELL SECTION (previously WELL FORMATION) table by removing the formation names provided by the vendor and replacing with their own based on the reported depth. In this case, the data has been altered, and the question cannot be addressed. If this information is needed, you should load the incoming values as one set of interpretation values; if you want to create a new interpretation that replaces the original formation names with your own, create a new VERSION_OBS_NO.

```
select      UWI, SOURCE, STRAT_UNIT_ID, PICK_DEPTH,
            STRAT_NAME_SET_ID
  from      STRAT_WELL_SECTION
 where      PICK_VERSION_TYPE = 'VENDOR'
   and      UWI = '100043408813W600'
```

Are there any overturned beds in this area (Named Area = WEST CAN)?

This question can be addressed through STRAT COLUMN, STRAT WELL SECTION or STRAT FIELD SECTION depending on how you have populated your database. We have provided two examples:

Check the STRAT COLUMNS in the area to determine whether any of them have the OVERTURNED_IND turned on.

```
select      SC.STRAT_COLUMN_NAME, SC.AREA_ID, SC.AREA_TYPE,
            SCU.STRAT_NAME_SET_ID, SCU.STRAT_UNIT_ID,
            SCU.OVERTURNED_IND
  from      STRAT_COLUMN SC, STRAT_COLUMN_UNIT SCU
 where      SC.AREA_ID = 'WEST CAN'
   and      SC.AREA_TYPE = 'GEOGRAPHIC'
   and      OVERTURNED_IND = 'Y'
order by    ORDINAL_SEQ_NO
```

Check the STRAT WELL SECTIONS in the area to determine whether any of them have the OVERTURNED_IND turned on.

```
select      SWS.UWI, SWS.AREA_ID, SWS.AREA_TYPE,
            SWS.STRAT_NAME_SET_ID, SWS.STRAT_UNIT_ID,
            SWS.OVERTURNED_IND, SWS.PICK_DATE
  from      STRAT_WELL_SECTION SWS
 where      AREA_ID = 'WEST CAN'
   and      AREA_TYPE = 'GEOGRAPHIC'
   and      OVERTURNED_IND = 'Y'
order by    ORDINAL_SEQ_NO
```

Are there any age reversals in the depth sequence for this well? Why is there an age reversal? (SHND, PKSK, BNFF, AXIAL)

```
select      SWS.UWI, SWS.STRAT_NAME_SET_ID, SWS.STRAT_UNIT_ID,
            SWS.ORDINAL_SEQ_NO,SUA.MAX_AGE, SUA.MIN_AGE
  from      STRAT_WELL_SECTION SWS, STRAT_UNIT SU,
            STRAT_UNIT_AGE SUA
 where      SWS.UWI = '100043408813W600'
   and      SWS.STRAT_UNIT_ID = SU.STRAT_UNIT_ID
   And      SWS.STRAT_NAME_SET_ID = SU.STRAT_NAME_SET_ID
   and      SU.STRAT_UNIT_ID = SUA.STRAT_UNIT_ID
```

```
   And       SU. STRAT_NAME_SET_ID = SUA.STRAT_NAME_SET_ID
order by     MAX_AGE, ORDINAL_SEQ_NO
```

What unconformities are there in this well (100060708713W600)?

Again, this question can be addressed in two ways. For simplicity, we have only addressed the STRAT WELL SECTION query, but the same query can be made for STRAT FIELD SECTION or STRAT COLUMN.

```
select       SWS.UWI, SWS.AREA_ID, SWS.AREA_TYPE,
             SWS.STRAT_NAME_SET_ID, SWS.STRAT_UNIT_ID,
             SWS.CONFORMITY_RELATIONSHIP
  from       STRAT_WELL_SECTION SWS
 where       UWI = '100043408813W600'
   and       CONFORMITY_RELATIONSHIP = 'UNCONF'
order by     ORDINAL_SEQ_NO
```

What faults are in this area? What occurrences of overthrusting have been found?

```
select       SWS.UWI, SWS.STRAT_NAME_SET_ID , SWS.STRAT_UNIT_ID,
             SWS.PICK_DEPTH, SU.STRAT_UNIT_TYPE, SU.FAULT_TYPE,
             SU.STRAT_UNIT_TYPE
  from       STRAT_UNIT SU,    STRAT_WELL_SECTION SWS
 where       SWS.AREA_ID  = 'WEST CAN'
   and       SWS.AREA_TYPE = 'GEOGRAPHIC'
   and       SWS.STRAT_UNIT_ID = SU.STRAT_UNIT_ID
   And       SWS.STRAT_NAME_SET_ID = SU.STRAT_NAME_SET_ID
   and       SU.STRAT_UNIT_TYPE IN ('FAULT', 'UNCONF')
```

For the well (100060508814W600), were there any formations that were expected but absent? Why is the pick missing?

```
select       UWI, STRAT_NAME_SET_ID , STRAT_UNIT_ID,
             PICK_QUALIFIER, PICK_QUALIF_REASON, PICK_QUALITY
  from       STRAT_WELL_SECTION
 where       UWI =  '100060508814W600'
   and       PICK_QUALIFIER = 'MISSING'
```

What wells did I interpret for this project (DEMO_CAN)?

```
select       PROJECT_ID, UWI
  from       PROJECT_COMPONENT
```

```
where      PROJECT_ID = 'DEMO_CAN'
```

How many times has this well been interpreted?

```
select     DISTINCT VERSION_OBS_NO
  from     STRAT_WELL_SECTION
 where     UWI = '100043408813W600'
```

List the picks for this well as interpreted in the demo_can Project and indicate the relative certainty of the pick and the confidence in the value.

```
select     SWS.UWI, SWS.VERSION_OBS_NO, SWS.STRAT_NAME_SET_ID,
           SWS.REPEAT_STRAT_OCCUR_NO, SWS.REPEAT_STRAT_TYPE,
           SWS.STRAT_UNIT_ID, SWS.INTERP_ID,
           SWS.PICK_LOCATION, SWS.PICK_QUALITY,
           SWS.PICK_QUALIFIER, SWS.PICK_QUALIF_REASON
  from     STRAT_WELL_ACQTN SWA, STRAT_WELL_SECTION SWS
 where     SWS.UWI = '100043408813W600'
   and     SWA.UWI = '100043408813W600'
   and     SWS.STRAT_UNIT_ID = SWA.STRAT_UNIT_ID
   And     SWS.STRAT_NAME_SET_ID = SWA.STRAT_NAME_SET_ID
   and     SWS.INTERP_ID = SWA.INTERP_ID
   and     SWA.PROJECT_ID = 'DEMO_CAN'
```

Describe the Hanson as it would be defined in a lexicon.

Note: This query will be constructed in parts, to duplicate the entries as given in the CSPG Lexicon.

1. Title entry

```
select     SU.STRAT_UNIT_ID, SU.LONG_NAME,
           SUA.AVERAGE_REL_STRAT_NAME_SET,
           SUA.AVERAGE_REL_STRAT_UNIT_ID
  from     STRAT_UNIT SU, STRAT_UNIT_AGE SUA
 where     SU.STRAT_UNIT_ID = 'HANSON'
   and     SU.STRAT_NAME_SET_ID = 'CSPG LEXICON'
   and     SU.STRAT_UNIT_ID = SUA.STRAT_UNIT_ID
   and     SU.STRAT_NAME_SET_ID = SUA.STRAT_NAME_SET_ID
```

2. Type locality

```
select     STRAT_UNIT_ID, DESCRIPTION_SEQ_NO, DESCRIPTION_TYPE,
           DESCRIPTION, REFERENCE_PAGES
```

```
  from       STRAT_UNIT_DESCRIPTION
 where       DESCRIPTION_TYPE = 'TYPE LOCAL'
   and       STRAT_UNIT_ID = 'HANSON'
   and       STRAT_NAME_SET_ID = 'CSPG LEXICON'
order by     DESCRIPTION_SEQ_NO
```

3. Lithology

```
select       STRAT_UNIT_ID, DESCRIPTION_SEQ_NO, DESCRIPTION_TYPE,
             DESCRIPTION, REFERENCE_PAGES
  from       STRAT_UNIT_DESCRIPTION
 where       DESCRIPTION_TYPE = 'LITHOLOGY'
   and       STRAT_UNIT_ID = 'HANSON'
   and       STRAT_NAME_SET_ID = 'CSPG LEXICON'
order by     DESCRIPTION_SEQ_NO
```

4. Thickness and Distribution

```
select       STRAT_UNIT_ID, DESCRIPTION_SEQ_NO, DESCRIPTION_TYPE,
             DESCRIPTION, REFERENCE_PAGES
  from       STRAT_UNIT_DESCRIPTION
 where       DESCRIPTION_TYPE = 'T AND D'
   and       STRAT_UNIT_ID = 'HANSON'
   and       STRAT_NAME_SET_ID = 'CSPG LEXICON'
order by     DESCRIPTION_SEQ_NO
```

5. Relationship to other units

```
select       STRAT_UNIT_ID, DESCRIPTION_SEQ_NO, DESCRIPTION_TYPE,
             DESCRIPTION, REFERENCE_PAGES
  from       STRAT_UNIT_DESCRIPTION
 where       DESCRIPTION_TYPE = 'RELATION'
   and       STRAT_UNIT_ID = 'HANSON'
   and       STRAT_NAME_SET_ID = 'CSPG LEXICON'
order by     DESCRIPTION_SEQ_NO
```

6. Paleontology

```
select       STRAT_UNIT_ID, DESCRIPTION_SEQ_NO, DESCRIPTION_TYPE,
             DESCRIPTION, REFERENCE_PAGES
  from       STRAT_UNIT_DESCRIPTION
 where       DESCRIPTION_TYPE = 'PALEO'
   and       STRAT_UNIT_ID = 'HANSON'
   and       STRAT_NAME_SET_ID = 'CSPG LEXICON'
order by     DESCRIPTION_SEQ_NO
```

7. References

```
select       DISTINCT SDR.SOURCE_DOCUMENT, SDA.AUTHOR_FIRST_NAME,
             SDA.AUTHOR_INITIAL, SDA.AUTHOR_LAST_NAME,
             SD.PUBLICATION_NAME,  SD.PUBLICATION_DATE,
             SDR.DOCUMENT_TITLE
  from       STRAT_UNIT_DESCRIPTION SUD, SOURCE_DOCUMENT SD,
```

```
           SOURCE_DOCUMENT SDR, SOURCE_DOC_AUTHOR SDA,
           SOURCE_DOC_BIBLIO SDB
 where     SUD.STRAT_UNIT_ID = 'HANSON'
   and     SUD.STRAT_NAME_SET_ID = 'CSPG LEXICON'
   and     SUD.SOURCE_DOCUMENT = SD.SOURCE_DOCUMENT
   and     SD.SOURCE_DOCUMENT = SDB.SOURCE_DOCUMENT
   and     SDB.REFERENCED_DOCUMENT = SDR.SOURCE_DOCUMENT
   and     SDA.SOURCE_DOCUMENT = SDR.SOURCE_DOCUMENT
```

What equivalencies have been defined in Western Canada?

```
select     STRAT_NAME_SET_ID, STRAT_UNIT_ID,
           EQUIV_STRAT_NAME_SET_ID, EQUIV_STRAT_UNIT_ID,
           EQUIV_DIRECTION
  from     STRAT_EQUIVALENCE
 where     AREA_ID = 'WEST CAN'
   and     AREA_TYPE = 'GEOGRAPHIC'
```

What name set does the Wapiti belong to? Is the name set it belongs to related to any other name set?

```
select     SU.STRAT_UNIT_ID, SU.STRAT_NAME_SET_ID,
           SNS.STRAT_NAME_SET_NAME, SNX.STRAT_NAME_SET_ID_1,
           SNX.STRAT_NAME_SET_ID_2
  from     STRAT_UNIT SU, STRAT_NAME_SET SNS,
           STRAT_NAME_SET_XREF SNX
 where     SU.STRAT_UNIT_ID = 'WAPIT'
   and     SU.STRAT_NAME_SET_ID = SNS.STRAT_NAME_SET_ID
   and     (SNS.STRAT_NAME_SET_ID = SNX.STRAT_NAME_SET_ID_1
    or     SNS.STRAT_NAME_SET_ID = SNX.STRAT_NAME_SET_ID_2)
```

What is the expected order of formations in northwest Alberta? (Note: We used a strat column in the area).

```
select     STRAT_COLUMN_ID, STRAT_NAME_SET_ID,
           STRAT_UNIT_ID, ORDINAL_SEQ_NO
  from     STRAT_COLUMN_UNIT
 where     STRAT_COLUMN_ID = 'NORTHWEST PLAINS'
order by   ORDINAL_SEQ_NO
```

What information or technique was used to create this interpretation? What application did I use?

```
select      UWI, STRAT_NAME_SET_ID,
            STRAT_UNIT_ID, APPLICATION_NAME,
            STRAT_INTERPRET_METHOD
  from      STRAT_WELL_SECTION
 where      UWI = '100043408813W600'
order by    ORDINAL_SEQ_NO
```

Where in the records library can I find the project reports for the DEMO_CAN project that Joe did in 1988?

```
select      II.INFORMATION_ITEM_ID, II.INFO_ITEM_TYPE,
            PIS.STORE_ID , PIS.PHYSICAL_ITEM_ID
  from      RM_PHYS_ITEM_STORE  PIS, RM_INFORMATION_ITEM II,
            RM_INFO_ITEM_CONTENT IIC, RM_DATA_CONTENT DC,
            RM_PHYSICAL_ITEM PI
 where      IIC.PROJECT_ID = 'DEMO_CAN'
   and      IIC.INFORMATION_ITEM_ID = II.INFORMATION_ITEM_ID
   and      IIC.INFO_ITEM_TYPE = II.INFO_ITEM_TYPE
   and      II.INFORMATION_ITEM_ID = DC.INFORMATION_ITEM_ID
   and      II.INFO_ITEM_TYPE = DC.INFO_ITEM_TYPE
   and      DC.PHYSICAL_ITEM_ID = PI.PHYSICAL_ITEM_ID
   and      PI.PHYSICAL_ITEM_ID = PIS.PHYSICAL_ITEM_ID
```

Who created the Northwest Plains stratigraphic column and where can I find the original documentation for it?

Note: There are two ways of thinking about who created the column. The Business Associate column in STRAT COLUMN tracks the business associate for whom the column was made. In the case of the CSPG columns, you might also want to know who the author of the source document was. This query will return both.

```
select      SC.STRAT_COLUMN_NAME, SC.STRAT_COLUMN_TYPE,
            SC.BUSINESS_ASSOCIATE, SC.SOURCE_DOCUMENT,
            SDA.AUTHOR_FIRST_NAME, SDA.AUTHOR_LAST_NAME
  from      STRAT_COLUMN SC, SOURCE_DOCUMENT SD,
            SOURCE_DOC_AUTHOR SDA
 where      SC.STRAT_COLUMN_NAME = 'NORTHWEST PLAINS'
   and      SC.SOURCE_DOCUMENT = SD.SOURCE_DOCUMENT
   and      SD.SOURCE_DOCUMENT = SDA.SOURCE_DOCUMENT
```

For the IPL Stratigraphic name set, which formations have the relationship that the BASE of one is the TOP of the other?

```sql
select      STR.STRAT_NAME_SET_ID_1, STR.STRAT_UNIT_ID_1,
            STR.STRAT_TOPO_RELATION, STR.STRAT_NAME_SET_ID_2,
            STR.STRAT_UNIT_ID_2
  from      STRAT_TOPO_RELATION STR, STRAT_NAME_SET SNS
 where      STRAT_TOPO_RELATION = 'BASE1 EQ TP2'
   and      (STR.STRAT_NAME_SET_ID_1 = SNS.STRAT_NAME_SET_ID
    or      STR.STRAT_NAME_SET_ID_2 = SNS.STRAT_NAME_SET_ID)
   and      SNS.STRAT_NAME_SET_ID = 'IPL'
```

Are there any correlations between picks in the DEMO_CAN Project? What is the correlation based on, and what is the confidence in the correlation? Who did the correlation?

```sql
select      UWI_1, UWI_STRAT_NAME_SET_1, UWI_STRAT_UNIT_ID_1,
            UWI_2, UWI_STRAT_NAME_SET_2, UWI_STRAT_UNIT_ID_2,
            STRAT_CORRELATION_TYPE, STRAT_CORRELATION_CRITERIA,
            STRAT_CORRELATION_TYPE, STRAT_INTERPRET_METHOD,
            BUSINESS_ASSOCIATE
  from      STRAT_INTERP_CORR
 where      PROJECT_ID = 'DEMO_CAN'
```

Appendix B: Changes to the Model

The PPDM Association has made a concerted effort to reduce the impact of new model development on members who are using other versions of PPDM. However, any new development is accompanied by some changes. Arriving at a model that is sufficiently detailed to meet the business needs of every member and yet flexible or abstract enough to be shielded from the corporate or regulatory variations is complex, but achievable. Every attempt is made to ensure the model complies with, but is relatively independent of, specific jurisdictional requirements, changes in government policy, regulations, or structure that may at times invalidate portions of the model. Internal re-engineering of business processes in industry companies may affect business requirements, which drive the data model. Rapid technological changes may also affect the model structure.

This section identifies all applicable changes from the latest version to the newest release version to assist the members in an ease of transition to implement the latest version of the model.

Changes Between Versions 3.4 and 3.5

Destructive model changes between PPDM versions are difficult and time consuming to implement. In recognition of this issue, the Stratigraphy work group attempted to ensure that foreign key references from STRAT UNIT to tables in other modules contain the same number and type of key components as existed in PPDM version 3.4 (one key component).

However, test results demonstrated that it is impractical to do this and allow the functionality within the Stratigraphy Module to remain intact. It is essential that the Stratigraphy Module allow users to input more than one set of stratigraphic names, so that aliases, equivalencies, hierarchies, ages, and so on can be supported. Further, data exchanges and submissions between partners and regulatory authorities will benefit from the use of multiple stratigraphic name sets.

The Primary Key structure of STRAT_UNIT is comprised of two components:

- STRAT UNIT ID
- STRAT NAME SET NAME

Changes between Version 3.5 and 3.6

For details on the mapping between the two versions, please refer to the mapping database, available from the PPDM Association. This document provides a high level summary of some key changes only.

Deleted columns

The following columns were deleted in PPDM Version 3.6 as work groups indicated they were not required.

STRAT_ALIAS	AREA_ID
STRAT_ALIAS	AREA_TYPE
STRAT_ALIAS	STRAT_ALIAS_DIRECTION
STRAT_ALIAS	STRAT_COLUMN_SOURCE
STRAT_COL_UNIT_AGE	STRAT_AGE_TYPE
STRAT_FLD_INTERP_AGE	STRAT_AGE_TYPE
STRAT_UNIT_AGE	STRAT_AGE_TYPE
STRAT_WELL_INTERP_AGE	STRAT_AGE_TYPE

Primary Key changes

The length of the primary key columns STRAT_NAME_SET_NAME and STRAT_COLUMN_NAME proved cumbersome for queries. The primary keys of these and all subordinate tables have been modified to reference STRAT_NAME_SET_ID and STRAT_COLUMN_ID respectively.

New tables

Two new tables were added:

- STRAT_HIERARCHY_DESC
- STRAT_COLUMN_XREF

Table changes

Additional foreign key references to STRAT_COLUMN or STRAT_COLUMN_UNIT have been provided in the three cross reference tables for STRAT_UNIT (STRAT_EQUIVALENCE, STRAT_HIERARCHY, STRAT_TOPO_RELATION). These foreign key references allow specification of the stratigraphic column interpretation that defines each relationship.

The structure of the %AGE tables has been modified to support horizontal data population, rather than vertical population. This will simplify query development and reduce the total number of data rows needed for implementations.

Changes Between Version 3.6 and 3.7

Minor modifications have been made. Please refer to the model mapping document for specific details.