GeoScience Data Model Based on GeoSciML v.2 UML schema

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This schema represents development of a database designed for compatibility with GeoSciML. One critical design challenge is the degree to which entities from related schema (SWE, ISO19115, Observation and Measurement) are incorporated. Where properties correlating to properties from these schema have been incorporated, their names from original schema are used, even if the entire containing entity from that schema has not been implemented here.

Patterns

All keys are strings
sysID is the Primary Key in every table
Every table includes these standard fields, which are of course optional:
gmlName: Text string for human naming/ID of data instanct
gmlDescription: memo field, free text description
md_MetadataLink: link to iso19119 metadata (skeletal implementation included in metadata tables in this design)
SysCreated: data, designed for autopopulate with creation date for table row
SysCreatedby: identifier for person who created table row; meant to be autopopulated using login ID or something like that.
SysUpdated: data, designed for autopopulate with date/time of last data update for table row
SysCreatedby: identifier for person who executed most recent update to table row; meant to be autopopulated using login ID or something like that.
SysTemp: string field available for non-session persistent flagging of records
SysOwningRepositoryID: string to identify owner for data instance; use for access control

Schema uses ESRI CASE tool conventions for representing relational databse tables. Inheritance indicates all fields from parent are included in child tables. Abstract classes (names in italics) are not materializaed in the database, but serve to package fields or behavior/semantics for child entities to inherit.

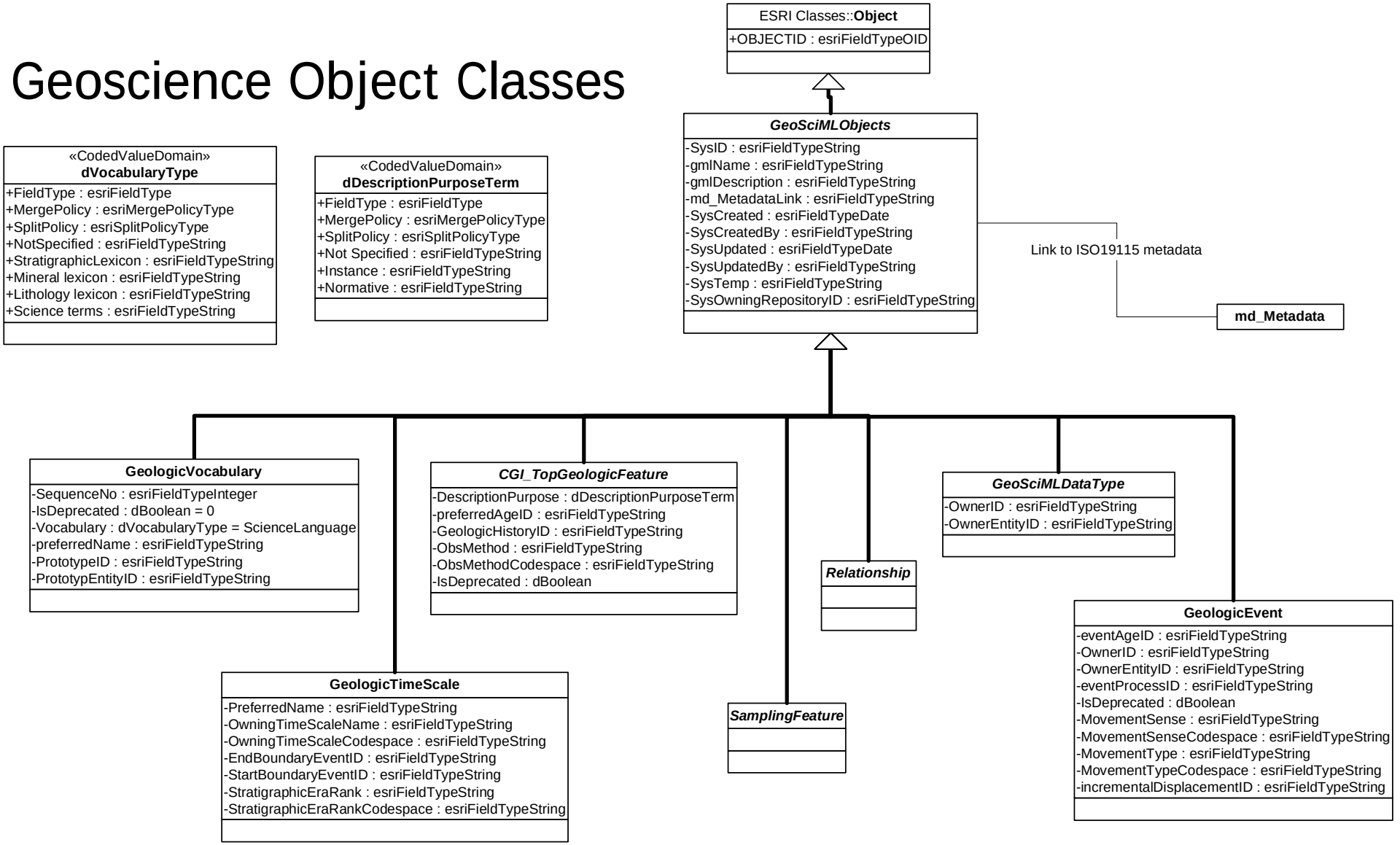
Fields with names ending in ID are foreign keys. If there is an associated xxEntityID field, then the link may be to one of several other tables, and the key is compound. The ID identifies a row in the linked table, EntityID identifies the target table.

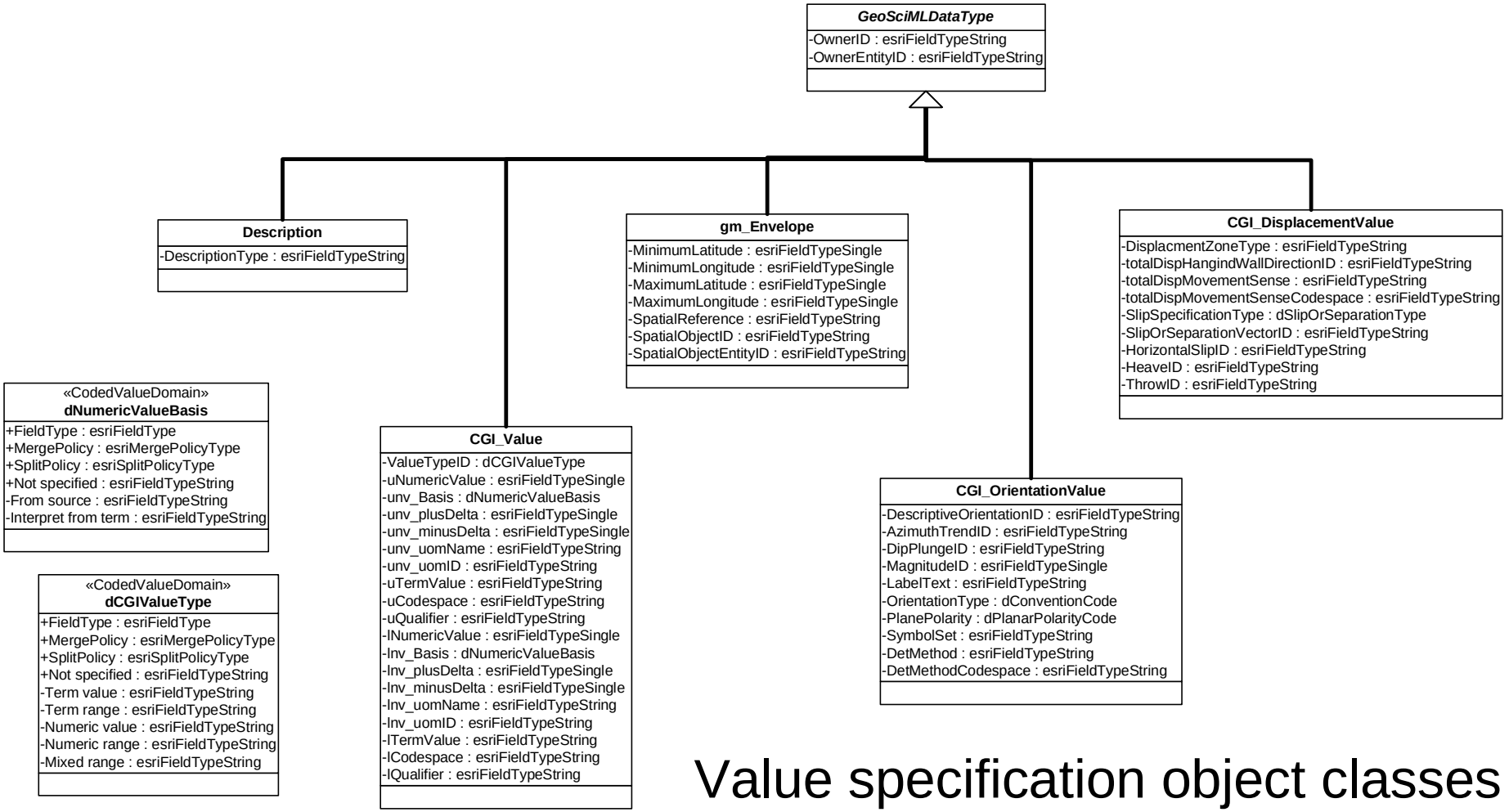
Fields with a Name/Codespace pair implement ScopedNames

AttributeLink correlation table implements all 0..* properties to allow multiple values. The OwnerID/OwnerEntityID field pairs link attribute instances back to owning descriptions. Db should execute cascade deletes on these links. EstimaterPropertyAttributeID is to implement Estimated property stereotype, but associated table with estimated properties has not been implemented here; need more work.

GeologicRelation is a generic correlation table to implement generic geologic Relationships; SourceID/SourceEntityID, TargetID/TargetEntityID follow standard compound foreign key convention.

Geoscience Object Classes

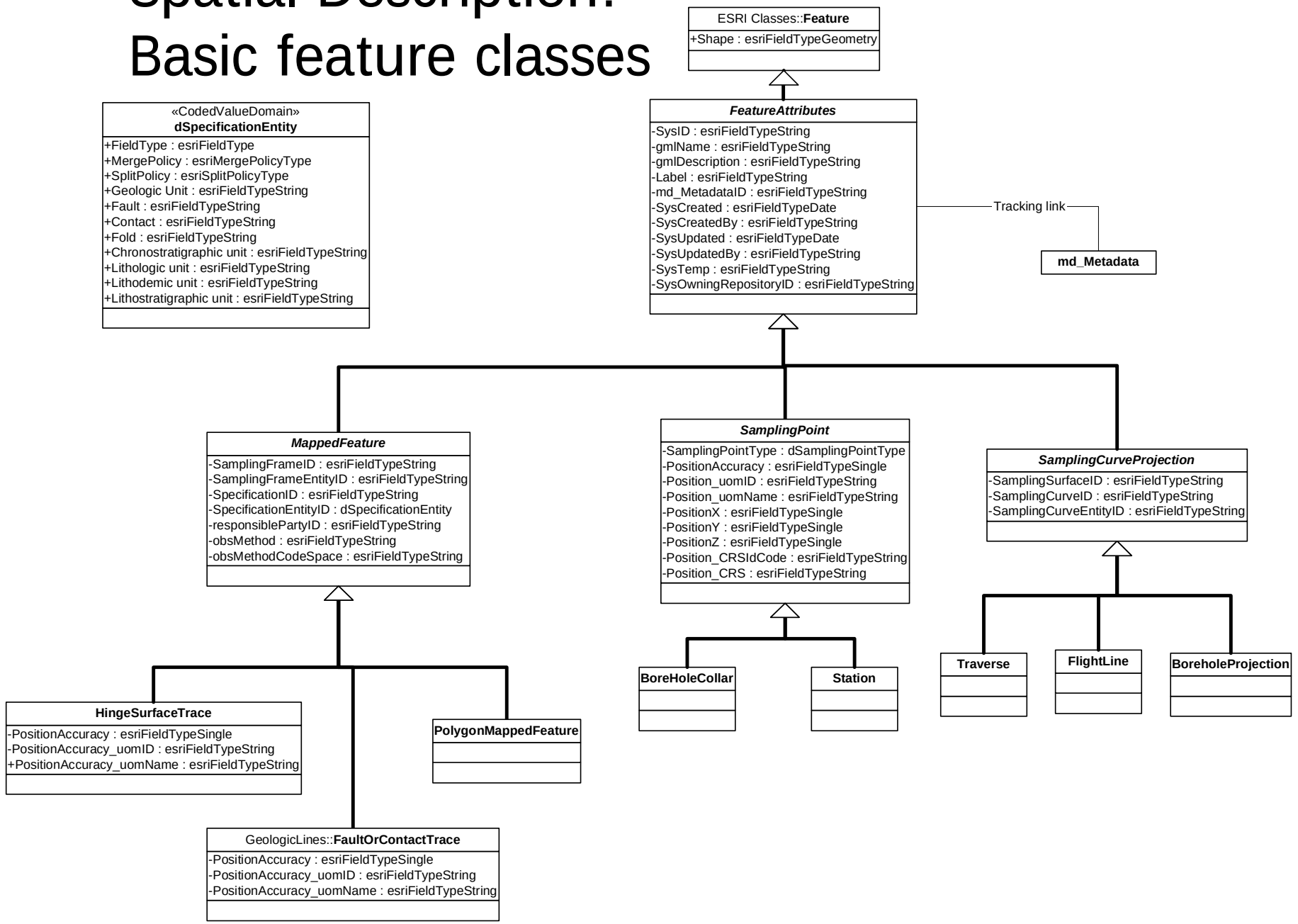




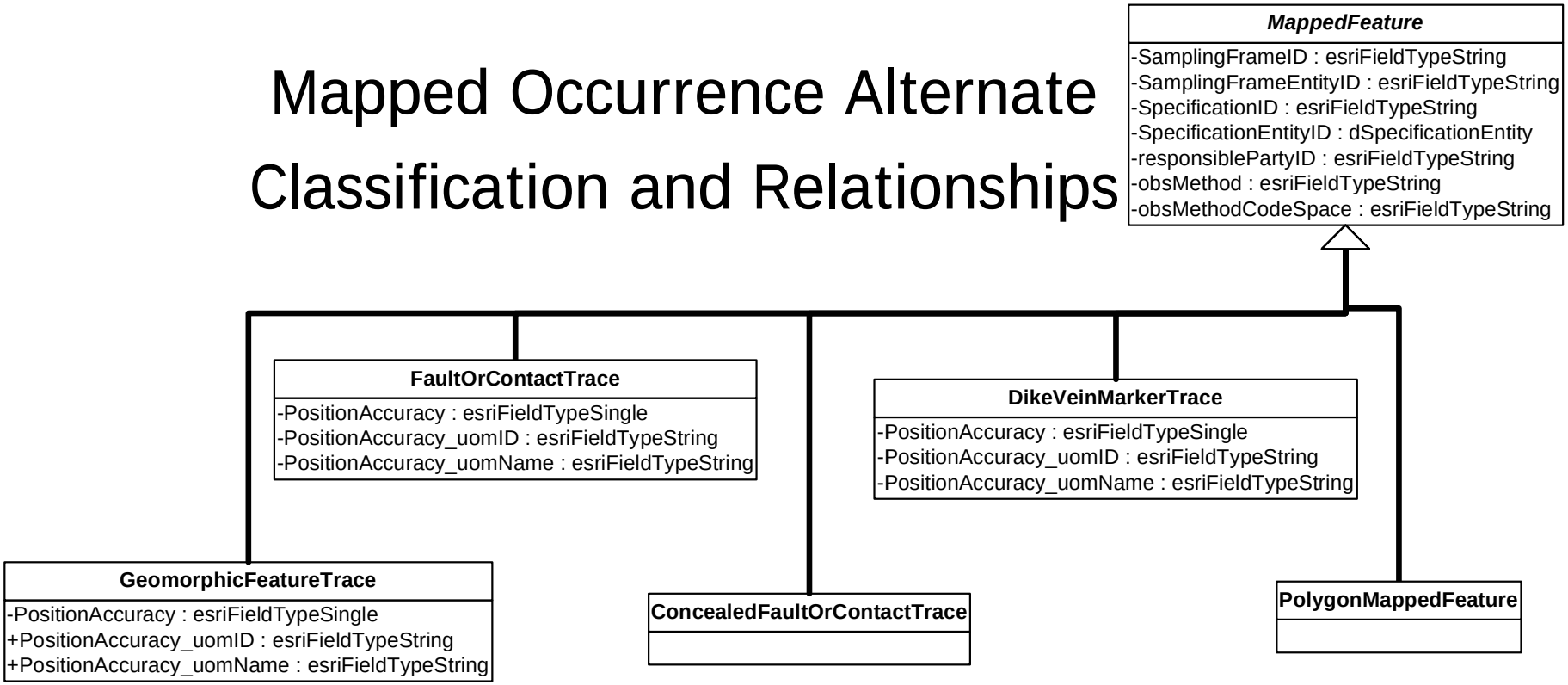
Value specification object classes

classes that are used to represent property values

Spatial Description: Basic feature classes



Mapped Occurrence Alternate Classification and Relationships

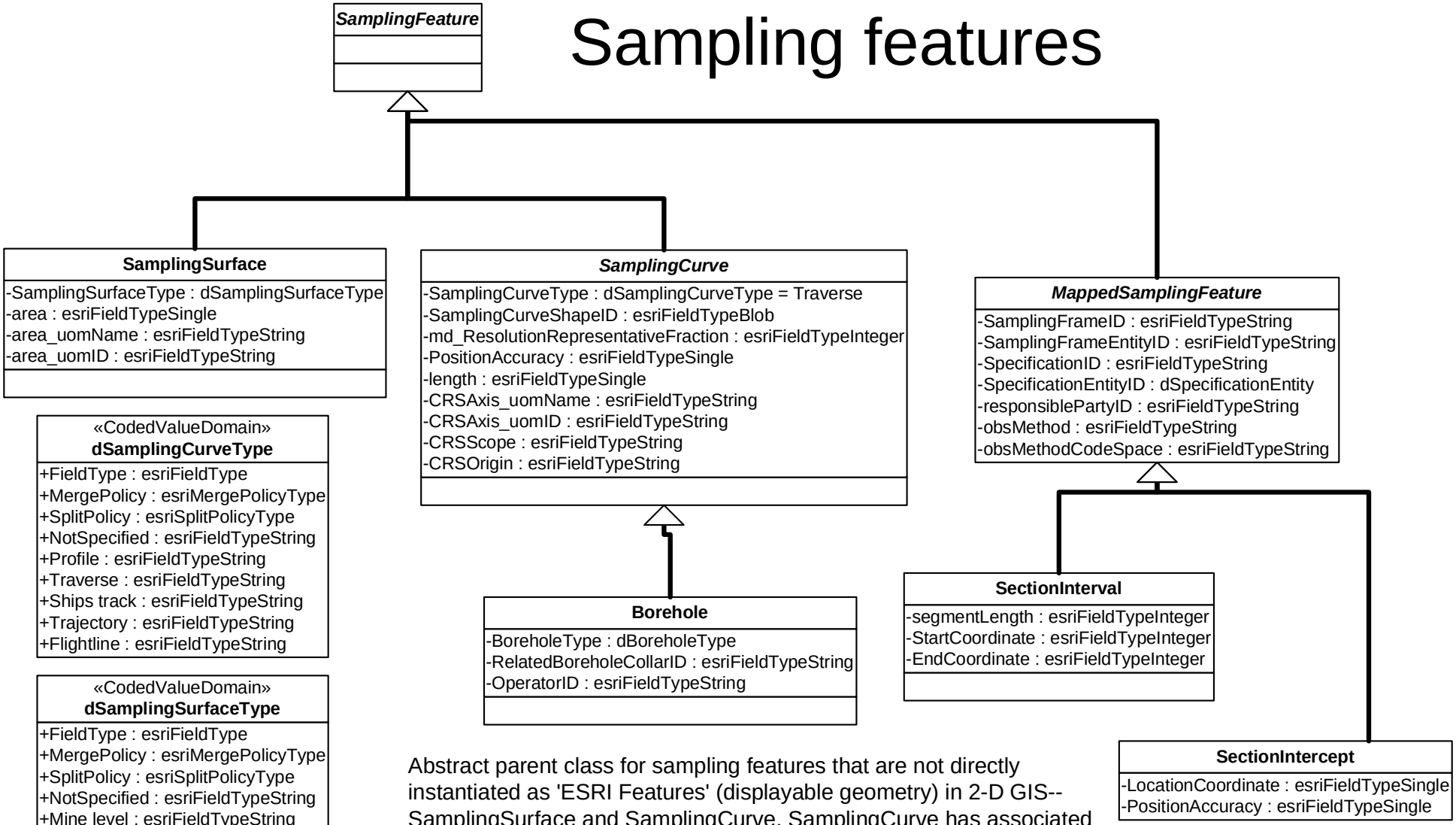


ESRI geodatabase topology rules could be applied to FaultOrContactTrace and PolygonMappedFeature:

FaultOrContactTrace: no intersections, no dangles (use exceptions for fault dangles)

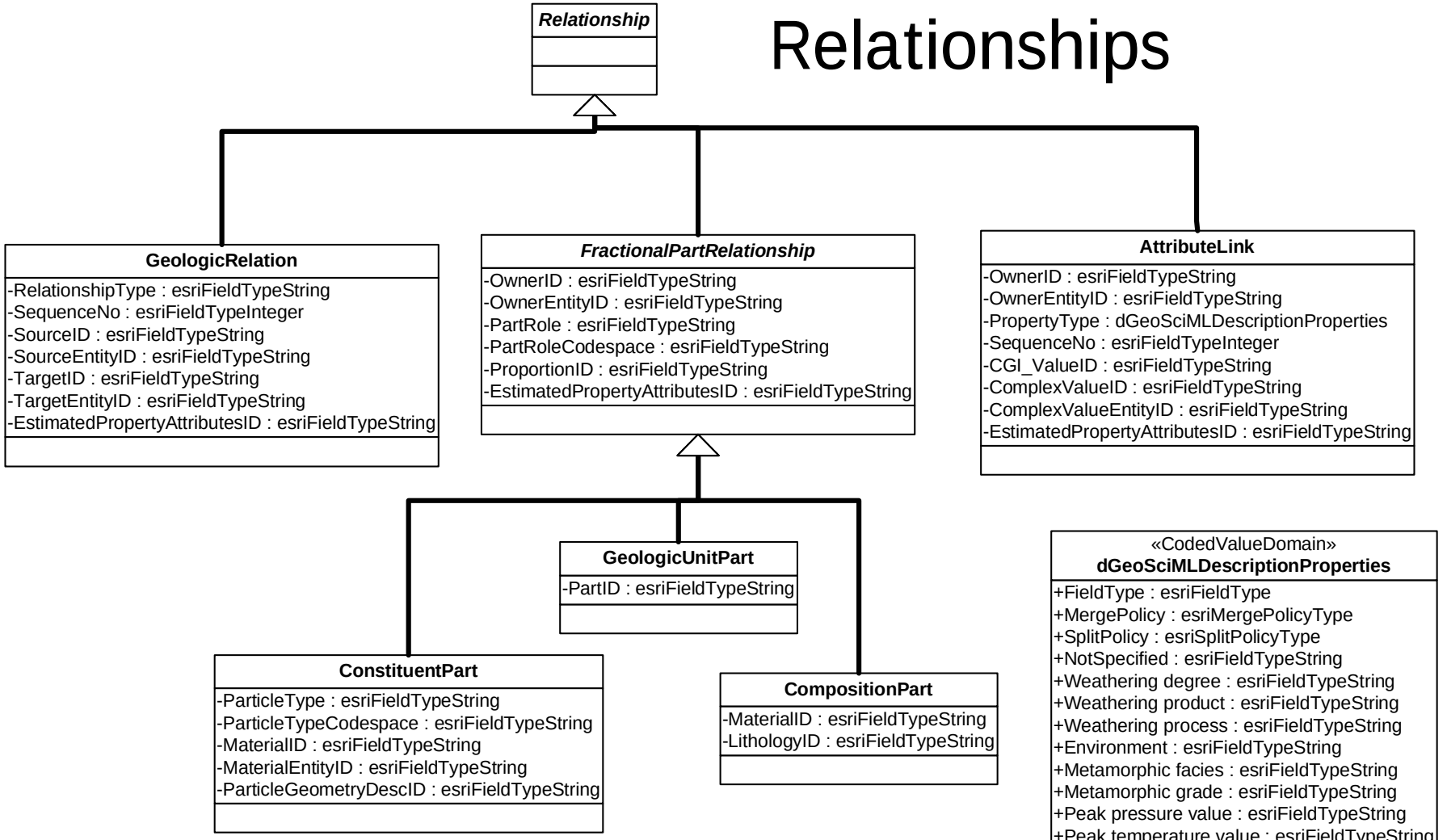
PolygonMappedFeature: no overlap, must cover, boundary must be covered by FaultOrContactTrace

Sampling features



Abstract parent class for sampling features that are not directly instantiated as 'ESRI Features' (displayable geometry) in 2-D GIS--SamplingSurface and SamplingCurve. SamplingCurve has associated GIS 'Feature' Classes that represent projection or trace of curve in a samplingSurface.

Relationships

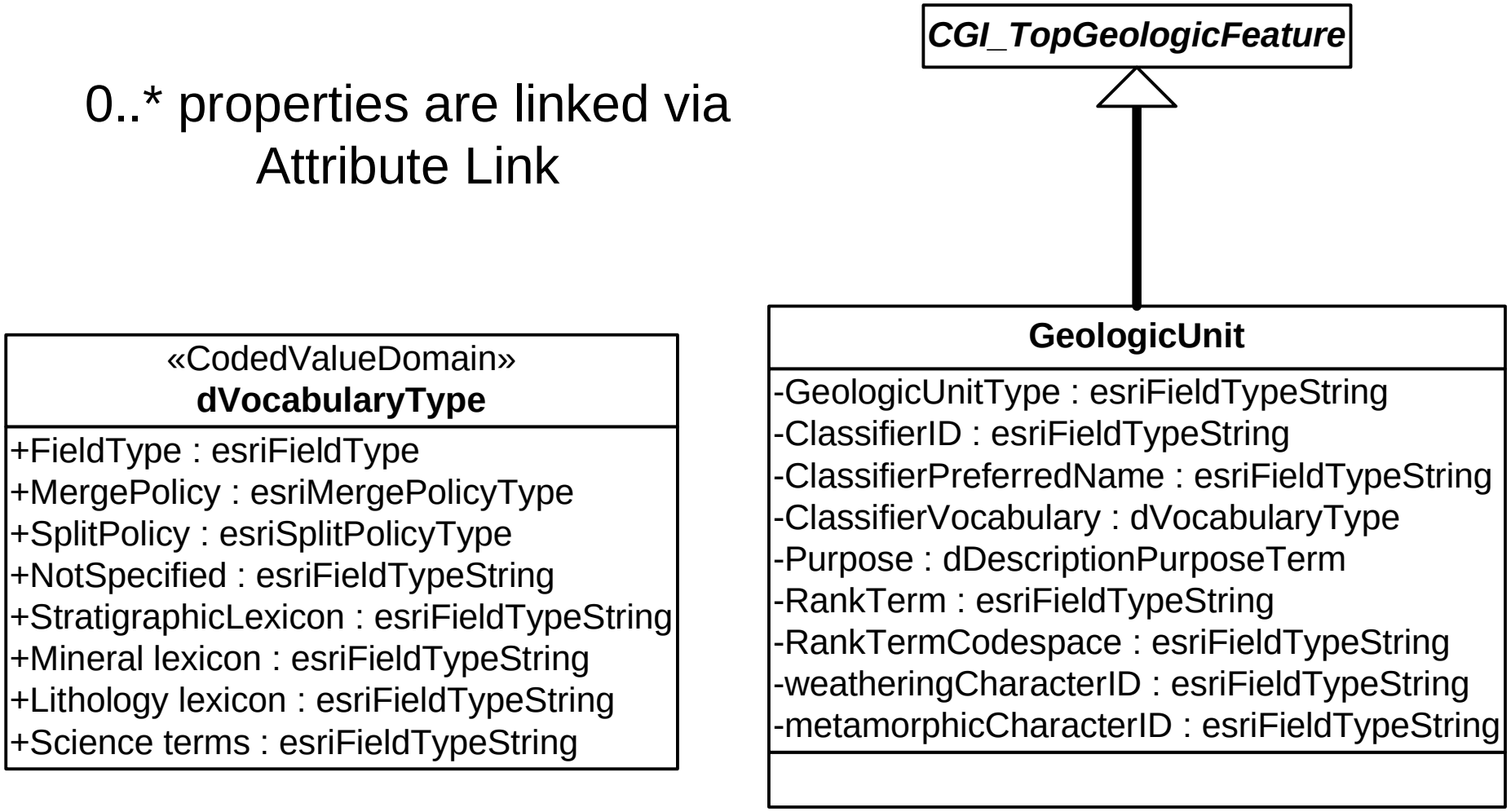


«CodedValueDomain»
dGeoSciMLDescriptionProperties

+FieldType : esriFieldType
+MergePolicy : esriMergePolicyType
+SplitPolicy : esriSplitPolicyType
+NotSpecified : esriFieldTypeString
+Weathering degree : esriFieldTypeString
+Weathering product : esriFieldTypeString
+Weathering process : esriFieldTypeString
+Environment : esriFieldTypeString
+Metamorphic facies : esriFieldTypeString
+Metamorphic grade : esriFieldTypeString
+Peak pressure value : esriFieldTypeString
+Peak temperature value : esriFieldTypeString
+Protolith rock type : esriFieldTypeString
+Particle size : esriFieldTypeString
+Particle sorting : esriFieldTypeString
+Particle shape : esriFieldTypeString
+Particle aspect ratio : esriFieldTypeString
+Fabric type : esriFieldTypeString
+Density : esriFieldTypeString
+Magnetic susceptibility : esriFieldTypeString
+Porosity : esriFieldTypeString
+Permeability : esriFieldTypeString

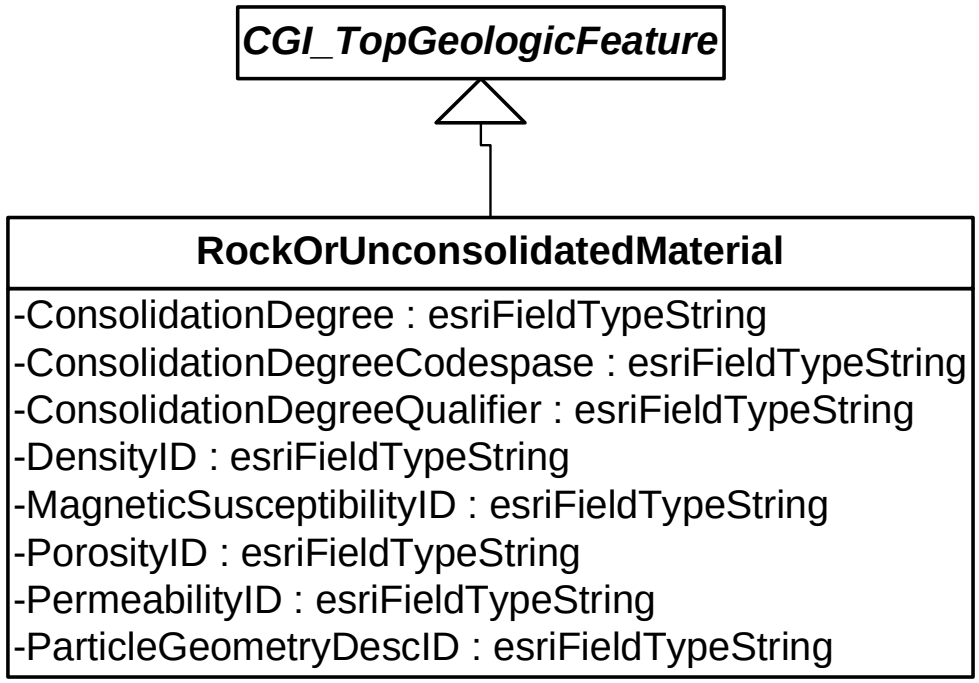
Composition relationships: ProportionID is FK to CGI_Value. PartID is FK to GeologicUnit. MaterialID on CompositionPart is FK to RockOrUnconsolidatedMaterial, on ConstituentPart, MaterialEntityID indicates whether points to RockOrUnconsolicatedMaterial or to Mineral. LithologyID is FK to GeologicVocabulary for lithology categories

0..* properties are linked via Attribute Link



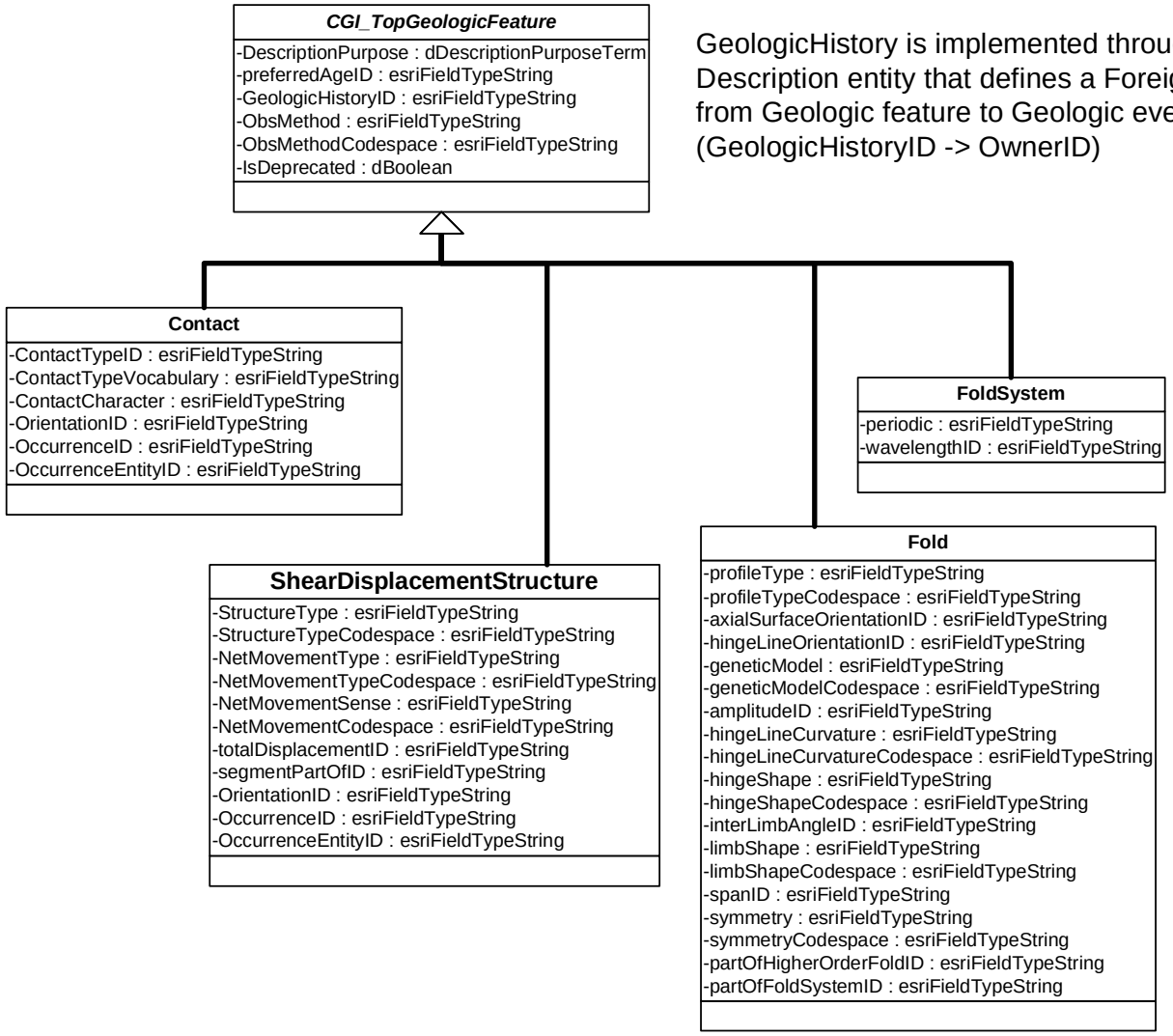
Geologic Unit

0..* properties implemented through AttributeLink correlation table. Composition implemented through ConstituentPart table. Since PhysicalProperty is 0..1, put those inline to minimize indirection; these are all FK to CGI_Value



Compound Earth Material

Geologic Structure



GeologicHistory is implemented through Description entity that defines a Foreign key from Geologic feature to Geologic events (GeologicHistoryID -> OwnerID)

Fault system aggregation is implemented through GeologicFeatureRelation links to allow for model cardinality that is many to many between shear-Displacement Structure and Fault system. Relationship type is ‘FaultSystemAggregation’

Orientation description

CGI_OrientationValue
-DescriptiveOrientationID : esriFieldTypeString -AzimuthTrendID : esriFieldTypeString -DipPlungeID : esriFieldTypeString -MagnitudeID : esriFieldTypeSingle -LabelText : esriFieldTypeString -OrientationType : dConventionCode -PlanePolarity : dPlanarPolarityCode -SymbolSet : esriFieldTypeString -DetMethod : esriFieldTypeString -DetMethodCodespace : esriFieldTypeString

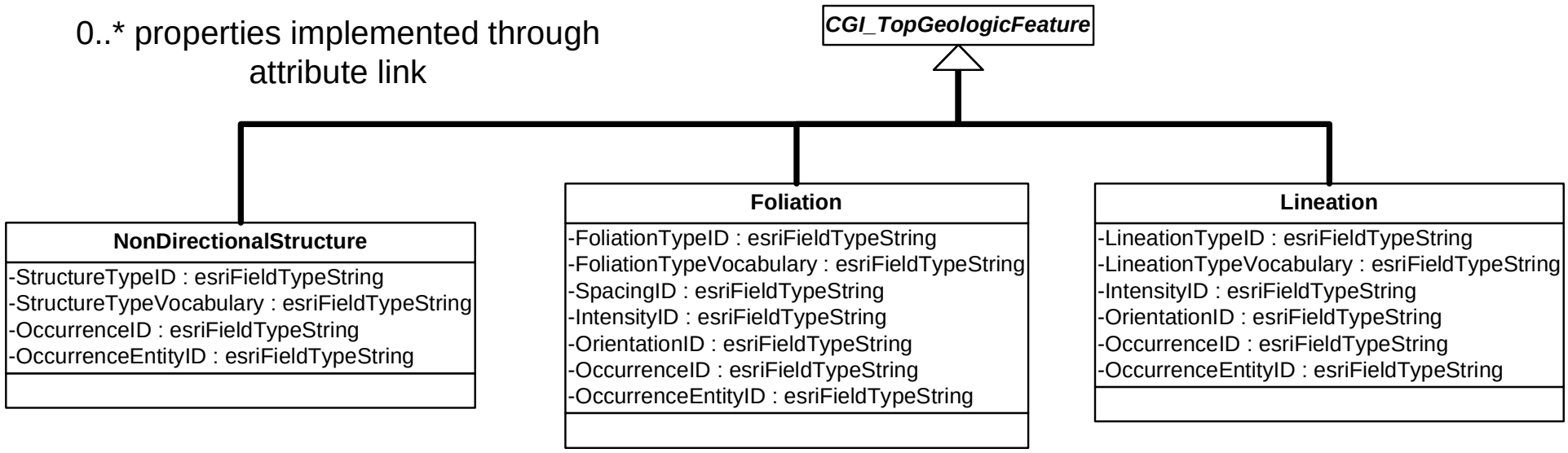
AzimuthTrendID, DipPlungeID, MagnitudeID, and DescriptiveOrientationID are FK to CGI_Value

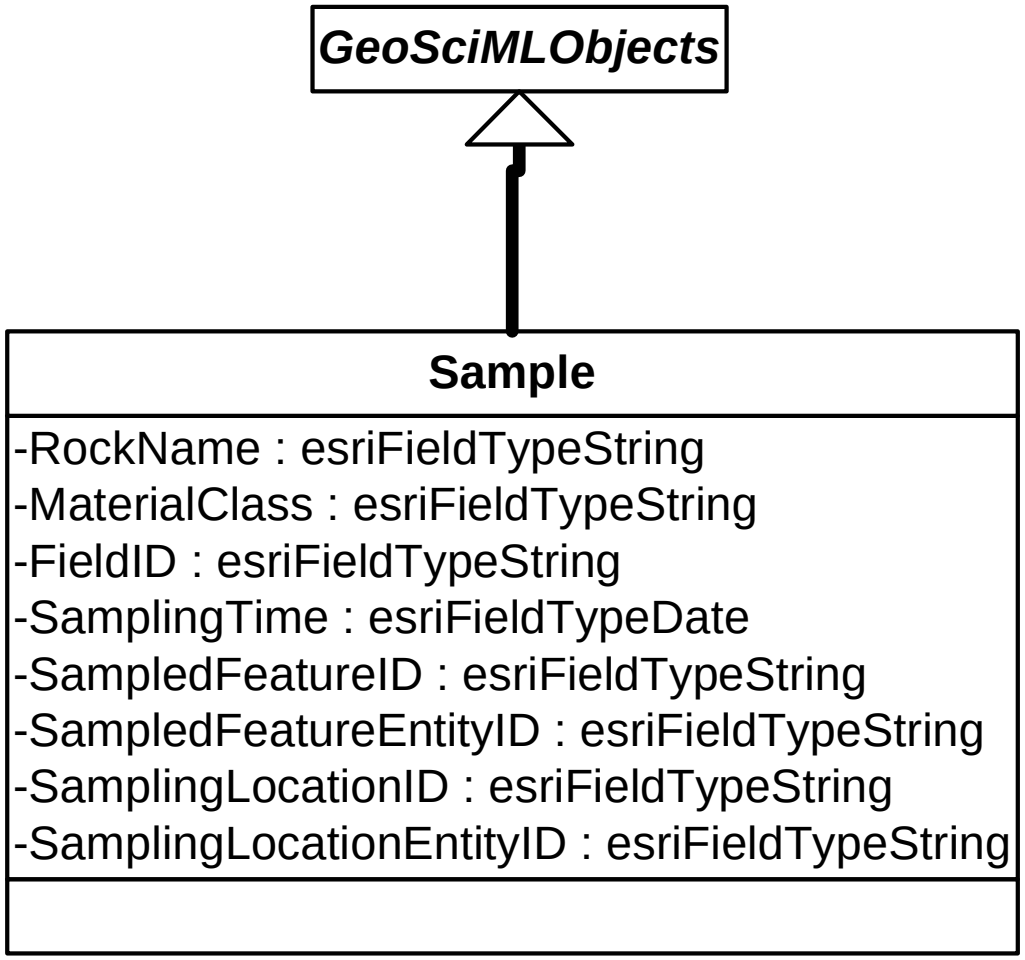
«CodedValueDomain» **dConventionCode**
+FieldType : esriFieldType +MergePolicy : esriMergePolicyType +SplitPolicy : esriSplitPolicyType +dip dip direction : esriFieldTypeString +strike dip right hand rule : esriFieldTypeString +linear nondirected : esriFieldTypeString +linear directed : esriFieldTypeString

«CodedValueDomain» **dPlanarPolarityCode**
+FieldType : esriFieldType +MergePolicy : esriMergePolicyType +SplitPolicy : esriSplitPolicyType +upright : esriFieldTypeString +overturned : esriFieldTypeString +vertical : esriFieldTypeString +not applicable : esriFieldTypeString +unknown : esriFieldTypeString

Foliation,Lineation, Non directional structure

0..* properties implemented through attribute link

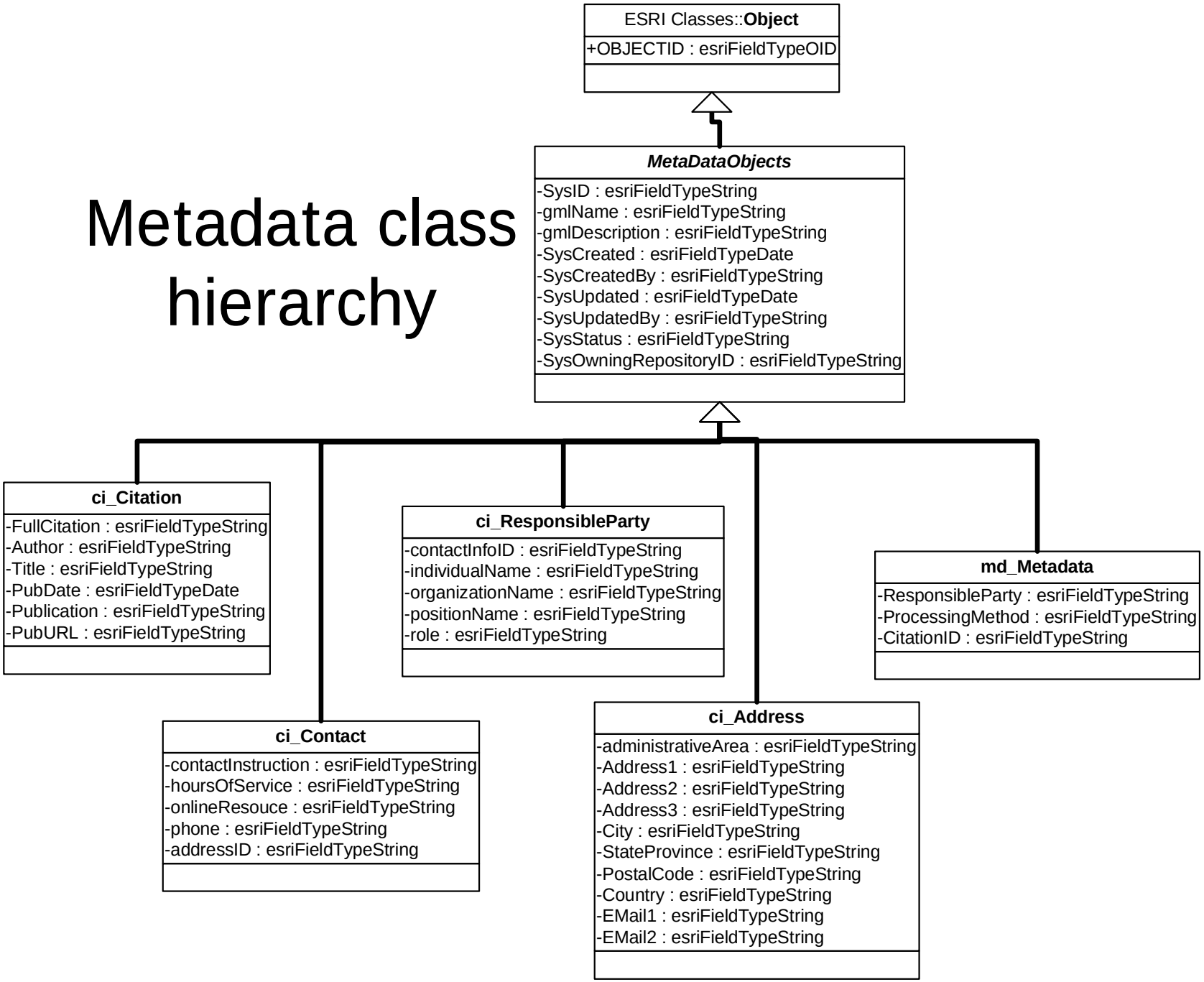




Sample

This db entity conflates SamplingFeature, FeatureOfInterest, Specimen. Field ID is user defined field identifier for sample.

Metadata class hierarchy



«CodedValueDomain»
dSlipOrSeparationType

+FieldType : esriFieldType = esriFieldTypeString
+MergePolicy : esriMergePolicyType = esriMPTDefaultValue
+SplitPolicy : esriSplitPolicyType = esriSPTDefaultValue
+NotSpecified : esriFieldTypeString = not specified
+net slip : esriFieldTypeString = netSlip
+separationVector : esriFieldTypeString = separationVector
+slipComponents : esriFieldTypeString = slipComponents

«CodedValueDomain»
dSamplingSurfaceType

+FieldType : esriFieldType = esriFieldTypeString
+MergePolicy : esriMergePolicyType = esriMPTDefaultValue
+SplitPolicy : esriSplitPolicyType = esriSPTDefaultValue
+NotSpecified : esriFieldTypeString = not specified
+Mine level : esriFieldTypeString = MineLevel
+Map horizon : esriFieldTypeString = MapHorizon
+Section : esriFieldTypeString = Section
+Swath : esriFieldTypeString = Swath
+Scene : esriFieldTypeString = Scene

«CodedValueDomain»
dConventionCode

+FieldType : esriFieldType = esriFieldTypeString
+MergePolicy : esriMergePolicyType = esriMPTDefaultValue
+SplitPolicy : esriSplitPolicyType = esriSPTDefaultValue
+dip dip direction : esriFieldTypeString = DipDipDirection
+strike dip right hand rule : esriFieldTypeString = StrikeDipRHR
+linear nondirected : esriFieldTypeString = LinearNondirected
+linear directed : esriFieldTypeString = LinearDirected

«CodedValueDomain»
dSamplingPointType

+FieldType : esriFieldType = esriFieldTypeString
+MergePolicy : esriMergePolicyType = esriMPTDefaultValue
+SplitPolicy : esriSplitPolicyType = esriSPTDefaultValue
+NotSpecified : esriFieldTypeString = not specified
+Sampling point : esriFieldTypeString = SamplingPoint
+Station : esriFieldTypeString = Station
+Borehole intercept : esriFieldTypeString = BoreholeIntercept
+Section intercept : esriFieldTypeString = SectionIntercept
+Flightline sample point : esriFieldTypeString = FlightlineSamplePoint

«CodedValueDomain»
dBoreholeType

+FieldType : esriFieldType = esriFieldTypeString
+MergePolicy : esriMergePolicyType = esriMPTDefaultValue
+SplitPolicy : esriSplitPolicyType = esriSPTDefaultValue
+Not specified : esriFieldTypeString = NotSpecified
+Borehole : esriFieldTypeString = Borehole
+Observation well : esriFieldTypeString = ObservationWell

«CodedValueDomain»
dSamplingCurveType

+FieldType : esriFieldType = esriFieldTypeString
+MergePolicy : esriMergePolicyType = esriMPTDefaultValue
+SplitPolicy : esriSplitPolicyType = esriSPTDefaultValue
+NotSpecified : esriFieldTypeString = not specified
+Profile : esriFieldTypeString = Profile
+Traverse : esriFieldTypeString = Traverse
+Ships track : esriFieldTypeString = ShipsTrack
+Trajectory : esriFieldTypeString = Trajectory
+Flightline : esriFieldTypeString = Flightline

«CodedValueDomain»
dVocabularyType

+FieldType : esriFieldType = esriFieldTypeString
+MergePolicy : esriMergePolicyType = esriMPTDefaultValue
+SplitPolicy : esriSplitPolicyType = esriSPTDefaultValue
+NotSpecified : esriFieldTypeString = not specified
+StratigraphicLexicon : esriFieldTypeString = StratigraphicLexicon
+Mineral lexicon : esriFieldTypeString = Minerals
+Lithology lexicon : esriFieldTypeString = Lithology
+Science terms : esriFieldTypeString = ScienceLanguage

«CodedValueDomain»
dDescriptionType

+FieldType : esriFieldType = esriFieldTypeString
+MergePolicy : esriMergePolicyType = esriMPTDefaultValue
+SplitPolicy : esriSplitPolicyType = esriSPTDefaultValue
+NotSpecified : esriFieldTypeString = not specified
+Weathering description : esriFieldTypeString = WeatheringDescription
+Metamorphic description : esriFieldTypeString = MetamorphicDescription
+Particle geometry description : esriFieldTypeString = ParticleGeometryDesription
+Fabric description : esriFieldTypeString = FabricDescription
+Physical property description : esriFieldTypeString = PhysicalDescription

«CodedValueDomain»
dDescriptionPurposeTerm

+FieldType : esriFieldType = esriFieldTypeString
+MergePolicy : esriMergePolicyType = esriMPTDefaultValue
+SplitPolicy : esriSplitPolicyType = esriSPTDefaultValue
+Not Specified : esriFieldTypeString = NotSpecified
+Instance : esriFieldTypeString = Instance
+Normative : esriFieldTypeString = Normative

«CodedValueDomain»
dBoolean

+FieldType : esriFieldType = esriFieldTypeInteger
+MergePolicy : esriMergePolicyType = esriMPTDefaultValue
+SplitPolicy : esriSplitPolicyType = esriSPTDefaultValue
+True : esriFieldTypeInteger = -1
-False : esriFieldTypeInteger = 0

«CodedValueDomain»
dGeoSciMLDescriptionProperties

+FieldType : esriFieldType = esriFieldTypeString
+MergePolicy : esriMergePolicyType = esriMPTDefaultValue
+SplitPolicy : esriSplitPolicyType = esriSPTDefaultValue
+NotSpecified : esriFieldTypeString = NotSpecified
+Weathering degree : esriFieldTypeString = weatheringDegree
+Weathering product : esriFieldTypeString = weatheringProduct
+Weathering process : esriFieldTypeString = weatheringProcess
+Environment : esriFieldTypeString = environment
+Metamorphic facies : esriFieldTypeString = metamorphicFacies
+Metamorphic grade : esriFieldTypeString = metamorphicGrade
+Peak pressure value : esriFieldTypeString = peakPressureValue
+Peak temperature value : esriFieldTypeString = peakTemperatureValue
+Protolith rock type : esriFieldTypeString = protolithLithology
+Particle size : esriFieldTypeString = size
+Particle sorting : esriFieldTypeString = sorting
+Particle shape : esriFieldTypeString = shape
+Particle aspect ratio : esriFieldTypeString = aspectRatio
+Fabric type : esriFieldTypeString = fabricType
+Density : esriFieldTypeString = density
+Magnetic susceptibility : esriFieldTypeString = magneticSusceptibility
+Porosity : esriFieldTypeString = porosity
+Permeability : esriFieldTypeString = permeability

GeoDatabase Domains: Pre configured pick lists