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 materializated 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.

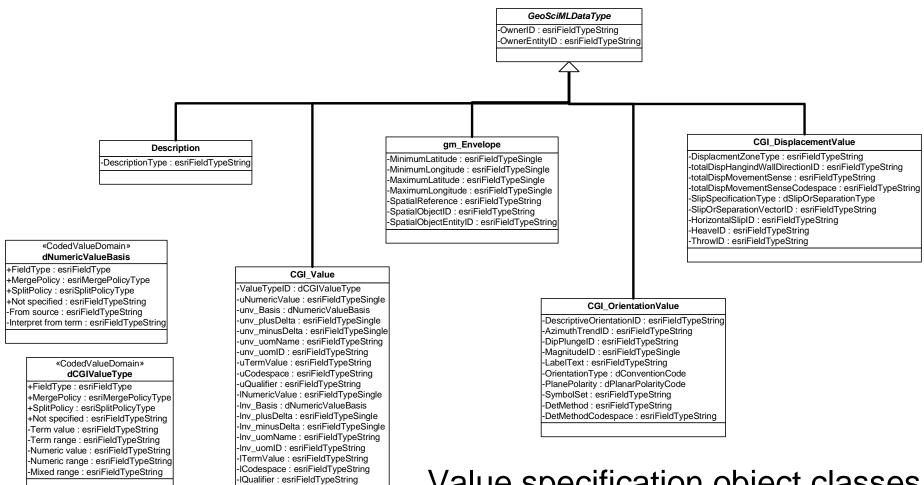
Fields with a Name/Codespace pair implement ScopedNames

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.

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

ESRI Classes::Object +OBJECTID: esriFieldTypeOID Geoscience Object Classes GeoSciMLObjects -SysID: esriFieldTypeString «CodedValueDomain» «CodedValueDomain» -gmlName : esriFieldTypeString dVocabularyType -gmlDescription: esriFieldTypeString dDescriptionPurposeTerm +FieldType: esriFieldType -md_MetadataLink : esriFieldTypeString +FieldType : esriFieldType +MergePolicy : esriMergePolicyType -SysCreated : esriFieldTypeDate +MergePolicy: esriMergePolicyType +SplitPolicy: esriSplitPolicyType -SysCreatedBy : esriFieldTypeString +SplitPolicy: esriSplitPolicyType +NotSpecified : esriFieldTypeString -SysUpdated : esriFieldTypeDate Link to ISO19115 metadata +Not Specified : esriFieldTypeString +StratigraphicLexicon: esriFieldTypeString -SysUpdatedBy: esriFieldTypeString +Instance : esriFieldTypeString +Mineral lexicon : esriFieldTypeString -SvsTemp : esriFieldTvpeString +Normative : esriFieldTypeString +Lithology lexicon: esriFieldTypeString -SysOwningRepositoryID : esriFieldTypeString +Science terms : esriFieldTypeString md Metadata GeologicVocabulary CGI_TopGeologicFeature GeoSciMLDataType -SequenceNo: esriFieldTypeInteger -DescriptionPurpose: dDescriptionPurposeTerm -OwnerID : esriFieldTypeString -IsDeprecated : dBoolean = 0 -preferredAgeID : esriFieldTypeString -OwnerEntityID: esriFieldTypeString -Vocabulary : dVocabularyType = ScienceLanguage -GeologicHistoryID: esriFieldTypeString -preferredName : esriFieldTypeString -ObsMethod: esriFieldTypeString -PrototypeID: esriFieldTypeString ObsMethodCodespace : esriFieldTypeString Relationship -PrototypEntityID: esriFieldTypeString -IsDeprecated : dBoolean GeologicEvent -eventAgeID : esriFieldTypeString OwnerID : esriFieldTypeString -OwnerEntityID : esriFieldTypeString GeologicTimeScale -eventProcessID: esriFieldTypeString -IsDeprecated : dBoolean -PreferredName : esriFieldTypeString SamplingFeature -MovementSense : esriFieldTypeString -OwningTimeScaleName : esriFieldTypeString -MovementSenseCodespace : esriFieldTypeString -OwningTimeScaleCodespace : esriFieldTypeString -MovementType : esriFieldTypeString -EndBoundaryEventID: esriFieldTypeString -MovementTypeCodespace : esriFieldTypeString -StartBoundaryEventID: esriFieldTypeString -incrementalDisplacementID: esriFieldTypeString -StratigraphicEraRank : esriFieldTypeString -StratigraphicEraRankCodespace: esriFieldTypeString



Value specification object classes

classes that are used to represent property values

Spatial Description: ESRI Classes::Feature Basic feature classes +Shape: esriFieldTypeGeometry **FeatureAttributes** «CodedValueDomain» dSpecificationEntity -SysID : esriFieldTypeString +FieldType : esriFieldType -gmlName : esriFieldTypeString +MergePolicy: esriMergePolicyType -amlDescription: esriFieldTypeString +SplitPolicy: esriSplitPolicyType -Label: esriFieldTypeString +Geologic Unit: esriFieldTypeString -md MetadataID: esriFieldTypeString +Fault : esriFieldTypeString -SysCreated : esriFieldTypeDate -Tracking link-+Contact : esriFieldTypeString SysCreatedBy : esriFieldTypeString +Fold : esriFieldTypeString -SysUpdated : esriFieldTypeDate +Chronostratigraphic unit : esriFieldTypeString SysUpdatedBy : esriFieldTypeString md Metadata +Lithologic unit : esriFieldTypeString -SysTemp : esriFieldTypeString +Lithodemic unit : esriFieldTypeString -SysOwningRepositoryID: esriFieldTypeString +Lithostratigraphic unit : esriFieldTypeString SamplingPoint MappedFeature -SamplingPointType : dSamplingPointType SamplingCurveProjection -SamplingFrameID: esriFieldTypeString -PositionAccuracy : esriFieldTypeSingle -SamplingFrameEntityID : esriFieldTypeString -SamplingSurfaceID : esriFieldTypeString -Position uomID : esriFieldTypeString -SpecificationID: esriFieldTypeString -Position uomName : esriFieldTypeString -SamplingCurveID : esriFieldTypeString -SpecificationEntityID : dSpecificationEntity SamplingCurveEntityID : esriFieldTypeString -PositionX : esriFieldTypeSingle -responsiblePartyID : esriFieldTypeString -PositionY : esriFieldTypeSingle -obsMethod : esriFieldTypeString -PositionZ : esriFieldTypeSingle -obsMethodCodeSpace : esriFieldTypeString -Position_CRSIdCode : esriFieldTypeString -Position_CRS : esriFieldTypeString FlightLine BoreholeProjection **Traverse** BoreHoleCollar Station HingeSurfaceTrace PolygonMappedFeature -PositionAccuracy : esriFieldTypeSingle -PositionAccuracy_uomID : esriFieldTypeString +PositionAccuracy_uomName : esriFieldTypeString GeologicLines::FaultOrContactTrace -PositionAccuracy: esriFieldTypeSingle ·PositionAccuracy uomID: esriFieldTypeString PositionAccuracy_uomName : esriFieldTypeString

Mapped Occurrence Alternate Classification and Relationships -obsMethodCodeSpace: esriField -obsMethodCodeSpace: esriField -obsMethodCodeSpace: esriField

MappedFeature

SamplingFrameID: esriFieldTypeString SamplingFrameEntityID: esriFieldTypeString SpecificationID: esriFieldTypeString SpecificationEntityID: dSpecificationEntity responsiblePartyID: esriFieldTypeString

-obsMethodCodeSpace : esriFieldTypeString

PolygonMappedFeature |

FaultOrContactTrace -PositionAccuracy : esriFieldTypeSingle -PositionAccuracy_uomID: esriFieldTypeString -PositionAccuracy_uomName : esriFieldTypeString

DikeVeinMarkerTrace

-PositionAccuracy: esriFieldTypeSingle -PositionAccuracy_uomID : esriFieldTypeString

-PositionAccuracy_uomName : esriFieldTypeString

GeomorphicFeatureTrace

-PositionAccuracy: esriFieldTypeSingle +PositionAccuracy uomID: esriFieldTypeString

+PositionAccuracy_uomName : esriFieldTypeString

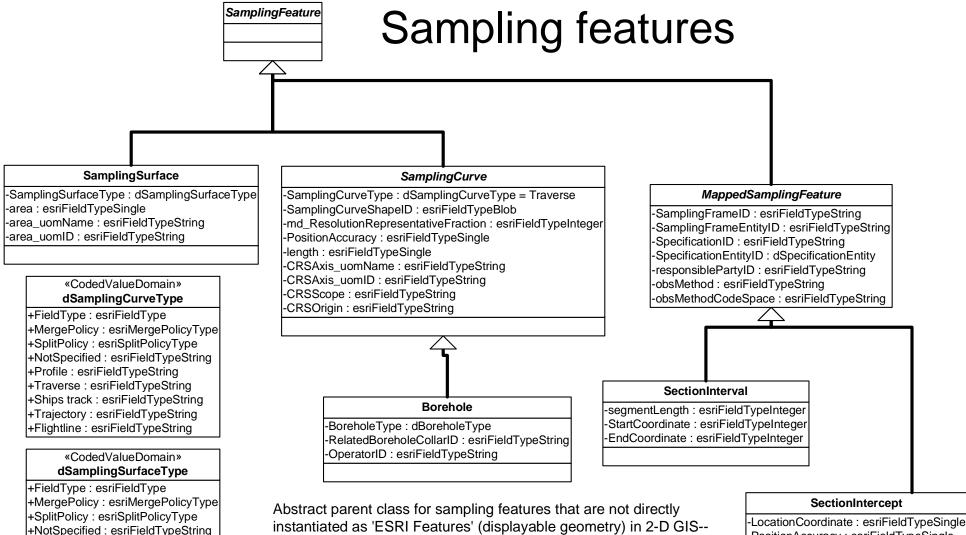
ConcealedFaultOrContactTrace

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

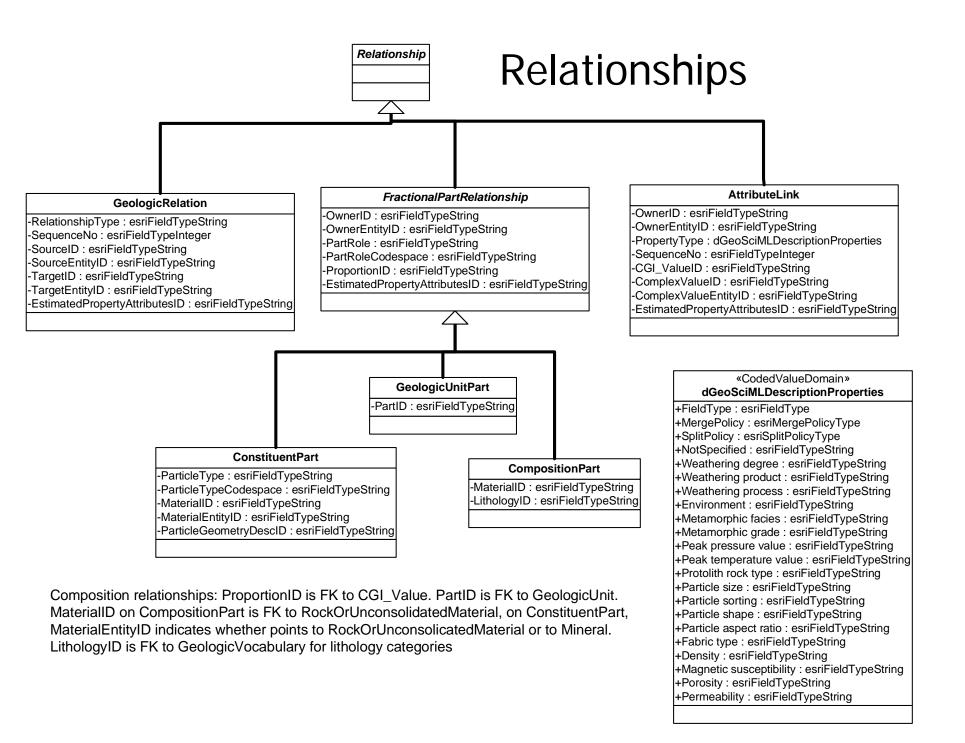


SamplingSurface and SamplingCurve. SamplingCurve has associated GIS 'Feature' Classes that represent projection or trace of curve in a samplingSurface.

+Mine level : esriFieldTypeString +Map horizon : esriFieldTypeString

+Section: esriFieldTypeString

+Swath: esriFieldTypeString +Scene: esriFieldTypeString -PositionAccuracy : esriFieldTypeSingle



0..* properties are linked via Attribute Link

CGI_TopGeologicFeature

«CodedValueDomain» dVocabularyType

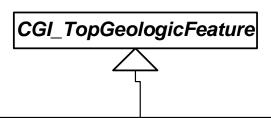
- +FieldType : esriFieldType
- +MergePolicy: esriMergePolicyType
- +SplitPolicy: esriSplitPolicyType
- +NotSpecified : esriFieldTypeString
- +StratigraphicLexicon: esriFieldTypeString
- +Mineral lexicon : esriFieldTypeString
- +Lithology lexicon: esriFieldTypeString
- +Science terms : esriFieldTypeString

GeologicUnit

- -GeologicUnitType : esriFieldTypeString
- -ClassifierID : esriFieldTypeString
- -ClassifierPreferredName : esriFieldTypeString
- -ClassifierVocabulary : dVocabularyType
- -Purpose: dDescriptionPurposeTerm
- -RankTerm : esriFieldTypeString
- -RankTermCodespace : esriFieldTypeString
- -weatheringCharacterID: esriFieldTypeString
- -metamorphicCharacterID : esriFieldTypeString

Geologic Unit

O..* 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



RockOrUnconsolidatedMaterial

-ConsolidationDegree : esriFieldTypeString

-ConsolidationDegreeCodespase : esriFieldTypeString

-ConsolidationDegreeQualifier: esriFieldTypeString

-DensityID: esriFieldTypeString

-MagneticSusceptibilityID : esriFieldTypeString

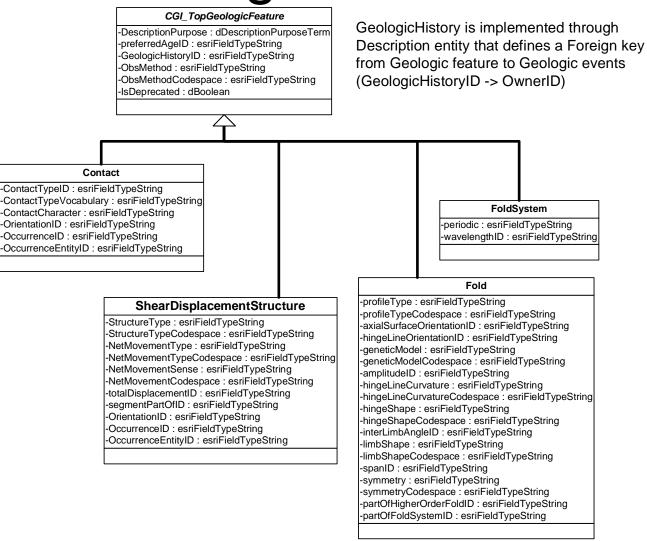
-PorosityID : esriFieldTypeString

-PermeabilityID: esriFieldTypeString

-ParticleGeometryDescID: esriFieldTypeString

Compound Earth Material

Geologic Structure



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

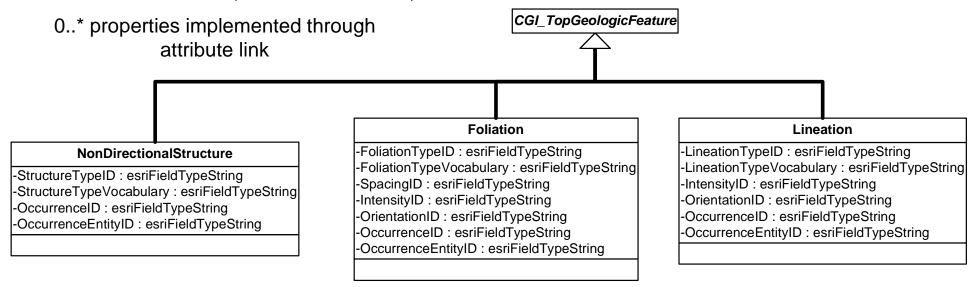
+overturned : esriFieldTypeString

+vertical: esriFieldTypeString

+not applicable : esriFieldTypeString

+unknown: esriFieldTypeString

Foliation, Lineation, Non directional structure



GeoSciMLObjects

Sample

-RockName : esriFieldTypeString

-MaterialClass : esriFieldTypeString

-FieldID : esriFieldTypeString

-SamplingTime : esriFieldTypeDate

-SampledFeatureID : esriFieldTypeString

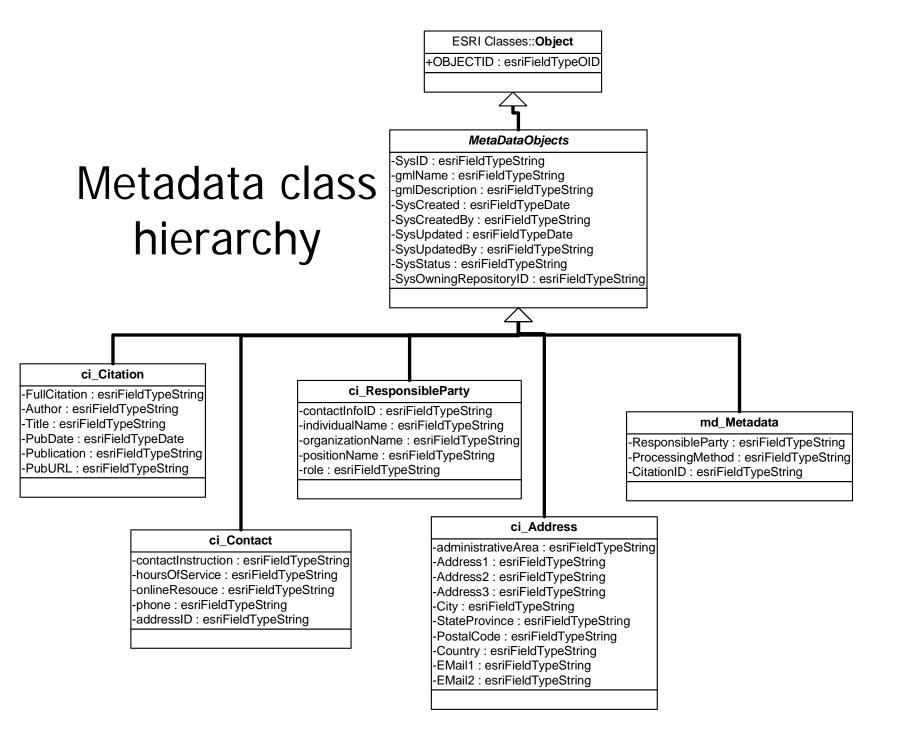
-SampledFeatureEntityID : esriFieldTypeString

-SamplingLocationID: esriFieldTypeString

-SamplingLocationEntityID : esriFieldTypeString

Sample

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



«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

+Fliahtline: esriFieldTypeString = Fliahtline

«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 : esriFieldTvpeString = 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