

The EFG Geosciences Extension Schema for ABCD

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1. The EFG extension to the ABCD schema

Large museum collections are as widespread in the geosciences as they are in the biological sciences. Even more than the biological sciences, the geosciences are faced with a large array of different objects, which are described in a heterogeneous fashion. In spite of several individual endeavours attempting to database and mobilise geoscience data, we propose that building on the existing ABCD schema will be the fastest and at the same time most comprehensive way to mobilise information in the earth science disciplines.

In the framework of the European project SYNTHSYS we organised an international workshop in Berlin (Humboldt University, Museum für Naturkunde, 14th to 16th July 2005) to develop comprehensive information models for the earth sciences, building on existing models in biology. The Extension For Geosciences (EFG), outlined at the Berlin workshop, was elaborated and translated into an XML schema by Charles Copp and integrated into the ABCD schema by Charles Copp and Markus Döring.

The preliminary ABCDEFG schema is now being utilised to map the large paleontological, geological and mineralogical collections of the Berlin Museum für Naturkunde and the London Natural History Museum. This will demonstrate the functionality of the new schema to a broad audience and ease the recruitment of other large museums. The databases are expected to go online by May 2006.

This document describes the proposed geological data schema (EFG).

2. The EFG Model

2.1 Data Model

The EFG model attempts to add those data elements, currently missing from the ABCD schema, that would allow it to be used to represent data relating to earth science observations and specimens, including the description of stratal sequences (geological sections). The EFG model does not stand on its own, as much of the information relating to earth science observations and specimens is common with that for biological specimens and is already contained within the ABCD schema. This includes a number of general purpose global types, for instance those relating to people, organisations, documentary references and generic measurements and facts.

The EFG model is not, therefore, a complete stand-alone relational model but exists as a set of entity descriptions of specific areas of interest. Some of the entities, notably stratigraphic determination, may be used by several others and so there are relational links in the model. Most of the EFG data model is specific to the earth sciences but the global type for describing analytical procedures that yield multiple

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results would also be applicable to the biological sciences. An overview of the content ‘entities’ of the EFG model (essentially global types in the EFG schema) and how they relate to existing parts of the ABCD schema is given in *Figure 1*.

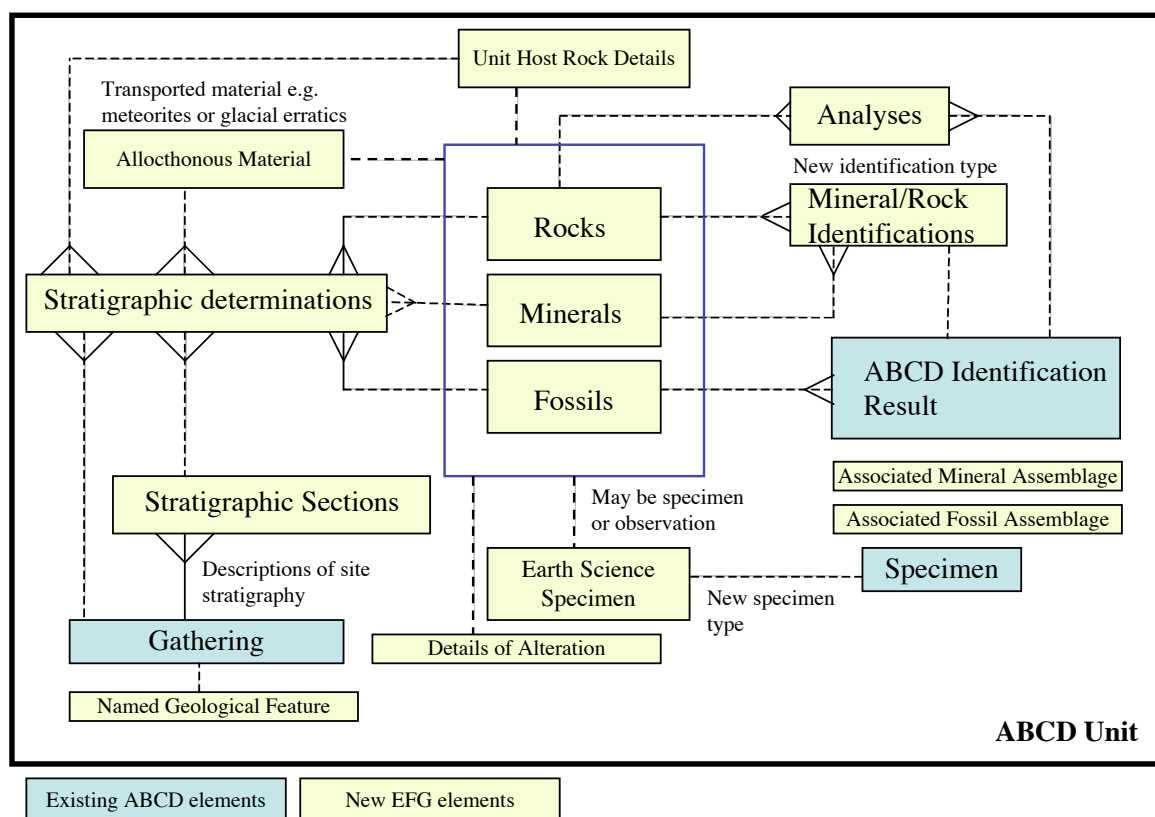


Figure 1: The relationship between EFG ‘entities’ and the ABCD schema. All the EFG components (elements and complex types) are used within the ABCD Unit Complex Type.

2.2 Schema Coverage

The EFG schema consists of a set of global elements and complex types that replace or extend existing complex types within the ABCD schema. All of the EFG elements and types are extensions to the **Unit** Type or its subsidiary complex types (e.g. **Gathering** and **Identification**) within the ABCD schema.

The proposed EFG elements and types are all global schema components and are therefore readily available for re-use in new combinations and modification as new requirements are identified.

The full documentation and diagrams for the current version of each of these components can be found on the eim website⁵ at:

http://eim.metapath.org/ABCDEFWeb/EFG_6Feb.XSD.html

The schema includes elements for the description of:

⁵ Note that this is a temporary location, for use during the development process. The EFG schema and documentation will be moved to a longer term location following this initial stage of the project.

- geological and geomorphological observations
 - geological specimens and preparations (e.g. thin sections)
 - palaeontological specimens and assemblages
 - mineral specimens and assemblages
 - rock and sediment specimens and assemblages
 - meteorites
 - anomalous items, such as glacial erratics and transported assemblages
- Diagenetic, metasomatic and metamorphic changes to any of the above
- Stratigraphic and absolute dates and correlations for any of the above
 - Measured stratigraphic sections and borehole logs
- Identifications (extended to cover rock and mineral classifications, varietal names etc.)
 - Analyses (Analytical techniques and results e.g. chemical composition of minerals, petrological analysis of rock)
- Integrated description of the host rock as part of a unit record – e.g. if the unit is an ammonite specimen, there is provision for describing the enclosing matrix, including mineralisation and alteration.
 - Recording the name of geological or geomorphological features (e.g. ‘The Great Whin Sill’ or ‘Redrock Fault’) where this differs from the location name.

The EFG model allows for both very simple descriptions of geological material (e.g. the name and geological age of a single fossil) or more complex ones where, for instance, a unit may consist of a fossil assemblage in an identified and described host rock with associated mineralisation (mineral assemblage) and other evidence of post-depositional alteration or transport (e.g. trilobites and brachiopods in a pyritised slate of Upper Ordovician age that has been transported as a glacial erratic!).

2.2.1 Stratigraphy

The model allows great flexibility when dealing with stratigraphic dates and correlations. It is possible to record chronostratigraphic, lithostratigraphic and biostratigraphic ‘ages’ as well as magnetostratigraphic and isotope stratigraphic correlations and radiometric dates. All dates can include earliest and latest values to cover ranges.

Stratigraphic attributions, of any type, can be recorded individually or in combination and can be independently attached to:

- the unit (a specimen, group of specimens or an observation)
- the host rock of a unit
- allocthonous material associated with the unit
- the gathering site for a unit.

It is also possible to record stratigraphic sequences such as measured sections and borehole logs with stratigraphic dates, rock names and correlations attributable to each layer. Stratigraphic sections are a feature of the Gathering location.

Stratigraphic sections are essentially a special form of observation that yields a structured list of items with associated data (e.g. bed number, age, associated fossil assemblage etc.). This could be achieved using separate unit records and the associated unit element but this is a very clumsy way of representing the data and makes it very difficult to link a measured section to an individual geological unit. For instance it might be desired to create a unit for an important fossil specimen and incorporate the measured geological section and a list of associated taxa for its collection site into a single record.

A stratigraphic section could also exist as an independent site-based record and this would normally be the case for boreholes and wells

2.2.2 Analytical Data

An **Analysis** Complex Type has been introduced to allow for the recording of analytical results associated with either petrological analysis of rocks or of mineral composition and analyses used in the identification of any materials. This is a global re-usable type and so could be used in other situations, such as the analysis of preserved organic materials associated with palaeontological specimens. The analysis complex type differs from the global **MeasurementOrFact** type in that it allows multiple values to be linked to a single analysis, for instance a single mass spectrometer run would yield peaks for a whole series of elements.

Further details of the component global types in the EFG schema are given below.

3. Schema Details

The full EFG schema (EFG.xsd) is listed in Annex 1 of this paper. The following notes describe the global complex types, each of which may be made up of other complex types and individual data elements.

3.1 Global Components in the EFG Schema

3.1.1 Component List

The EFG Schema is composed of a number of global types with no overall root for the whole schema (e.g. an EFG complex type). This decision was made in order to keep XPath lengths shorter and to make type re-use as flexible as possible. The components in the EFG schema are listed below. Some of the complex types contain many individual elements, not listed here. A listing of the xsd file, which includes all elements and proposed enumerations is given in Annex 1 to this document.

1. **EarthScienceSpecimenType** Complex Type: Container for details that generally relate to the management of earth science specimens and their individual stratigraphic age (which may be different or more specific than that recorded for the gathering site or the host rock).
2. **RockUnitType** Complex Type: Container for descriptive elements related to rock units.
3. **PalaeontologicalUnitType** Complex Type: Container for descriptive elements related to palaeontological material.
4. **MineralogicalUnitType** Complex Type: Container for descriptive elements related to mineral units.
5. **AllocthonousMaterialType** Complex Type: Container for descriptive elements related to transported material ranging from glacial erratics to meteorites.
6. **UnitHostRockType** Complex Type: Container for elements relating to the host rock for units primarily described for their palaeontological or mineralogical interest.

7. **AlterationType** Complex Type: Container for elements describing diagenetic, metasomatic and metamorphic changes to units. (e.g. the shock metamorphic grade of a meteorite or chloritisation of biotite in a granite)
8. **MineralRockIdentifiedType** Complex Type: Container for elements associated with mineral and rock identifications. This global type is an extension to the Result complex type within the ABCD Identification type. It includes elements for recording analytical results linked to an identification.
9. **IdentificationAnalysis** Complex Type: Container for analytical techniques and results employed for identifying minerals and rocks. Note that this complex type differs from the ABCD schema MeasurementOrFact Complex Type in that it allows for multiple values to be obtained from a single analysis e.g. percentage values for elements in a mineral.
10. **SiteStratigraphyType** Complex Type: Container for elements and complex types relating to the stratigraphy of a named or spatially defined location (site) and the attribution of relative and absolute dates and correlations. This complex type extends the Gathering Complex Type in ABCD and allows the comprehensive description of the stratigraphy of a site including tectonic and sequence stratigraphy contexts and the recording of measured sections..
11. **NamedGeologicalFeature** Element: The name of a geological or geomorphological feature that is not the placename of the gathering location. For instance, “The Whin Sill” or the “Great Glen Fault” (both of which extend through many named sites).
12. **StratigraphicAttributionsType** Complex Type: Container for elements relating to the absolute and relative dating and correlation of geological units and gathering sites. Equivalent to 'Result' in Taxon Identification schema. Where a range of dates is associated with a unit, use multiple entries for attribution e.g. if a named unit definitely includes lower raricostatum zone set to certain but may range up into spinatum zone, use one record for raricostatum zone set to certain and another for spinatum zone set to uncertain. If necessary include all intermediate horizons at same or higher level terms that encompass range, to ensure proper indexing.
13. **ChronostratigraphicAttributionsType** Complex Type: Container for one or more identified chronostratigraphic dates. One of the complex types used within the StratigraphicAttributionsType.
14. **LithostratigraphicAttributionsType** Complex Type: Container for one or more identified lithostratigraphic terms (e.g. “Blackrock Limestone”). One of the complex types used within the StratigraphicAttributionsType.
15. **BiostratigraphicAttributionsType** Complex Type: Container for one or more identified Biostratigraphic zones or subzones. One of the complex types used within the StratigraphicAttributionsType.
16. **MagnetostratigraphicDeterminationsType** Complex Type: Container for one or more magnetostratigraphic determinations. One of the complex types used within the StratigraphicAttributionsType
17. **IsotopeStratigraphicDeterminationsType** Complex Type: Container for one or more isostratigraphic dates/correlations. One of the complex types used within the StratigraphicAttributionsType

18. **RadiometricDatesType** Complex Type: Container for one or more radiometric dates. One of the complex types used within the StratigraphicAttributionsType
19. **DatingQualifier** Element: simple element allowing for qualification of a date, for instance, as early/lower, middle late/upper e.g. late Cambrian, early raricostatum zone etc.
20. **StratigraphicSectionType** Complex Type: Container for repeatable elements giving a layer by layer description of stratigraphic sections, wells and boreholes.
21. **StratigraphicMeasurementsOrFacts** Element: Container for measurements and facts. References the ABCD MeasurementOrFact Complex Type but allows for modification if required.
22. **IdentifiersType** Complex Type: Container for elements naming people and organisations involved in identification. References ABCD person and organisation types but allows for further elaboration (e.g. relationship of person to organisation)
23. **IdentificationAnalysisType** Complex Type: Container for one or more instances of the AnalysisAtomised complex type when used in association with an identification.
24. **AnalysisAtomisedType** Complex Type: Container for elements describing an analysis and its results e.g. chemical analysis of a mineral.
25. **AnalysisDateTime** Element: When analysis was carried out. References ABCD DateTime element and allows for text qualification.
26. **AnalysisReferences** Element: Any documentary references linked to an analysis/References ABCD Reference Type.
27. **AssociatedFossilAssemblageType** Complex Type: Container for list of taxa that form an assemblage, normally used as context information for an individual fossil or rock unit. Detailed accounts of different individual fossil items on the same block (or other associated group) should be dealt with as separate units as they normally have different registration details (e.g. registration numbers etc.). The assemblage may be associated with individual layers in stratigraphic sections.
28. **AssociatedMineralAssemblageType** Complex Type: Container for list of minerals that form an assemblage, normally used as context information for an individual fossil, mineral or rock unit. Detailed accounts of individual minerals on the same block (or other associated group) may need to be dealt with as separate units as they may need to be linked to detailed analyses, identification events, publications etc.. The assemblage may be associated with individual layers in stratigraphic sections.
29. **Certainty** Element: Element used for describing the certainty associated with a date determination. May use an enumerated list e.g. unknown, certain, probable, uncertain, possibly wrong, known wrong.

4. Implementing EFG as an extension to ABCD schema

The global types listed above can be used in different ways but they do include calls to complex types within the ABCD schema (or the developing type libraries) and a complete record would use much of

the ABCD structure. The following notes demonstrate how the EFG types could be implemented within ABCD to create a highly flexible and powerful means of representing and transferring geological data.

4.1 ABCD Types extended by EFG

4.1.1 Unit: extensions to ABCD Unit complex type

- RecordBasis & KindOfUnit - no changes but note that these should be used to signify geological material and stratigraphic sections – enumeration (if used) will need editing.
- Add optional efg PalaeontologicalUnit (uses PalaeontologicalUnitType) to replace existing abcd PalaeontologicalUnit type
- Add optional RockUnit (RockUnitType)
- Add optional MineralUnit (uses MineralogicalUnitType)
- Add optional AllothonousUnit (uses AllothonousUnitType)
- Add optional UnitHostRock (uses UnitHostRockType)

4.1.2 Gathering: extensions to ABCD Gathering complex type

- Add optional Straigraphy (uses SiteStratigraphyType)
- Add optional NamedGeologicalFeature (element)

4.1.3 Identifications: extension to ABCD Identifications complex type

- IdentificationAnalysis (uses IdentificationAnalysisType)
- MineralRockIdentified (uses MineralRockIdentifiedType)

4.1.4 Result: extensions to ABCD Result complex type (for identifications)

- MineralOrRockIdentified (uses MineralOrRockIdentifiedType)

Annex 1: EFG XML Schema

```
<?xml version="1.0" encoding="UTF-8"?>
<!-- edited with XMLSpy v2005 rel. 3 U (http://www.altova.com) by Markus Döring (BGBM) -->
<!-- edited with XMLSPY v2004 rel. 2 U (http://www.xmlspy.com) by Charles Copp (EIM) -->
<!-- Proposed collection of global elements and extensions for Earth Sciences extension to the ABCD Schema -->
<!-- This version last edited 7th February 2006 by Charles Copp -->

<xs:schema targetNamespace="http://www.synthesys.info/ABCDEF/1.0"
xmlns:efg="http://www.synthesys.info/ABCDEF/1.0" xmlns:xs="http://www.w3.org/2001/XMLSchema"
elementFormDefault="qualified" attributeFormDefault="unqualified">
```

<!--Elements extending ABCD Unit-->

```
<xs:complexType name="EarthScienceSpecimenType">
<xs:annotation>
<xs:documentation>Container for details that generally relate to the management of earth science specimens and their
individual stratigraphic age (which may be different or more specific than that recorded for the gathering site or the host
rock.</xs:documentation>
</xs:annotation>
<xs:sequence>
<xs:element name="UnitSize" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>Free text field for describing the overall size of the specimen - frequently used information and therefore
placed here as a summary. Details should be entered under MeasurementOrFact complex type.</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="UnitWeight" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>Free text field to enter gross weight of geological specimens. - frequently used information and used
here as a summary. Details should be entered under MeasurementOrFact complex type.</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="Hazard" minOccurs="0">
<xs:annotation>
<xs:documentation>Container for describing hazards that may be associated with the specimen e.g. radioactive, toxic,
carcinogens etc.</xs:documentation>
</xs:annotation>

<xs:complexType>
<xs:sequence>
<xs:element name="HazardText" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>Free text describing any hazards that may be associated with the specimen/unit e.g. is it radioactive,
poisonous, carcinogenic?</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="HazardKeywords" maxOccurs="unbounded">
<xs:simpleType>
<xs:restriction base="xs:string">
<xs:enumeration value="acidic"/>
<xs:enumeration value="caustic"/>
<xs:enumeration value="carcinogenic"/>
<xs:enumeration value="heavy"/>
<xs:enumeration value="neurotoxin"/>
<xs:enumeration value="radioactive"/>
<xs:enumeration value="sharp edges/points"/>
<xs:enumeration value="toxic"/>
<xs:enumeration value="unknown"/>
</xs:restriction>
</xs:simpleType>
</xs:element>
</xs:sequence>
</xs:complexType>
```



```

</xs:element>
<xs:element name="RockMineralUsage" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>Description of the use to which this mineral or rock has been put e.g. building stone, ore, sculpture, cut
gemstone.</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="UnitStratigraphicDetermination" type="efg:StratigraphicAttributionsType" minOccurs="0">
<xs:annotation>
<xs:documentation>Formal stratigraphic date or correlation for an individual earth science unit (e.g. a single fossil specimen).
Use efgGathering for site-related stratigraphy. This allows for individual specimens to be given an exact stratigraphic date and
the wider stratigraphy of the site to also be listed.</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="StratigraphicDateComment" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>Free text element to allow discussion of geological age of a specimen or observed
feature</xs:documentation>
</xs:annotation>
</xs:element>
</xs:sequence>
</xs:complexType>

<xs:complexType name="RockUnitType">
<xs:annotation>
<xs:documentation>Container for descriptive elements related to rock units</xs:documentation>
</xs:annotation>
<xs:sequence>
<xs:element name="RockType" maxOccurs="unbounded">
<xs:annotation>
<xs:documentation>For simple classification e.g. igneous, metamorphic, sedimentary or meteorite - enumeration list is
provisional!</xs:documentation>
</xs:annotation>
<xs:simpleType>
<xs:restriction base="xs:string">
  <xs:enumeration value="carbonaceous"/>
  <xs:enumeration value="carbonate"/>
  <xs:enumeration value="clastic"/>
  <xs:enumeration value="evaporite"/>
  <xs:enumeration value="fault rock"/>
  <xs:enumeration value="gneiss"/>
  <xs:enumeration value="high-grade metamorphic"/>
  <xs:enumeration value="hornfels"/>
  <xs:enumeration value="igneous"/>
  <xs:enumeration value="igneous extrusive"/>
  <xs:enumeration value="igneous intrusive"/>
  <xs:enumeration value="low-grade metamorphic"/>
  <xs:enumeration value="metamorphic"/>
  <xs:enumeration value="metasomatic"/>
  <xs:enumeration value="meteorite"/>
  <xs:enumeration value="migmatite"/>
  <xs:enumeration value="mylonite"/>
  <xs:enumeration value="plutonic intrusive"/>
  <xs:enumeration value="sedimentary"/>
  <xs:enumeration value="schist"/>
  <xs:enumeration value="slate"/>
  <xs:enumeration value="vein / pegmatite"/>
  <xs:enumeration value="volcaniclastic"/>
</xs:restriction>
</xs:simpleType>
</xs:element>
<xs:element name="RockPhysicalCharacteristics" type="abcd:MeasurementOrFact" minOccurs="0"
maxOccurs="unbounded">
<xs:annotation>
<xs:documentation>Container for descriptive terms and measurements related to rocks e.g. grain size, grain sphericity, crystal
sizes and orientations, laminations etc.</xs:documentation>
</xs:annotation>

```

```

</xs:element>
<xs:element name="Petrology" minOccurs="0">
  <xs:annotation>
    <xs:documentation>Container for petrographic descriptions related to a rock or mineral unit</xs:documentation>
  </xs:annotation>
  <xs:complexType>
    <xs:sequence>
      <xs:element name="PetrologyDescriptiveText" type="xs:string" minOccurs="0">
        <xs:annotation>
          <xs:documentation>Free text element for petrographic description of the associated rock or mineral unit.</xs:documentation>
        </xs:annotation>
      </xs:element>
      <xs:element name="PetrologicalAnalyses" minOccurs="0">
        <xs:annotation>
          <xs:documentation>Container element for one or more sets of analytical results relating to the petrogenesis of a rock unit.</xs:documentation>
        </xs:annotation>
        <xs:complexType>
          <xs:sequence>
            <xs:element name="PetrologicalAnalysis" maxOccurs="unbounded">
              <xs:annotation>
                <xs:documentation>Container for a single analysis related to the petrogenesis of a rock unit</xs:documentation>
              </xs:annotation>
              <xs:complexType>
                <xs:sequence>
                  <xs:element name="PetrologicalAnalysisComment" type="xs:string" minOccurs="0">
                    <xs:annotation>
                      <xs:documentation>Free text element describing a petrological analysis or its results</xs:documentation>
                    </xs:annotation>
                  </xs:element>
                  <xs:element name="PetrologicalAnalysisAtomised" type="efg:AnalysisAtomisedType" minOccurs="0"/>
                </xs:sequence>
              </xs:complexType>
            </xs:element>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
    </xs:sequence>
  </xs:complexType>
</xs:element>
<xs:element name="AssociatedMineralAssemblage" type="efg:AssociatedMineralAssemblageType" minOccurs="0"/>
</xs:sequence>
</xs:complexType>
</xs:element>
<xs:element name="AssociatedFossilAssemblage" type="efg:AssociatedFossilAssemblageType" minOccurs="0">
  <xs:annotation>
    <xs:documentation>Container element for describing fossil assemblage associated with the rock or mineral unit
  </xs:documentation>
  </xs:annotation>
  </xs:element>
  <xs:element name="DepositionalEnvironment" minOccurs="0">
    <xs:annotation>
      <xs:documentation>Container for describing the original environment in which the rock was deposited or the mineral formed
      e.g. hypersaline lagoon, lacustrine, intertidal etc.</xs:documentation>
    </xs:annotation>
    <xs:complexType>
      <xs:sequence>
        <xs:element name="DepositionalEnvironmentText" type="xs:string" minOccurs="0">
          <xs:annotation>
            <xs:documentation>free text describing the original environment in which the rock was deposited or the mineral formed e.g.
            hypersaline lagoon, lacustrine, intertidal etc.</xs:documentation>
          </xs:annotation>
        </xs:element>
        <xs:element name="DepositionalEnvironmentType" maxOccurs="unbounded">
          <xs:annotation>
            <xs:documentation>keywords from enumerated list for indexing of depositional environments</xs:documentation>
          </xs:annotation>
        </xs:element>
      </xs:sequence>
    </xs:complexType>
  </xs:element>

```

```

<xs:simpleType>
<xs:restriction base="xs:string">
  <xs:enumeration value="alluvial fan"/>
  <xs:enumeration value="basinal carbonate"/>
  <xs:enumeration value="basinal siliceous"/>
  <xs:enumeration value="carbonate"/>
  <xs:enumeration value="cave"/>
  <xs:enumeration value="channel"/>
  <xs:enumeration value="channel lag"/>
  <xs:enumeration value="coarse channel fill"/>
  <xs:enumeration value="coastal"/>
  <xs:enumeration value="crater lake"/>
  <xs:enumeration value="crevasse splay"/>
  <xs:enumeration value="deep subtidal"/>
  <xs:enumeration value="deep subtidal ramp"/>
  <xs:enumeration value="deep subtidal shelf"/>
  <xs:enumeration value="deltaic"/>
  <xs:enumeration value="delta front"/>
  <xs:enumeration value="delta plain"/>
  <xs:enumeration value="dry floodplain"/>
  <xs:enumeration value="dune"/>
  <xs:enumeration value="estuarine"/>
  <xs:enumeration value="eolian"/>
  <xs:enumeration value="fissure fill"/>
  <xs:enumeration value="floodplain"/>
  <xs:enumeration value="fluvial"/>
  <xs:enumeration value="fluvial-deltaic"/>
  <xs:enumeration value="fluvial-lacustrine"/>
  <xs:enumeration value="foreshore"/>
  <xs:enumeration value="glacial"/>
  <xs:enumeration value="interdistributary bay"/>
  <xs:enumeration value="interdune"/>
  <xs:enumeration value="karst"/>
  <xs:enumeration value="lacustrine"/>
  <xs:enumeration value="lagoonal"/>
  <xs:enumeration value="levee"/>
  <xs:enumeration value="loess"/>
  <xs:enumeration value="marginal marine"/>
  <xs:enumeration value="marine"/>
  <xs:enumeration value="offshore"/>
  <xs:enumeration value="offshore ramp"/>
  <xs:enumeration value="offshore shelf"/>
  <xs:enumeration value="open shallow subtidal"/>
  <xs:enumeration value="paralic"/>
  <xs:enumeration value="peritidal"/>
  <xs:enumeration value="pond"/>
  <xs:enumeration value="prodelta"/>
  <xs:enumeration value="reef or bioherm"/>
  <xs:enumeration value="shallow subtidal"/>
  <xs:enumeration value="shoreface"/>
  <xs:enumeration value="shore transition zone"/>
  <xs:enumeration value="sinkhole"/>
  <xs:enumeration value="slope"/>
  <xs:enumeration value="swamp"/>
  <xs:enumeration value="restricted shallow subtidal"/>
  <xs:enumeration value="sand shoal"/>
  <xs:enumeration value="tar"/>
  <xs:enumeration value="terrestrial"/>
  <xs:enumeration value="wet floodplain"/>
</xs:restriction>
</xs:simpleType>
</xs:element>
</xs:sequence>

</xs:complexType>
</xs:element>
</xs:sequence>

```

</xs:complexType>

<xs:complexType name="PalaeontologicalUnitType">

<xs:annotation>

<xs:documentation>Container for descriptive elements related to palaeontological material</xs:documentation>

</xs:annotation>

<xs:sequence>

<xs:element name="PartOfOrganism" type="xs:string" minOccurs="0">

<xs:annotation>

<xs:documentation>Free text description relating to the part or parts of the organism that have been preserved e.g. shell, skeleton, skull, soft tissue etc.</xs:documentation>

</xs:annotation>

</xs:element>

<xs:element name="Completeness" type="xs:string" minOccurs="0">

<xs:annotation>

<xs:documentation>Free text describing the degree of completeness of the specimen e.g. complete, cephalon only, but may describe completeness of a part e.g. complete skull</xs:documentation>

</xs:annotation>

</xs:element>

<xs:element name="Articulation" type="xs:string" minOccurs="0">

<xs:annotation>

<xs:documentation>Free text description of the articulation in the preserved specimen - applies to invertebrate shells and exoskeletons as well as vertebrate skeletons. e.g. articulated, dis-articulated, single valves etc.</xs:documentation>

</xs:annotation>

</xs:element>

<xs:element name="FeedingPredationTraces" type="xs:string" minOccurs="0">

<xs:annotation>

<xs:documentation>Free text description relating to aspects of feeding and predation e.g. ammonite with bite mark from plesiosaur, shell drilled by predatory gastropod etc.</xs:documentation>

</xs:annotation>

</xs:element>

<xs:element name="Bioerosion" type="xs:string" minOccurs="0">

<xs:annotation>

<xs:documentation>Free text description of damage due to biological action, such as, boring worms and sponges.</xs:documentation>

</xs:annotation>

</xs:element>

<xs:element name="Encrustation" type="xs:string" minOccurs="0">

<xs:annotation>

<xs:documentation>Free text description of biological encrustations, such as oysters and tube worms.</xs:documentation>

</xs:annotation>

</xs:element>

<xs:element name="Orientation" type="xs:string" minOccurs="0">

<xs:annotation>

<xs:documentation>Free text description of the orientation of the fossil remains in the host rock e.g. unknown, life position, toppled etc.</xs:documentation>

</xs:annotation>

</xs:element>

<xs:element name="AssemblageOrigin" type="xs:string" minOccurs="0">

<xs:annotation>

<xs:documentation>Free text description relating to the mode of origin of the assemblage e.g. unknown, allocthonous, autocthonous, paraautocthonous etc.</xs:documentation>

</xs:annotation>

</xs:element>

<xs:element name="PostBurialTransportation" type="xs:string" minOccurs="0">

<xs:annotation>

<xs:documentation>Free text relating to any post burial transport of fossil material e.g. river transport, scree slope etc.</xs:documentation>

</xs:annotation>

</xs:element>

<xs:element name="PreservationQuality" type="xs:string" minOccurs="0">

<xs:annotation>

<xs:documentation>Free text describing the preservation quality e.g. poor, medium, good, excellent. Includes preservation of anatomical detail and softparts.</xs:documentation>

</xs:annotation>

</xs:element>

```

<xs:element name="PreservationMode" minOccurs="0">
  <xs:annotation>
    <xs:documentation>Container for preservation mode description and keywords</xs:documentation>
  </xs:annotation>
  <xs:complexType>
    <xs:sequence>
      <xs:element name="PreservationModeText" type="xs:string" minOccurs="0">
        <xs:annotation>
          <xs:documentation>Free text for describing the mode of preservation e.g. is the specimen a cast or mold,are soft parts
          preserved or mineralised etc.</xs:documentation>
        </xs:annotation>
      </xs:element>
      <xs:element name="PreservationModeKeywords" minOccurs="0" maxOccurs="unbounded">
        <xs:annotation>
          <xs:documentation>keywords for how fossil material has been preserved e.g. body, cast, mold, trace fossil, soft parts
          mineralised etc.</xs:documentation>
        </xs:annotation>
        <xs:simpleType>
          <xs:restriction base="xs:string">
            <xs:enumeration value="adpression/compression"/>
            <xs:enumeration value="body"/>
            <xs:enumeration value="cast"/>
            <xs:enumeration value="charcoalification"/>
            <xs:enumeration value="coalified"/>
            <xs:enumeration value="concretion"/>
            <xs:enumeration value="dissolution traces"/>
            <xs:enumeration value="mold/impression"/>
            <xs:enumeration value="permineralised"/>
            <xs:enumeration value="recrystallised"/>
            <xs:enumeration value="soft parts"/>
            <xs:enumeration value="trace"/>
          </xs:restriction>
        </xs:simpleType>
      </xs:element>
      <xs:element name="PreservationSpecialMode" minOccurs="0">
        <xs:annotation>
          <xs:documentation>Keyword for any special mode of preservation e.g. preserved in amber or frozen in tundra, tar pit
          etc.</xs:documentation>
        </xs:annotation>
        <xs:simpleType>
          <xs:restriction base="xs:string">
            <xs:enumeration value="amber"/>
            <xs:enumeration value="anthropogenic"/>
            <xs:enumeration value="bone collector"/>
            <xs:enumeration value="concretion"/>
            <xs:enumeration value="coprolite"/>
            <xs:enumeration value="frozen soil"/>
            <xs:enumeration value="hypersaline"/>
            <xs:enumeration value="midden"/>
            <xs:enumeration value="peat"/>
            <xs:enumeration value="tar pit"/>
            <xs:enumeration value="other"/>
          </xs:restriction>
        </xs:simpleType>
      </xs:element>
    </xs:sequence>
  </xs:complexType>
</xs:element>
<xs:element name="PreservationAlteration" minOccurs="0">
  <xs:annotation>
    <xs:documentation>Container for description of preservation and alsteration of specimen</xs:documentation>
  </xs:annotation>
  <xs:complexType>
    <xs:sequence>
      <xs:element name="PreservationAlterationText" type="xs:string" minOccurs="0">
        <xs:annotation>

```

```

<xs:documentation>Free text relating to mineralogical changes in preserved specimens e.g. original shell material preserved,
replacement minerals, re-crystallisation, silicification etc.</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="OriginalBiomaterials" minOccurs="0" maxOccurs="unbounded">
<xs:annotation>
<xs:documentation>List of original organic or biomaterial preserved in the specimen</xs:documentation>
</xs:annotation>
<xs:simpleType>
<xs:restriction base="xs:string">
  <xs:enumeration value="aragonite"/>
  <xs:enumeration value="carbon"/>
  <xs:enumeration value="calcite"/>
  <xs:enumeration value="cellulose"/>
  <xs:enumeration value="chitin"/>
  <xs:enumeration value="phosphate"/>
  <xs:enumeration value="silica"/>
  <xs:enumeration value="sporopollenin"/>
</xs:restriction>
</xs:simpleType>
</xs:element>
<xs:element name="ReplacementMinerals" minOccurs="0" maxOccurs="unbounded">
<xs:annotation>
<xs:documentation>List of replacement minerals in the specimen e.g. silica</xs:documentation>
</xs:annotation>
<xs:simpleType>
<xs:restriction base="xs:string">
  <xs:enumeration value="calcite"/>
  <xs:enumeration value="carbon"/>
  <xs:enumeration value="dolomite"/>
  <xs:enumeration value="haematite"/>
  <xs:enumeration value="limonite"/>
  <xs:enumeration value="opal"/>
  <xs:enumeration value="phosphate"/>
  <xs:enumeration value="pyrite"/>
  <xs:enumeration value="siderite"/>
  <xs:enumeration value="silica"/>
  <xs:enumeration value="unknown"/>
</xs:restriction>
</xs:simpleType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>

<xs:complexType name="MineralogicalUnitType">
<xs:annotation>
<xs:documentation>Container for descriptive elements related to mineral units</xs:documentation>
</xs:annotation>
<xs:sequence>
<xs:element name="MineralHabit" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>Free text description of the mineral habit. Minerals occur in a variety of forms, which may or may not be
directly dependent on their crystalline structure e.g. nodular, columnar, radiating, mamillated, botryoidal, granular
etc.</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="MineralColour" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>Description of coloration of the mineral</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="CrystalForm" minOccurs="0">
<xs:annotation>
<xs:documentation>Container element for describing the crystal form of a mineral unit.</xs:documentation>

```

```

</xs:annotation>
<xs:complexType>
<xs:sequence>
<xs:element name="Twinning" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>Free text to describe any twinning features displayed by a mineral unit. Types include interpenetrant,
rotation and geniculate.</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="Pseudomorph" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>Free text to describe any pseudomorph features associated with a mineral or rock unit. Types include
substitution, encrustation and infill</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="CrystalMeasurements" minOccurs="0">
<xs:annotation>
<xs:documentation>container for measurements of crystal physical and chemical characteristics</xs:documentation>
</xs:annotation>
<xs:complexType>
<xs:sequence>
<xs:element name="CrystalMeasurement" type="abcd:MeasurementOrFact" maxOccurs="unbounded">
<xs:annotation>
<xs:documentation>Individual measurement or fact related to a crystal unit - container for standard MeasurementOrFact
complex type from main schema</xs:documentation>
</xs:annotation>
</xs:element>
</xs:sequence>
</xs:complexType>

</xs:element>
<xs:element name="CrystalFormText" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>Free text description of crystal form</xs:documentation>
</xs:annotation>
</xs:element>
</xs:sequence>
</xs:complexType>

</xs:element>
<xs:element name="MineralMeasurementsOrFacts" minOccurs="0">
<xs:annotation>
<xs:documentation>Container for measurements or facts related to physical properties of mineral e.g. streak, cleavage,
specific gravity etc.</xs:documentation>
</xs:annotation>
<xs:complexType>
<xs:sequence>
<xs:element name="MineralMeasurementOrFact" type="abcd:MeasurementOrFact" maxOccurs="unbounded">
<xs:annotation>
<xs:documentation>Container for a single physical measurement or fact related to mineral</xs:documentation>
</xs:annotation>
</xs:element>
</xs:sequence>
</xs:complexType>

</xs:element>
<xs:element name="MineralDescriptionText" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>Free text description of mineral unit which may include observations on its form and occurrence, origin
or other associated facts</xs:documentation>
</xs:annotation>
</xs:element>
</xs:sequence>
</xs:complexType>

<xs:complexType name="AllocthonousMaterialType">
<xs:annotation>

```

```

<xs:documentation>Container for descriptive elements related to transported material ranging from glacial erratics to
meteorites</xs:documentation>
</xs:annotation>
<xs:sequence>
<xs:element name="PlaceOfOrigin" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>The place of origin for material that has been transported during its history e.g. glacial erratics and
meteorites</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="ModeOfTransport" type="xs:string">
<xs:annotation>
<xs:documentation>How the material was transported e.g. glacier, turbidity current, meteorite etc.</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="OriginalStratigraphy" minOccurs="0">
<xs:annotation>
<xs:documentation>The original stratigraphic associations of allocthonous material e.g. a Devonian erratic obtained from a
Pleistocene tillite.</xs:documentation>
</xs:annotation>
<xs:complexType>
<xs:sequence>
<xs:element name="StratigraphicComment" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>Free text comments relating to the stratigraphy</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="StratigraphicAttributions" type="efg:StratigraphicAttributionsType"/>
<xs:element name="StratigraphicReferences" minOccurs="0">
<xs:annotation>
<xs:documentation>Container for any documentary references relating to the stratigraphy</xs:documentation>
</xs:annotation>
<xs:complexType>
<xs:sequence>
<xs:element name="StratigraphicReference" type="abcd:Reference" maxOccurs="unbounded">
<xs:annotation>
<xs:documentation>Details of individual documentary references to the stratigraphy </xs:documentation>
</xs:annotation>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
<xs:complexType name="UnitHostRockType">
<xs:annotation>
<xs:documentation>Container relating to the host rock for units primarily described for their palaeontological or
mineralogical interest</xs:documentation>
</xs:annotation>
<xs:sequence>
<xs:element name="LithologyHostRock" type="efg:MineralRockIdentifiedType" minOccurs="0" maxOccurs="unbounded">
<xs:annotation>
<xs:documentation>The type of rock representing the host rock e.g. sandstone, mudstone, limestone etc </xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="LithificationHostRock" minOccurs="0">
<xs:annotation>
<xs:documentation>The degree of lithification of the host rock e.g. unlithified, poorly lithified, lithified
etc.</xs:documentation>
</xs:annotation>
</xs:element>
</xs:sequence>
</xs:complexType>

```



```

<xs:restriction base="xs:string">
  <xs:enumeration value="unlithified"/>
  <xs:enumeration value="poorly lithified"/>
  <xs:enumeration value="lithified"/>
  <xs:enumeration value="metamorphosed"/>
</xs:restriction>
</xs:simpleType>
</xs:element>
<xs:element name="LithologyAttributesHostRock" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>Lithological description of host rock e.g. cross-bedded, finely laminated etc. could use an enumeration
or lookup list</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="HostRockText" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>Free text element for general description of host rock</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="HostRockStratigraphy" type="efg:StratigraphicAttributionsType" minOccurs="0">
<xs:annotation>
<xs:documentation>Container for any stratigraphic determination specific to the host rock. For instance the gathering site
may include a range of stratigraphic horizons whilst the unit host rock may represent just one. The unit itself might be
different if it is allocthonous in origin. Minerals may be of a different age from their host rock.</xs:documentation>
</xs:annotation>
</xs:element>
</xs:sequence>
</xs:complexType>

<xs:complexType name="AlterationType">
<xs:annotation>
<xs:documentation>Container for describing metasomatic, metamorphic or diagenetic changes to units</xs:documentation>
</xs:annotation>
<xs:sequence>
<xs:element name="AlterationType" type="xs:string">
<xs:annotation>
<xs:documentation>Free text describing the type of change that has taken place e.g. chloritisation, migmatization, cataclastic
brecciation etc.</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="AlterationDegree" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>Free text describing the degree of alteration or metamorphic phase that has affected a rock. [This element
may need to be split into hydrothermal mineralogical change and metamorphic phases]</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="ShockMetamorphicGrade" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>Free text for describing the type of alteration caused by impact, as in meteorites. Also called shock
stage.</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="DiageneticChange" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>Free text for describing any physical and chemical changes that took place in a sediment during the
lithification process e.g. compaction, cementation, recrystallisation, dolomitisation and replacement.</xs:documentation>
</xs:annotation>
</xs:element>
</xs:sequence>
</xs:complexType>

<!--Elements extending ABCD Unit/Identifications/Identification/Result-->
<xs:complexType name="MineralRockIdentifiedType">
<xs:annotation>
<xs:documentation>Container for mineral and rock identifications. Equivalent of TaxonIdentified in main schema. This
global should be added as an extension to the abcd identification - result</xs:documentation>
</xs:annotation>

```

```

<xs:sequence>
<xs:element name="MineralRockGroup" minOccurs="0" maxOccurs="unbounded">
<xs:annotation>
<xs:documentation>Equivalent to higher taxon for plants and animals. Container for multiple higher groupings for minerals
(e.g. silicates, inosilicates) and rocks (e.g. sedimentary, clastic, igneous, extrusive etc.) </xs:documentation>
</xs:annotation>
<xs:complexType>
<xs:sequence>
<xs:element name="MineralRockGroupName" type="xs:string">
<xs:annotation>
<xs:documentation>A single instance of a higher 'taxon' for minerals e.g. Silicates or for rocks e.g. Pyroclstic or meteorites
e.g. Carbonaceous Chondrite</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="MineralRockClassification" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>Classification to which the group name belongs e.g. Dana, Strunz etc.</xs:documentation>
</xs:annotation>
</xs:element>
</xs:sequence>
</xs:complexType>

</xs:element>
<xs:element name="ClassifiedName" minOccurs="0">
<xs:annotation>
<xs:documentation>The formal name for the rock or mineral according to a given classification scheme</xs:documentation>
</xs:annotation>
<xs:complexType>
<xs:sequence>
<xs:element name="FullScientificNameString" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>Full formal name string as used in 'Taxon Identified' in main schema</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="MineralRockNameAtomised" minOccurs="0">
<xs:annotation>
<xs:documentation>Container for formal name elements for rocks, minerals and meteorites</xs:documentation>
</xs:annotation>
<xs:complexType>
<xs:sequence>
<xs:element name="ScientificNameString" type="xs:string">
<xs:annotation>
<xs:documentation>Equivalent of Scientific Name but minerals and rocks do not use binomials e.g. Quartz, Fluorite
etc.</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="AuthorTeamAndYear" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>who named the mineral or rock and when</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="MineralRockClassification" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>The classification from which this mineral or rockname has been taken</xs:documentation>
</xs:annotation>
</xs:element>
</xs:sequence>
</xs:complexType>

</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
<xs:element name="InformalNameString" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>Common name or language variant of formal mineral or rock name e.g. Fluor Spar. Includes attribute for
language.</xs:documentation>

```

```

</xs:annotation>
</xs:element>
<xs:element name="VarietalNameString" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>Name given to a variety of the mineral, usually based on its colour or form e.g. Sapphire is a blue form of
Corundum, Moss Agate and Carnelian are varieties of cryptocrystalline Quartz. Marston Marble is a varietal trade name for a
biomicrite from Lower Jurassic. Includes attribute for language.</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="NameAddendum" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>element from TaxonIdentified complex type</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="IdentificationQualifier" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>Element as used in TaxonIdentified</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element ref="efg:Certainty" minOccurs="0"/>
<xs:element name="NameComments" minOccurs="0">
<xs:annotation>
<xs:documentation>Free text relating to the identification of the mineral or rock</xs:documentation>
</xs:annotation>
</xs:element>
</xs:sequence>
</xs:complexType>

<xs:element name="IdentificationAnalysis" type="efg:IdentificationAnalysisType">
<xs:annotation>
<xs:documentation>container for analytical techniques employed for identifying a mineral or rock. Note that this differs from
the existing Measurement element in that it allows for multiple values to be obtained from a single analysis e.g. percentage
values of elements in a mineral.</xs:documentation>
</xs:annotation>
</xs:element>
<!--Elements extending ABCD Gathering-->
<xs:complexType name="SiteStratigraphyType">
<xs:annotation>
<xs:documentation>Container for information relating to stratigraphy and the identification of absolute and relative dates and
correlations. This complex type extends Gathering, covering the location, the geology of the site.</xs:documentation>
</xs:annotation>
<xs:sequence>
<xs:element name="SiteStratigraphicAttributions" type="efg:StratigraphicAttributionsType">
<xs:annotation>
<xs:documentation>Individual stratigraphic determinations related to the Gathering site - not measured
sections.</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="StratigraphyComment" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>Free text for describing the stratigraphic context, correlation or similar notes</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="StratigraphicReferences" minOccurs="0">
<xs:annotation>
<xs:documentation>Container for complex type Reference. There may be more than one reference describing the
stratigraphy.</xs:documentation>
</xs:annotation>
<xs:complexType>
<xs:sequence>
<xs:element name="StratigraphicReference" type="abcd:Reference" maxOccurs="unbounded">
<xs:annotation>
<xs:documentation>Complex type for individual reference pertaining to stratigraphy uses abcd:Reference
type</xs:documentation>
</xs:annotation>
</xs:element>
</xs:sequence>

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</xs:complexType>

</xs:element>
<xs:element name="TectonicSetting" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>Free text description of the relationship of the observed stratigraphy to its tectonic context e.g. sequence
stratigraphy related to basin development and eustatic change, syn-tectonic stratigraphy related to plate movements and
orogenesis.</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="SequenceStratigraphicSetting" minOccurs="0">
<xs:annotation>
<xs:documentation>Keyword for position in sequence stratigraphy setting. Enumerated list.</xs:documentation>
</xs:annotation>
<xs:simpleType>
<xs:restriction base="xs:string">
  <xs:enumeration value="highstand systems tract"/>
  <xs:enumeration value="lowstand systems tract"/>
  <xs:enumeration value="maximum flooding surface"/>
  <xs:enumeration value="parasequence boundary"/>
  <xs:enumeration value="regressive"/>
  <xs:enumeration value="sequence boundary"/>
  <xs:enumeration value="transgressive"/>
  <xs:enumeration value="transgressive surface"/>
  <xs:enumeration value="transgressive systems tract"/>
</xs:restriction>
</xs:simpleType>
</xs:element>
<xs:element name="SiteSections" type="efg:StratigraphicSectionType" minOccurs="0">
<xs:annotation>
<xs:documentation>Measured section or borehole record associated with the gathering site.</xs:documentation>
</xs:annotation>
</xs:element>
</xs:sequence>
</xs:complexType>

<xs:element name="NamedGeologicalFeature" type="xs:string">
<xs:annotation>
<xs:documentation>The name for a geologic feature that is not a placename e.g. 'The Great Whin Sill', 'Bodmin Granite' or
'The Great Glen Fault'. Many landscape scale geologic and geomorphic features have names.</xs:documentation>
</xs:annotation>
</xs:element>
<!--library of reused types, elements, etc.-->
<!--Stratigraphy related types-->
<xs:complexType name="StratigraphicAttributionsType">
<xs:annotation>
<xs:documentation>Container for statements relating to the absolute and relative dating and correlation of geological units
and gathering sites. Equivalent to 'Result' in Taxon Identification schema. Where a range of dates is associated with a unit, use
multiple entries for attribution e.g. if a named unit definitely includes lower raricostatum zone set to certain but may range up
into spinatum zone, use one record for raricostatum zone set to certain and another for spinatum zone set to uncertain. If
necessary include all intermediate horizons at same or higher level terms that encompass range, to ensure proper
indexing.</xs:documentation>
</xs:annotation>
<xs:sequence>
<xs:element name="ChronostratigraphicAttributions" type="efg:ChronostratigraphicAttributionsType" minOccurs="0">
<xs:annotation>
<xs:documentation>Allows for multiple and range declarations of chronostratigraphic terms. This element combines both
chronostratigraphic and geochronologic terms with preference for chronostratigraphic. (Zalasiewicz et al.
2004)</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="LithostratigraphicAttributions" type="efg:LithostratigraphicAttributionsType" minOccurs="0">
<xs:annotation>
<xs:documentation>Allows for multiple identifications of any named lithostratigraphic units (e.g. Penarth Group, Langport
Member, Rhaetic Bone Bed)</xs:documentation>
</xs:annotation>
</xs:element>

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<xs:element name="BiostratigraphicAttributions" type="efg:BiostratigraphicAttributionsType" minOccurs="0">
<xs:annotation>
<xs:documentation>Container for optional multiple references to fossil zones e.g. where a range of zones and subzones might
be represented.</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="MagnetostratigraphicDeterminations" type="efg:MagnetostratigraphicDeterminationsType"
minOccurs="0">
<xs:annotation>
<xs:documentation>Container for details of any magnetostratigraphic evidence cited to support the dating of rocks.
Magnetostratigraphy uses a range of readings over a sequence of rocks to provide a pattern that is correlated with known
dated sequences. It includes its own series of divisions including superchrons, chrons and subchrons.</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="IsotopeStratigraphicDeterminations" type="efg:IsotopeStratigraphicDeterminationsType"
minOccurs="0">
<xs:annotation>
<xs:documentation>Container for detail referring to any isotope concentration study. Isotope stratigraphy uses a range of
readings over a sequence of rocks to create profiles that are correlated with dated sequences.</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="RadiometricDates" type="efg:RadiometricDatesType" minOccurs="0">
<xs:annotation>
<xs:documentation>Container for absolute dates obtained from radiometric analysis.</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="PositionInSequence" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>The position this stratigraphic 'unit' has in the sequence for the site. e.g. a bed
number</xs:documentation>
</xs:annotation>
</xs:element>
</xs:sequence>
</xs:complexType>

<xs:complexType name="ChronostratigraphicAttributionsType">
<xs:annotation>
<xs:documentation>container for one or more identified chronostratigraphic dates</xs:documentation>
</xs:annotation>
<xs:sequence>
<xs:element name="ChronostratigraphicAttribution" maxOccurs="unbounded">
<xs:annotation>
<xs:documentation>A single declaration of an identified chronostratigraphic date</xs:documentation>
</xs:annotation>
<xs:complexType>
<xs:sequence>
<xs:element name="ChronoStratigraphicDivision" type="xs:string">
<xs:annotation>
<xs:documentation>Classification level for the term e.g. eon, system, stage etc.</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="ChronostratigraphicName" type="xs:string">
<xs:annotation>
<xs:documentation>The formal geo/chrono chronologic name e.g. Jurassic, Kimmeridgian etc.</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element ref="efg:DatingQualifier" minOccurs="0"/>
<xs:element ref="efg:Certainty" minOccurs="0"/>
<xs:element name="RangePosition" minOccurs="0">
<xs:annotation>
<xs:documentation>text field to mark if this date is the earliest in a possible range, midway or the latest. May need to be used
if there is a possibility of a range of dates.</xs:documentation>
</xs:annotation>
<xs:simpleType>
<xs:restriction base="xs:string"/>
</xs:simpleType>
</xs:element>

```

```

<xs:element name="Identifiers" type="efg:IdentifiersType" minOccurs="0"/>
<xs:element ref="efg:StratigraphicMeasurementsOrFacts" minOccurs="0"/>
</xs:sequence>
</xs:complexType>

</xs:element>
</xs:sequence>
</xs:complexType>

<xs:complexType name="LithostratigraphicAttributionsType">
<xs:annotation>
<xs:documentation>Container for one or more identifications or attributions of lithostratigraphic units</xs:documentation>
</xs:annotation>
<xs:sequence>
<xs:element name="LithostratigraphicAttribution" maxOccurs="unbounded">
<xs:annotation>
<xs:documentation>An individual identification of a named lithostratigraphic unit e.g. The Hotwells Limestone Group. The
higher lithostratigraphic terms are also allowed to cover the possibility of rock name homonyms and indexing in the absence
of a complete dictionary of rock names.</xs:documentation>
</xs:annotation>
<xs:complexType>
<xs:sequence>
<xs:element name="Supergroup" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>Highest level of lithostratigraphic classification</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="Group" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>Lithostratigraphic unit consisting of two or more formations</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="Formation" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>The primary lithostratigraphic unit characterised by its lithologic features although it may be
diachronous. </xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="Member" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>A sub-division of a formation which may be local in extent or exhibits a distinctive
lithology</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="Bed" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>The smallest division of a named stratified series normally with well defined division from adjacent
deposits.</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="InformalLithostratigraphicName" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>An informal lithostratigraphic name (ie. one not yet characterised as a formation or member or an old
name still in general use e.g. Schaumkalk as part of the Muschelkalk or Keuper Marl as a synonym of the Mercia Mudstone
Group. includes language as an attribute.</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element ref="efg:Certainty" minOccurs="0"/>
<xs:element ref="efg:DatingQualifier" minOccurs="0"/>
<xs:element name="Identifiers" type="efg:IdentifiersType" minOccurs="0"/>
<xs:element ref="efg:StratigraphicMeasurementsOrFacts" minOccurs="0"/>
</xs:sequence>
</xs:complexType>

</xs:element>
</xs:sequence>
</xs:complexType>

```

```

<xs:complexType name="BiostratigraphicAttributionsType">
  <xs:annotation>
    <xs:documentation>Container for one or more attributions or identifications of fossil time zones</xs:documentation>
  </xs:annotation>
  <xs:sequence>
    <xs:element name="BiostratigraphicAttribution" maxOccurs="unbounded">
      <xs:annotation>
        <xs:documentation>A single declaration of a fossil zone or subzone.</xs:documentation>
      </xs:annotation>
      <xs:complexType>
        <xs:sequence>
          <xs:element name="ZonalFossilType" type="xs:string">
            <xs:annotation>
              <xs:documentation>What sort of biozone is being recorded? e.g. what animal or plant group is it based on? (ammonite, brachiopod, coral, plant, foram, nanoplankton etc.)</xs:documentation>
            </xs:annotation>
          </xs:element>
          <xs:element name="FossilZoneName" type="xs:string">
            <xs:annotation>
              <xs:documentation>The actual name of the biozone. Ideally this should be in its expanded form although common usage tends to abbreviate the generic epithet.</xs:documentation>
            </xs:annotation>
          </xs:element>
          <xs:element name="FossilSubzoneName" type="xs:string" minOccurs="0">
            <xs:annotation>
              <xs:documentation>The subzone name, if any, this should ideally be in expanded form rather than abbreviated.</xs:documentation>
            </xs:annotation>
          </xs:element>
          <xs:element ref="efg:Certainty" minOccurs="0"/>
          <xs:element name="RangePosition" type="xs:string" minOccurs="0">
            <xs:annotation>
              <xs:documentation>Range position if this attribution is the earliest, midway or latest in a possible range. e.g. It is not always clear what zone a particular taxon belongs to and therefore a range may be needed.</xs:documentation>
            </xs:annotation>
          </xs:element>
          <xs:element ref="efg:DatingQualifier" minOccurs="0"/>
          <xs:element name="Identifiers" type="efg:IdentifiersType" minOccurs="0" maxOccurs="unbounded"/>
          <xs:element ref="efg:StratigraphicMeasurementsOrFacts" minOccurs="0"/>
        </xs:sequence>
      </xs:complexType>
    </xs:element>
  </xs:sequence>
</xs:complexType>

<xs:complexType name="MagnetostratigraphicDeterminationsType">
  <xs:annotation>
    <xs:documentation>Container for one or more magnetostratigraphic determinations</xs:documentation>
  </xs:annotation>
  <xs:sequence>
    <xs:element name="MagnetostratigraphicDetermination" maxOccurs="unbounded">
      <xs:annotation>
        <xs:documentation>Single record of magnetostratigraphic dating</xs:documentation>
      </xs:annotation>
      <xs:complexType>
        <xs:sequence>
          <xs:element name="PolaritySuperchron" type="xs:string" minOccurs="0">
            <xs:annotation>
              <xs:documentation>largest division of magnetostratigraphic terms</xs:documentation>
            </xs:annotation>
          </xs:element>
          <xs:element name="PolarityChron" type="xs:string" minOccurs="0">
            <xs:annotation>
              <xs:documentation>Reference to numerical scheme for labelling time divisions based on magnetic anomalies and reversals</xs:documentation>
            </xs:annotation>
          </xs:element>
        </xs:sequence>
      </xs:complexType>
    </xs:element>
  </xs:sequence>
</xs:complexType>

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</xs:annotation>
</xs:element>
<xs:element name="PolaritySubchron" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>Any named subdivision of a Polarity Chron</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="MagnetostratigraphicDetail" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>Free text describing the use of magnetostratigraphic correlation. </xs:documentation>
</xs:annotation>
</xs:element>
<xs:element ref="efg:AnalysisDateTIme" minOccurs="0"/>
<xs:element ref="efg:Certainty" minOccurs="0"/>
<xs:element ref="efg:DatingQualifier" minOccurs="0"/>
<xs:element name="Identifiers" type="efg:IdentifiersType" minOccurs="0"/>
<xs:element ref="efg:AnalysisReferences" minOccurs="0" maxOccurs="unbounded"/>
</xs:sequence>
</xs:complexType>

</xs:element>
</xs:sequence>
</xs:complexType>

<xs:complexType name="IsotopeStratigraphicDeterminationsType">
<xs:annotation>
<xs:documentation>Container for one or more isotope stratigraphic determinations</xs:documentation>
</xs:annotation>
<xs:sequence>
<xs:element name="IsotopeStratigraphicDetermination" maxOccurs="unbounded">
<xs:annotation>
<xs:documentation>Single record of an isotope stratigraphic determination</xs:documentation>
</xs:annotation>
<xs:complexType>
<xs:sequence>
<xs:element name="IsotopesMeasured" type="xs:string">
<xs:annotation>
<xs:documentation>What isotopes were used for this correlation e.g. Oxygen, Strontium, Carbon or more specific
(O18/O16)</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="IsotopeStratigraphicDetail" type="xs:string">
<xs:annotation>
<xs:documentation>Free text describing the isotope correlation result.</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element ref="efg:AnalysisDateTIme" minOccurs="0"/>
<xs:element ref="efg:Certainty" minOccurs="0"/>
<xs:element ref="efg:DatingQualifier" minOccurs="0"/>
<xs:element name="Identifiers" type="efg:IdentifiersType" minOccurs="0"/>
<xs:element ref="efg:AnalysisReferences" minOccurs="0"/>
</xs:sequence>
</xs:complexType>

</xs:element>
</xs:sequence>
</xs:complexType>

<xs:complexType name="RadiometricDatesType">
<xs:annotation>
<xs:documentation>Container for one or more radiometric date determinations</xs:documentation>
</xs:annotation>
<xs:sequence>
<xs:element name="RadiometricDate" maxOccurs="unbounded">
<xs:annotation>
<xs:documentation>Container for a single radiometric date analysis</xs:documentation>
</xs:annotation>

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<xs:complexType>
<xs:sequence>
<xs:element name="RadiometricDatingMethod" type="xs:string">
<xs:annotation>
<xs:documentation>Method, analysis technique used to determine date e.g. radiocarbon, Potassium-Argon
etc.</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="MaterialDated" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>What was actually dated? e.g. Glauconite grains in a sandstone, wood from peat-core
etc.</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="EarliestDate" type="xs:string">
<xs:annotation>
<xs:documentation>The earliest date in a date range suggested by the analysis or the single date if only one is
given</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="LatestDate" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>The latest date where a range of values is given</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="TimeUnit" type="xs:string">
<xs:annotation>
<xs:documentation>The time units being measured or how the numbers are expressed e.g. millions of years B.P. or thousands
of years B.C.</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="DatingAccuracy" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>The degree of certainty or likely accuracy of the dating analysis e.g. +/- 1 m.y.</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="DatingComment" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>Free text description of the analysis or its result.</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element ref="efg:AnalysisDateTIme" minOccurs="0"/>
<xs:element name="Identifiers" type="efg:IdentifiersType" minOccurs="0"/>
<xs:element ref="efg:AnalysisReferences" minOccurs="0"/>
</xs:sequence>
</xs:complexType>

</xs:element>
</xs:sequence>
</xs:complexType>

<xs:element name="DatingQualifier" type="xs:string">
<xs:annotation>
<xs:documentation>Allows for qualification of date terms e.g. early/lower, middle, late/upper</xs:documentation>
</xs:annotation>
</xs:element>
<xs:complexType name="StratigraphicSectionType">
<xs:annotation>
<xs:documentation>Container for layer by layer description of stratigraphic sections, boreholes and
wells.</xs:documentation>
</xs:annotation>
<xs:sequence>
<xs:element name="SectionName" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>The name for the section e.g. Vallis Vale, Hapsford Bridge Section or it could be a borehole unique
name. This may be different from the locality name.</xs:documentation>
</xs:annotation>

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</xs:element>
<xs:element name="SectionIDNumber" type="xs:string" minOccurs="0">
  <xs:annotation>
    <xs:documentation>Unique identifying code or number for this section, borehole or well</xs:documentation>
  </xs:annotation>
</xs:element>
<xs:element name="TotalLengthOfSection" type="xs:string" minOccurs="0">
  <xs:annotation>
    <xs:documentation>The length of the named section in meters</xs:documentation>
  </xs:annotation>
</xs:element>
<xs:element name="TotalThicknessMeasured" type="xs:string" minOccurs="0">
  <xs:annotation>
    <xs:documentation>The total thickness of strata or rock exposed in the section or borehole</xs:documentation>
  </xs:annotation>
</xs:element>
<xs:element name="SectionLog">
  <xs:annotation>
    <xs:documentation>Container for the layer by layer description of the section, borehole or well. The layers or subdivisions are referred as SectionUnits - these represent layers, strata, beds, ore bodies, intrusive bodies etc. that might be recorded in a section or borehole. A SectionUnit or layer is also regarded as that which is recorded as a coherent sub-unit of the whole section or borehole. It may therefore be a single bed, a series of beds with similar characteristics or an unlayered body such as an igneous intrusion.</xs:documentation>
  </xs:annotation>
  <xs:complexType>
    <xs:sequence>
      <xs:element name="SectionUnitNumber" type="xs:string" minOccurs="0">
        <xs:annotation>
          <xs:documentation>Either a numerical identifier used for sorting the sequence or a UnitFieldNumber. A sectionunit could be a bed, a layer, an intrusive body or anything else encountered in a section or borehole.</xs:documentation>
        </xs:annotation>
      </xs:element>
      <xs:element name="NumberOfSubUnits" type="xs:string" minOccurs="0">
        <xs:annotation>
          <xs:documentation>Where the described sectionunit or 'layer' is represented by more than one similar unit e.g. a sequence of thin limestone beds with shale intercalations recorded as a single unit (layer) </xs:documentation>
        </xs:annotation>
      </xs:element>
      <xs:element name="SectionUnitDescriptiveText" type="xs:string" minOccurs="0">
        <xs:annotation>
          <xs:documentation>Free text description of the layer, stratum or rock body </xs:documentation>
        </xs:annotation>
      </xs:element>
      <xs:element name="DipDegrees" type="xs:string" minOccurs="0">
        <xs:annotation>
          <xs:documentation>The dip in degrees of laminae or stratal surfaces in this layer</xs:documentation>
        </xs:annotation>
      </xs:element>
      <xs:element name="Strike" type="xs:string" minOccurs="0">
        <xs:annotation>
          <xs:documentation>Direction of strike measured on stratal surface</xs:documentation>
        </xs:annotation>
      </xs:element>
      <xs:element name="MeasureFromBaseline" minOccurs="0">
        <xs:annotation>
          <xs:documentation>Container for recording either the distance (in metres) from a fixed baseline e.g. top of a borehole or bottom of a measured section</xs:documentation>
        </xs:annotation>
        <xs:complexType>
          <xs:sequence>
            <xs:element name="SectionUnitDatum" type="xs:string">
              <xs:annotation>
                <xs:documentation>Text for where the measurement is taken e.g. top of bed or bottom of bed.</xs:documentation>
              </xs:annotation>
            </xs:element>
            <xs:element name="BaselineDatum" type="xs:string">
              <xs:annotation>
            </xs:annotation>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
    </xs:sequence>
  </xs:complexType>

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<xs:documentation>Text - what is the baseline e.g. top of borehole or base of measured section</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="DistanceFromBaseline" type="xs:float">
<xs:annotation>
<xs:documentation>Number representing distance measured</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="MeasurementUnit" type="xs:string">
<xs:annotation>
<xs:documentation>Units that DistanceFromBaseline are measured in e.g. metres</xs:documentation>
</xs:annotation>
</xs:element>
</xs:sequence>
</xs:complexType>

</xs:element>
<xs:element name="RockUnit" type="efg:RockUnitType" minOccurs="0">
<xs:annotation>
<xs:documentation>Container element for attributes restricted to rocks</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="TopSurface" minOccurs="0">
<xs:annotation>
<xs:documentation>Container for details of top surface of a layer or stratum and it relationship with overlying
layers</xs:documentation>
</xs:annotation>
<xs:complexType>
<xs:sequence>
<xs:element name="TopSurfaceFeature" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>Text description of features e.g. top surface is a hardground or rockground</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="RelationshipToOverlyingLayer" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>Free text to record any observed relationship with overlying layer e.g. groove casts infilled by overlying
sediment.</xs:documentation>
</xs:annotation>
</xs:element>
</xs:sequence>
</xs:complexType>

</xs:element>
<xs:element name="BottomSurface" minOccurs="0">
<xs:annotation>
<xs:documentation>Container for details of bottom surface of layer or stratum</xs:documentation>
</xs:annotation>
<xs:complexType>
<xs:sequence>
<xs:element name="BottomSurfaceFeature" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>Text describing features at the base of a layer or stratum</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="RelationshipToUnderlyingLayer" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>Free text to describe relationship to underlying strata/layer e.g. unconformable and cross cuts strata or
base of bed includes clasts of underlying sediment</xs:documentation>
</xs:annotation>
</xs:element>
</xs:sequence>
</xs:complexType>

</xs:element>
<xs:element name="SectionUnitStratigraphy" type="efg:StratigraphicAttributionsType" minOccurs="0"/>
<xs:element name="SectionUnitSamples" minOccurs="0"/>

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```

<xs:annotation>
<xs:documentation>Container for samples taken from this layer. This should just list ABCD unit GUIDs to detailed
unit/sample records but could be extended to use global types to create a standalone schema</xs:documentation>
</xs:annotation>
<xs:complexType>
<xs:sequence>
<xs:element name="SectionUnitSample" maxOccurs="unbounded">
<xs:annotation>
<xs:documentation>Container for a single sample taken from this layer</xs:documentation>
</xs:annotation>
<xs:complexType>
<xs:sequence>
<xs:element name="SampleGUID" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>A unique identifier for another Unit Record in ABCD</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="SampleRef" minOccurs="0">
<xs:annotation>
<xs:documentation>Identifier for this sample e.g. field log sample number, registration number or
similar</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="SampleType">
<xs:annotation>
<xs:documentation>What sort of sample this is. Could be an enumerated list</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="SampleText" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>Short description of sample - longer descriptions should be treated under separate unit
records.</xs:documentation>
</xs:annotation>
</xs:element>
</xs:sequence>
</xs:complexType>

</xs:element>
</xs:sequence>
</xs:complexType>

</xs:element>
<xs:element name="SectionUnitImages" minOccurs="0">
<xs:annotation>
<xs:documentation>Container for images related to this bed, layer or body within the measured section or
borehole.</xs:documentation>
</xs:annotation>
<xs:complexType>

<xs:sequence>
<xs:element name="SectionUnitImage" type="abcd:MultimediaObject">
<xs:annotation>
<xs:documentation>Placeholder for multimedia complex type from main ABCD schema</xs:documentation>
</xs:annotation>
</xs:element>
</xs:sequence>
</xs:complexType>

</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
<xs:element name="Borehole" minOccurs="0">
<xs:annotation>
<xs:documentation>Container for details specific to boreholes and wells. Does not contain spatial reference as this and details
of platform etc. are under Gathering in main ABCD schema - but they could be copied to make an independent
schema.</xs:documentation>

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```

</xs:annotation>
<xs:complexType>
<xs:sequence>
<xs:element name="DrillMethod" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>How the borehole or well was drilled e.g. reverse circulation drilling, diamond coring, percussion
drilling, auger drilling, rotary/barber drilling etc.</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="TypeOfBit" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>What type bit was used in the drilling / cutting process - can include diameter and type
code</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="HoleDiameter" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>Diameter of the borehole in millimetres</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="HoleDirection" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>Direction and inclination of the borehole or well</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="TotalDepth" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>The total depth in metres that was bored or dug</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="OverburdenThickness" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>Thickness in metres of non-logged over-burden before solid or logged material was
reached.</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="Contractor" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>The drilling contractor who carried out the work</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="NumberOfCoreBoxes" type="xs:integer" minOccurs="0">
<xs:annotation>
<xs:documentation>How many core boxes were collected from the borehole or well - integer</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="TotalCoreRecovery" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>What percentage of the drilled material was recovered?</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="CommissionedBy" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>Company or organisation who commissioned the borehole or well</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="Geologists" type="efg:IdentifiersType" minOccurs="0">
<xs:annotation>
<xs:documentation>The geologist(s) and or organisation responsible for logging the borehole and or maintaining the borehole
record.</xs:documentation>
</xs:annotation>
</xs:element>
</xs:sequence>
</xs:complexType>

</xs:element>
<xs:element name="StratigraphicSectionImages" minOccurs="0">

```

```

<xs:annotation>
<xs:documentation>Container for images of the stratigraphic section or borehole and related media.</xs:documentation>
</xs:annotation>
<xs:complexType>
<xs:sequence>
<xs:element name="StratigraphicSectionImage" type="abcd:MultimediaObject" maxOccurs="unbounded">
<xs:annotation>
<xs:documentation>This is a placeholder for MultiMedia complex type from the main ABCD schema</xs:documentation>
</xs:annotation>
</xs:element>
</xs:sequence>
</xs:complexType>

</xs:element>
</xs:sequence>
</xs:complexType>

<xs:element name="StratigraphicMeasurementsOrFacts">
<xs:annotation>
<xs:documentation>Container element for multiple measurements (e.g. thickness, dip etc.) or facts (e.g. this bed was first
identified by Charles Moore as the Reptile and Fish Bed from which he obtained Nothosaurus). This element contains the
standard schema complex type MeasurementOrFact.</xs:documentation>
</xs:annotation>
<xs:complexType>
<xs:sequence>
<xs:element name="StratigraphicMeasurementOrFact" type="abcd:MeasurementOrFact" maxOccurs="unbounded">
<xs:annotation>
<xs:documentation>Container for single instance of complex type MeasurementOrFact</xs:documentation>
</xs:annotation>
</xs:element>
</xs:sequence>
</xs:complexType>

</xs:element>
<!--Identification related types-->
<xs:complexType name="IdentifiersType">
<xs:annotation>
<xs:documentation>Container for names of persons and organisations involved in the identification of rocks and
minerals</xs:documentation>
</xs:annotation>
<xs:sequence>
<xs:element name="Person" type="abcd:PersonName" minOccurs="0" maxOccurs="unbounded">
<xs:annotation>
<xs:documentation>Person type from the abcd schema</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="Organisation" type="abcd:Organisation" minOccurs="0" maxOccurs="unbounded">
<xs:annotation>
<xs:documentation>Organisation type from the abcd schema</xs:documentation>
</xs:annotation>
</xs:element>
</xs:sequence>
</xs:complexType>

<xs:complexType name="IdentificationAnalysisType">
<xs:annotation>
<xs:documentation>Container for one or more analysis events linked to identification of unit</xs:documentation>
</xs:annotation>
<xs:sequence>
<xs:element name="IdentificationAnalysisAtomised" type="efg:AnalysisAtomisedType" minOccurs="0"
maxOccurs="unbounded"/>
</xs:sequence>
</xs:complexType>

<xs:complexType name="AnalysisAtomisedType">
<xs:annotation>

```

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<xs:documentation>Container for elements describing an analysis such as a chemical analysis of a
mineral</xs:documentation>
</xs:annotation>
<xs:sequence>
<xs:element name="AnalysisMethod" type="xs:string">
<xs:annotation>
<xs:documentation>Analytical method used e.g. x-ray diffraction, electron probe, chemical analysis or thin
section.</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element ref="efg:AnalysisDateTime" minOccurs="0"/>
<xs:element name="AnalysisBy" type="efg:IdentifiersType" minOccurs="0">
<xs:annotation>
<xs:documentation>Persons or organisations carrying out the analysis </xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="AnalysisText" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>Free text to describe the analysis. This may be of value, for instance, if the mineral has been confirmed
by x-ray diffraction but no actual analysis data are given in the analytical results.</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element ref="efg:AnalysisReferences" minOccurs="0"/>
<xs:element name="AnalysisResults">
<xs:annotation>
<xs:documentation>Container for multiple values obtained by analysis e.g. percentages of different elements
present</xs:documentation>
</xs:annotation>
<xs:complexType>
<xs:sequence>
<xs:element name="AnalysisResult" maxOccurs="unbounded">
<xs:annotation>
<xs:documentation>Individual measurement made during an analysis e.g. the chemical composition of a
mineral</xs:documentation>
</xs:annotation>
<xs:complexType>
<xs:sequence>
<xs:element name="Parameter" type="xs:string">
<xs:annotation>
<xs:documentation>What the given value refers to e.g. amount of an individual element present in a crystalline structure or it
could be chemical formula</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="AppliesTo" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>Used to qualify the measurement parameter</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="UnitOfMeasurement" type="xs:string">
<xs:annotation>
<xs:documentation>The scale used for measurements in the analysis e.g. % for amounts or RI for refractive
index.</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="LowerValue" type="xs:string">
<xs:annotation>
<xs:documentation>Lower value of a range or single value. This can be expressed as a measured value e.g. 45% or as a
chemical formula e.g. NaCl</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="UpperValue" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>Higher value or upper limit of range of values</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="Accuracy" type="xs:string" minOccurs="0">
<xs:annotation>

```

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<xs:documentation>experimental degree of error e.g. +/- 5%</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="AnalysisResultComment" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>Free text comment relating to the analysis results</xs:documentation>
</xs:annotation>
</xs:element>
</xs:sequence>
</xs:complexType>

</xs:element>
</xs:sequence>
</xs:complexType>

</xs:element>
</xs:sequence>
</xs:complexType>

<xs:element name="AnalysisDateTime">
<xs:annotation>
<xs:documentation>When the analysis was carried out</xs:documentation>
</xs:annotation>
<xs:complexType>
<xs:sequence>
<xs:element name="ExactDate" type="abcd:DateTime" minOccurs="0">
<xs:annotation>
<xs:documentation>Uses DateTime element from ABCD</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="DateText" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>Free text to allow for vague dates or description of analysis period.</xs:documentation>
</xs:annotation>
</xs:element>
</xs:sequence>
</xs:complexType>

</xs:element>
<xs:element name="AnalysisReferences">
<xs:annotation>
<xs:documentation>Container for 1 or more references related to the analysis</xs:documentation>
</xs:annotation>
<xs:complexType>
<xs:sequence>
<xs:element name="AnalysisReference" type="abcd:Reference" maxOccurs="unbounded">
<xs:annotation>
<xs:documentation>Individual documentary reference linked to an analysis. Uses abcd:Reference Type</xs:documentation>
</xs:annotation>
</xs:element>
</xs:sequence>
</xs:complexType>

</xs:element>
<!--Other types -->
<xs:complexType name="AssociatedFossilAssemblageType">
<xs:annotation>
<xs:documentation>Container for list of fossils that form an assemblage. Detailed accounts of any individual taxon should be
dealt with under different units.</xs:documentation>
</xs:annotation>
<xs:sequence>
<xs:element name="AssociatedFossilList" minOccurs="0" maxOccurs="unbounded">
<xs:annotation>
<xs:documentation>Container for one or more fossil taxa (including ichnotaxa) that constitute the fossil assemblage
associated with the unit being described. Note that highly detailed information on identification or description of the taxa in
the assemblage should be treated as separate but related units.</xs:documentation>
</xs:annotation>

```



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<xs:complexType>
<xs:sequence>
<xs:element name="AssociatedFossilName" type="xs:string">
<xs:annotation>
<xs:documentation>A single taxon name at any level e.g. trilobite or Dalmanites myops</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="AssociatedFossilComment" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>Free text for describing occurrence of this particular taxon or any of its features.</xs:documentation>
</xs:annotation>
</xs:element>
</xs:sequence>
</xs:complexType>

</xs:element>
<xs:element name="AssociatedFossilAssemblageText" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>Free text for describing the occurrence, form or other features associated with this fossil assemblage e.g.
fore-reef community, condensed reworked assemblage, serpulid bioherm with high concentration of gastropods
etc.</xs:documentation>
</xs:annotation>
</xs:element>
</xs:sequence>
</xs:complexType>

<xs:complexType name="AssociatedMineralAssemblageType">
<xs:annotation>
<xs:documentation>Reusable type for listing minerals associated with a unit or layer</xs:documentation>
</xs:annotation>
<xs:sequence>
<xs:element name="AssociatedMineralList" maxOccurs="unbounded">
<xs:complexType>
<xs:sequence>
<xs:element name="AssociatedMineralName" type="xs:string">
<xs:annotation>
<xs:documentation>A single mineral name at any level of accuracy e.g. feldspar, pyroxene etc. or orthoclase, olivine,
hornblende etc.</xs:documentation>
</xs:annotation>
</xs:element>
<xs:element name="AssociatedMineralComment" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>Free text for describing the occurrence of this particular mineral or any of its
features.</xs:documentation>
</xs:annotation>
</xs:element>
</xs:sequence>
</xs:complexType>

</xs:element>
<xs:element name="AssociatedMineralAssemblageText" type="xs:string" minOccurs="0">
<xs:annotation>
<xs:documentation>Free text for describing the features or characteristics of the overall mineral assemblage e.g. typical North
Yorkshire primary copper-rich sulphide assemblage with complex secondary alteration products</xs:documentation>
</xs:annotation>
</xs:element>
</xs:sequence>
</xs:complexType>
<xs:element name="Certainty" type="xs:string">
<xs:annotation>
<xs:documentation>Degree of certainty associated with the date determination e.g. unknown, certain, uncertain, possibly,
known wrong.</xs:documentation>
</xs:annotation>
</xs:element>
</xs:schema>

```