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The GeoSciML Logical Model

GeoSciML Interoperability Working Group

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Background

It is becoming increasingly important to query and exchange geological information between geological data providers for legal, social, environmental and geoscientific reasons. Coincidentally, technological opportunities arising from the evolution of geospatial and geological information standards are making interoperability a viable endeavor.

In recognition of these trends the GeoSciML Interoperability Working Group was formed, which aims to develop relevant and timely standards and test them within the context of individual agency activities. The ultimate objective of the working group is to enable seamless web integration of select information hosted at different agencies in varied formats.

More specific objectives are

- to develop a conceptual model of geoscientific information drawing on existing data models
- to implement an agreed subset of this model in an agreed schema language
- implement an XML/GML encoding of the model subset
- develop a testbed to illustrate the potential of the data model for interchange
- identify areas that require standardised classifications in order to enable interchange

Materials developed by the Interoperability Working Group, including the GeoSciML UML schema, XML/GML schema, conformance criteria, instance documents and documentation, will be made available from the CGI website (http://www.cgi-iugs.org/)

GeoSciML development work is mainly carried out on a Twiki site (https://www.seegrid.csiro.au/twiki/bin/view/CGIModel/WebHome) where detailed information about all aspects of the work can be found. We welcome participation in these discussions from all those interested in the development of geoscience interchange standards. A password is required for such participation and you can apply for one by mailing jll@bgs.ac.uk giving your accreditation and outlining your interest and involvement in geoscience interoperability.

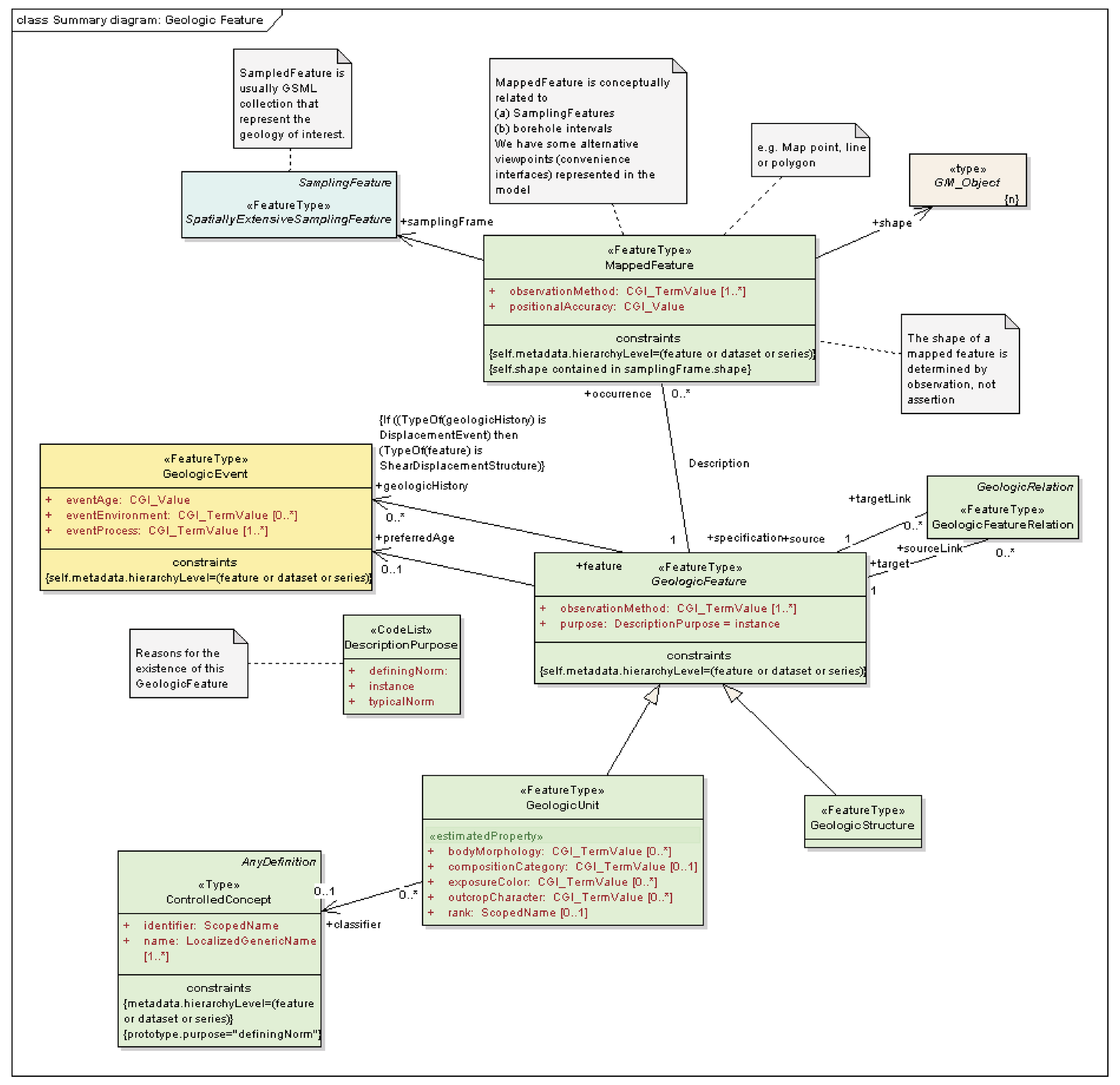
Occasional face to face meetings are also held. These are by invitation to those who have been active in the relevant Twiki discussions and are designed to provide a concentrated period of development and decision making.

This poster describes the GeoSciML logical model produced by the Design Task Group.

An Example of GeoSciML


```
<?xml version="1.0" encoding="UTF-8" ?>
- <GSML gml:id="GA_Contacts_Collection_000001" xmlns="urn:cgi:xmlns:CGI:GeoSciML:2.0"
   xmlns:gml="http://www.opengis.net/gml" xmlns:gsml="urn:cgi:xmlns:CGI:GeoSciML:2.0"
   xmlns:mo="urn:cgi:xmlns:GGIC:MineralOccurrence:1.0" xmlns:om="http://www.opengis.net/om/1.0.0"
   xmlns:xlink="http://www.w3.org/1999/xlink" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
   xmlns:cgu="urn:cgi:xmlns:CGI:Utilities:1.0" xsi:schemaLocation="urn:cgi:xmlns:CGI:GeoSciML:2.0
   https://www.seegrid.csiro.au/subversion/GeoSciML/trunk/schema/GeoSciML/geosciml.xsd">
 - <!--
   0..* gml:metadataProperty elements. Best Practice: use gsml:metadata to href ISO19115 metadata
   -->
       - <!--
           <gml:metaDataProperty>
               <contact xmlns="http://www.opengis.net/sensorML/1.0.1">
               <ResponsibleParty>
               <organizationName>Geoscience Australia</organizationName>
               </ResponsibleParty>
               </contact>
               </gml:metaDataProperty>
   -->
 - <!--
  one gml:description may be used to describe this collection
   -->
 <gml:description>Geological unit contacts - Surface Geology of Eastern Australia - 1:1 million scale</gml:description>
 - <!--
  0..* gml Name elements to identify the collection
   -->
 - <!--
  <gml:name></gml:name>
   -->
 - <!--
  wfs:featureCollection [gsml:gsml] includs 0..* gml:featureMember [gsml:member] elements. wfs also allows
   grouping of features in a gml:featureMembers element following any featureMember elements. This is designed
   to represent an array of features. Best Practice: include GeoSciML features as featureMember elements.
   -->
- <member>
- <MappedFeature gml:id="GA_UFI_24680">
 - <!--
  Use UFI from GIS dataset
   -->
 <gml:description>Mapped location of geological unit contact</gml:description>
 - <!--
  Constant for this dataset
   -->
 <gml:name>GA_UFI_24680</gml:name>
 - <!--
  Use UFI from GIS dataset
   -->
- <observationMethod>
- <CGI_TermValue>
 <value codeSpace="urn:cgi:classifierScheme:GA:1MillionGeology_ObservationMethod">Geological Survey of New South
   Wales, Statewide geodatabase, 1:250,000 scale or better, 2003. Simplified, edge matched and modified for
   representation at 1:1 million scale</value>
   </CGI_TermValue>
   </observationMethod>
- <positionalAccuracy>
- <CGI_NumericValue>
 <principalValue uom="urn:ogc:def:uom:UCUM:m">500</principalValue>
   </CGI_NumericValue>
   </positionalAccuracy>
- <shape>
- <gml:LineString srsName="http://www.opengis.net/gml/srs/epsg.xml#4326">
 <gml:coordinates decimal="." cs="," ts="">141.94618067,-36.59701912 141.94828905,-36.60132373 141.94951633,-
   36.60617081 141.94651695,-36.59688031 141.94622325,-36.59700336</gml:coordinates>
   </gml:LineString>
   </shape>
- <specification>
- <Contact>
 <gml:description>Geological boundary</gml:description>
 - <!--
  Use DESCRIPT from GIS dataset
   -->
 <gml:name>1000100</gml:name>
 - <!--
  Use FEAT_CODE from GIS dataset
   -->
- <observationMethod>
- <CGI_TermValue>
 <value codeSpace="urn:cgi:classifierScheme:GA:ObservationMethod">field mapping</value>
 - <!--
  Constant value
   -->
   </CGI_TermValue>
   </observationMethod>
```


Mapped Feature



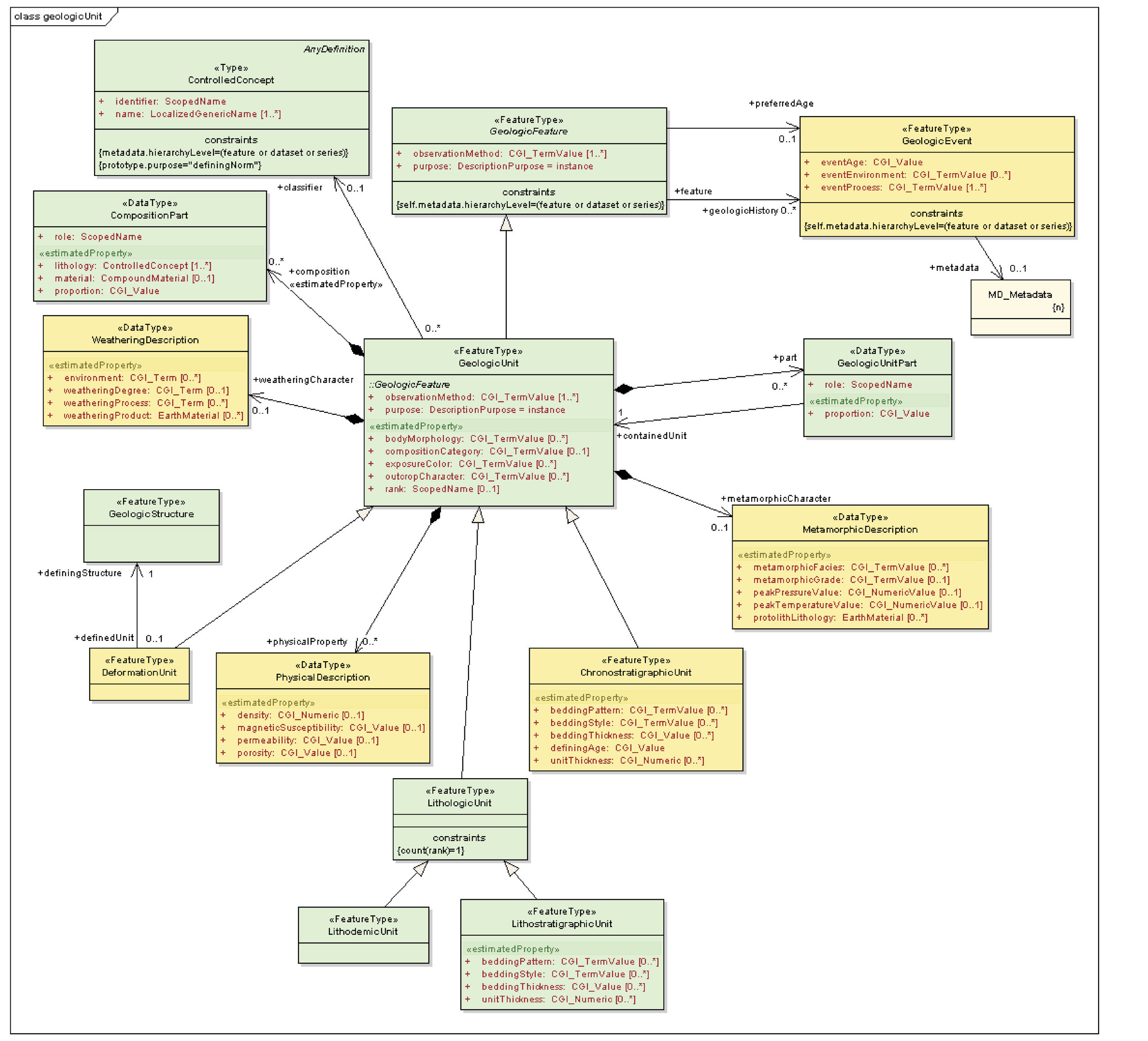
A MappedFeature can be considered an occurrence, such as a polygon on a geologic map, of a real-world geologic feature the full extent of which is unknown

It is independent of geometry, so the same GeologicFeature can have different MappedFeature instances representing mapped polygons at different scales or a modelled volume, for example

Each MappedFeature is associated with a SamplingFrame that indicates the spatial reference frame within which the MappedFeatures have been observed, such as a surface of mapping or a borehole

A GeologicFeature can be either a GeologicUnit or GeologicStructure

Geologic Unit



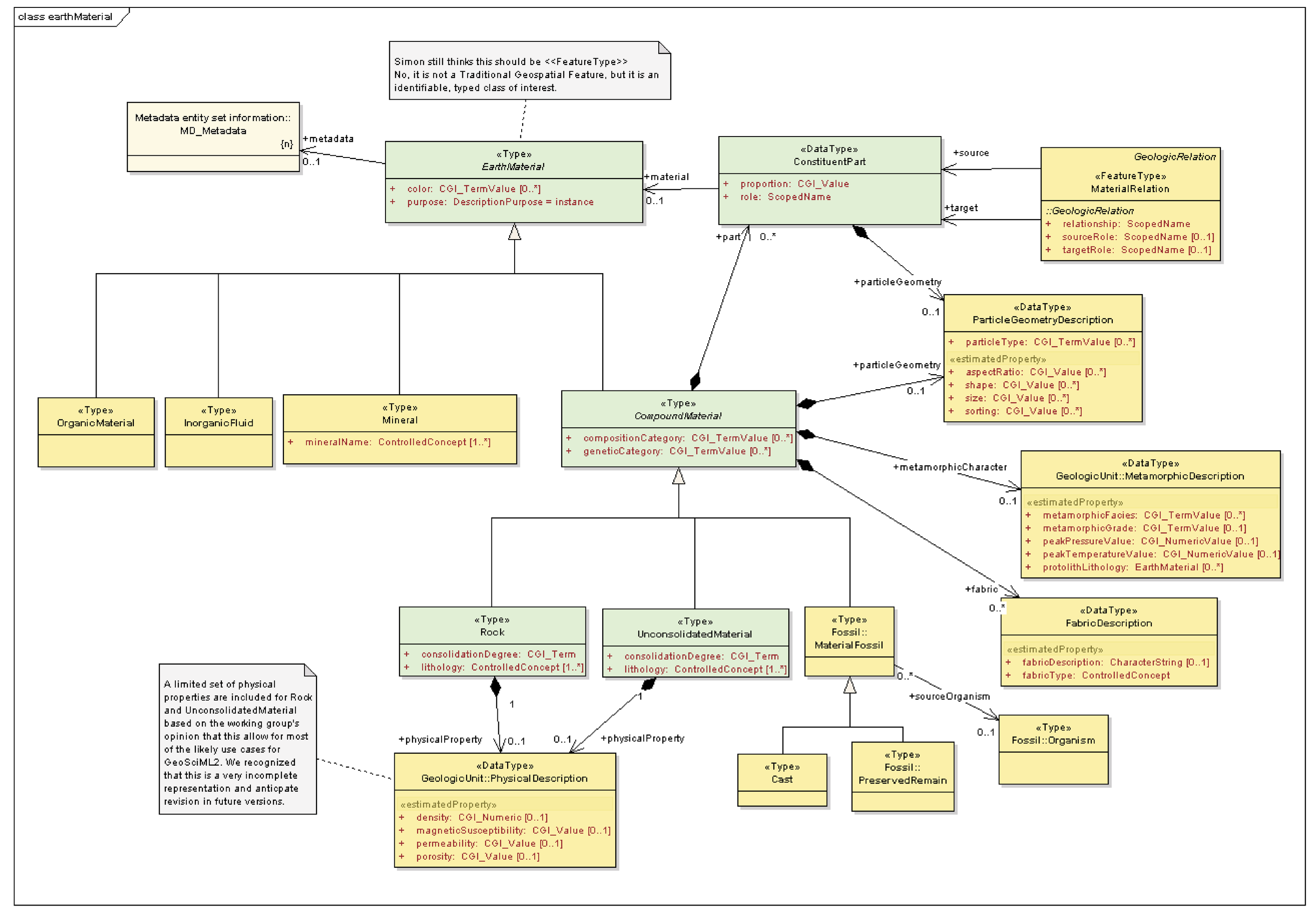
The two main types of geologic feature modelled are geologic units and geologic structures. Geologic units have specialisations for lithostratigraphic units, lithodemic units, chronostratigraphic units and deformation units, but more will be added in the future as required.

A GeologicUnit is associated with a GeologicEvent to record a preferredAge and/or a full geologicHistory as a series of events

A GeologicUnit can be classified with a ControlledConcept. The ControlledConcept can be a normative description of a GeologicUnit, defined in a Stratigraphic Lexicon for example

The model allows for composite geologic units, made up of other geologic units, to be described.

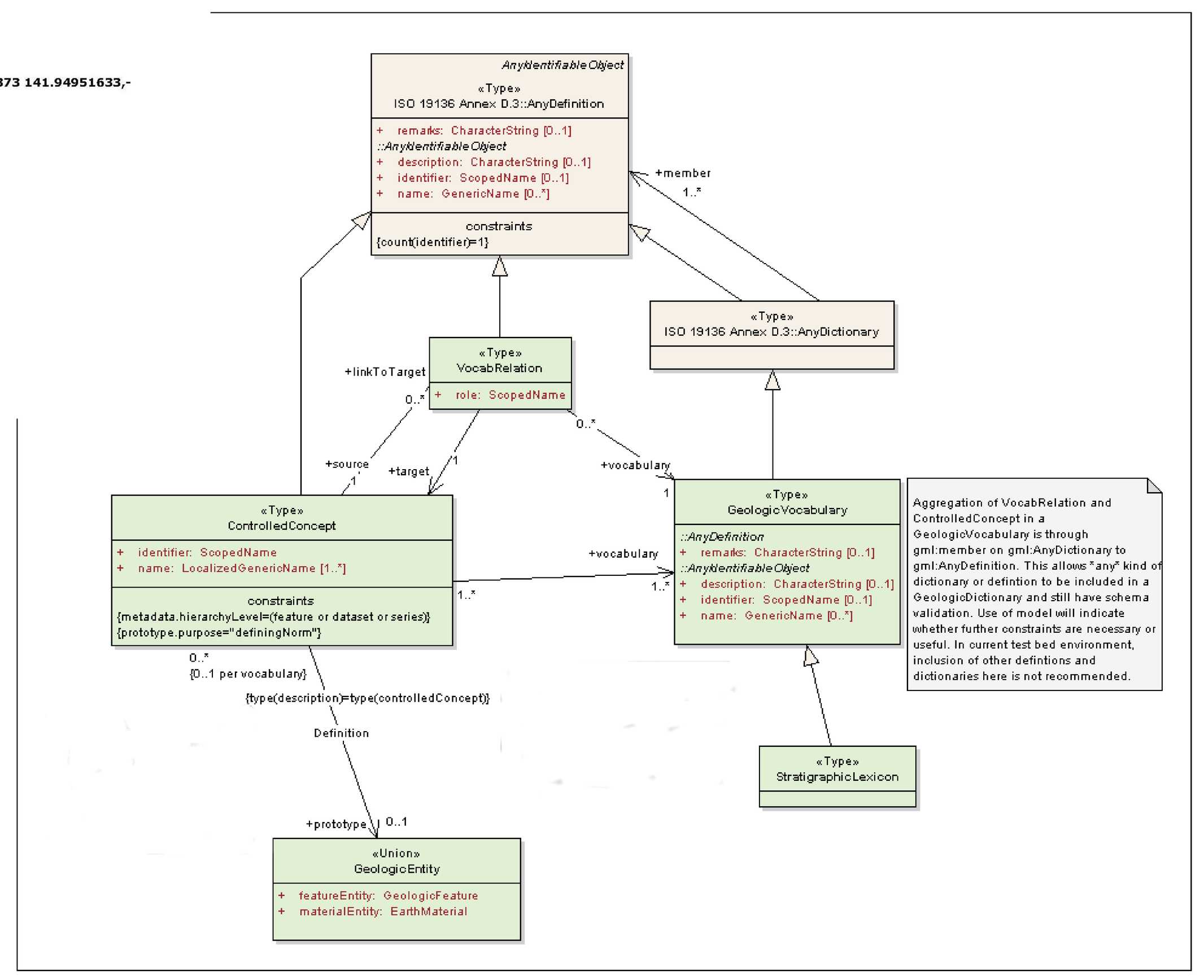
Earth Material



The EarthMaterial package allows for the description of both individual components, such as minerals, and compound materials such as rocks or unconsolidated material. This enables both the description of an individual rock type in terms of its mineral composition and also the description of composite rock types in terms of the constituent rock types (eg interlaminated sandstone and siltstone). The model allows the relationship between the component and the whole to be described (eg interlaminated, inclusion etc)

The model allows some PhysicalDescriptions to be made eg porosity and magneticSusceptibility. More such descriptions could be added in future depending on requirements

Vocabulary



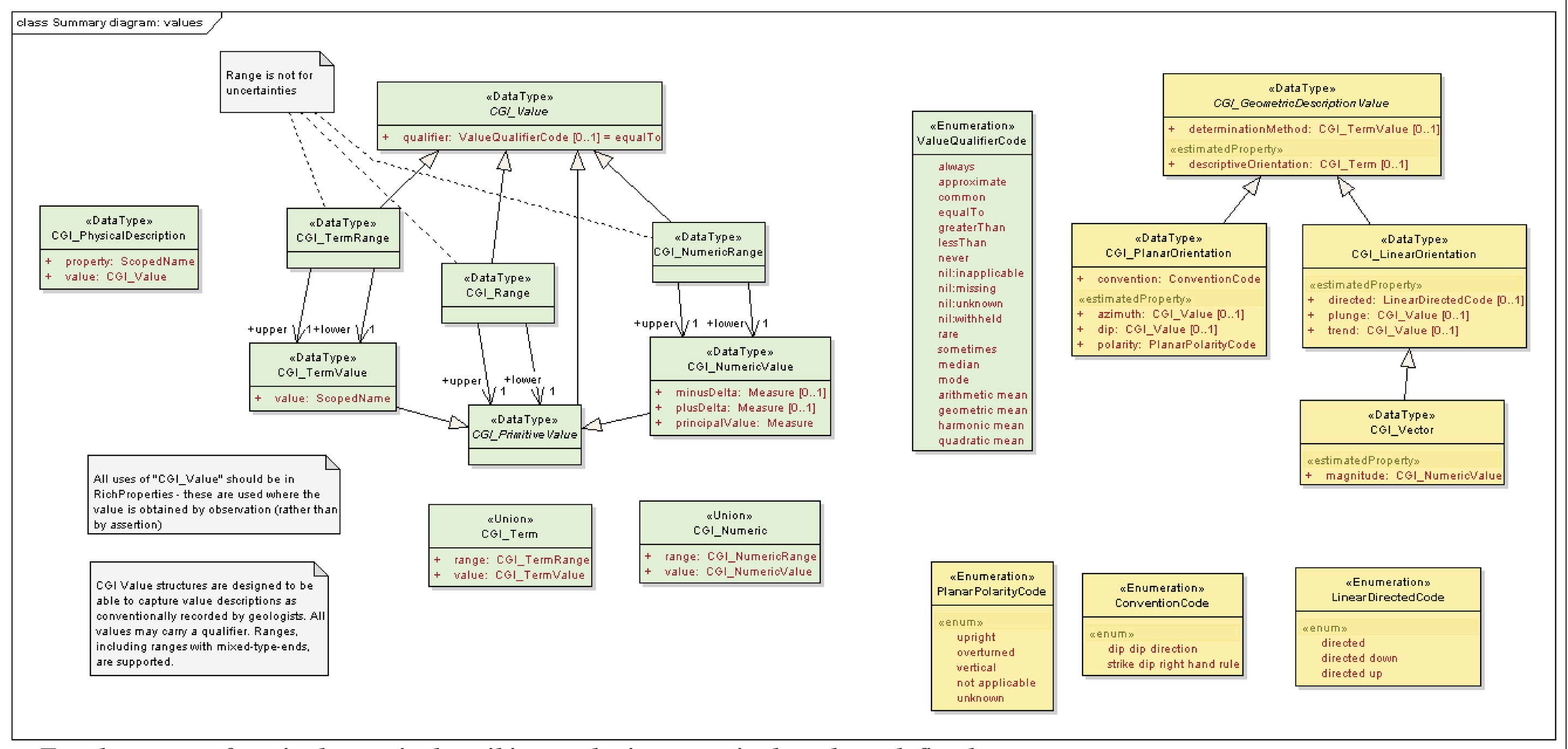
The model incorporates a structure for controlled concepts which can be defined in terms of normative descriptions of geologic units or earth materials. These can be built into Vocabularies, such as stratigraphic lexicons.

The GeosciML Vocabulary package uses a specification for vocabularies derived from gml

A GeologicVocabulary is made up of a collection of ControlledConcepts and VocabRelations. A VocabRelation describes the relationship between ControlledConcepts (eg parent-child)

LocalizedGenericName enables different names to be given to the same ControlledConcept eg for different languages

Values

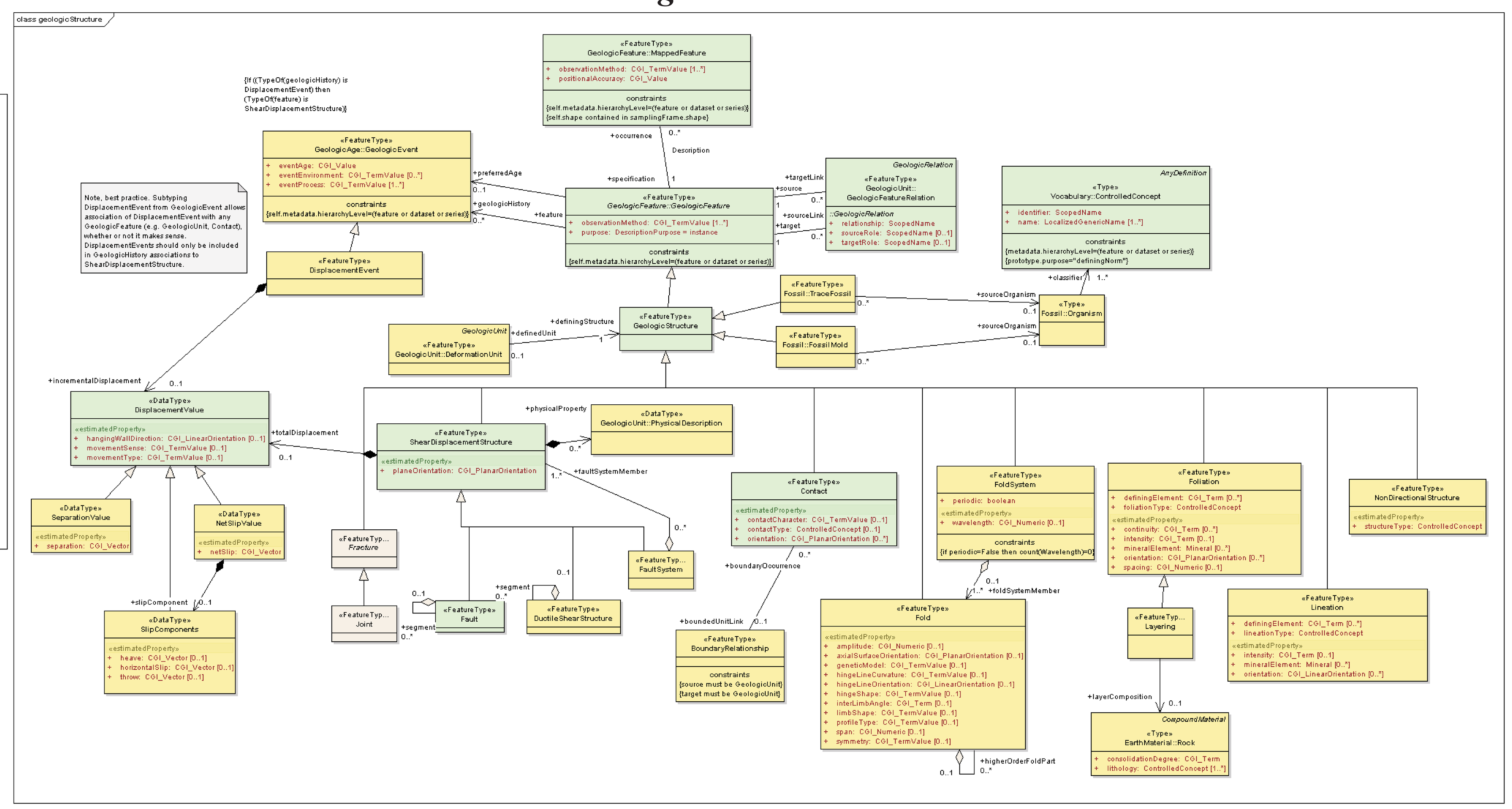


Two data types of particular use in describing geologic properties have been defined:

.CGI_Value allows properties to be recorded with term, number and range values along with a qualifier for handling the 'fuzziness' of much geologic data

.CGI_GeometricDescriptionValue allows for the recording of linear and planar structural measurements along with a code for recording the convention used eg 'right hand rule'

Geologic Structure



The Geologic Structure package models most types of geologic structure along with their descriptive properties. Primary sedimentary and igneous structures, as well as tectonic structures, are included

ShearDisplacementStructures include both Faults and FaultSystems, with the latter described in terms of their component Faults. The displacement value can be described both as a single total value for the structure, and as a series of discrete displacements each associated with a particular GeologicEvent

Both Folds and FoldSystems are modelled, the latter described in terms of their component Folds

Foliation is modelled and includes Layering, along with the Rock composition of each individual layer

Contacts are included as a type of Structure and the BoundaryRelationship between the GeologicUnits either side of the Contact can be described

Key