USGIN
U.S. Geoscience Information Network

Use of ISO 19139 xml schema to describe geoscience information dataset and dataset series resources.

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This document is a profile for using ISO19139 xml schema for North American Profile of ISO 19115 and ISO 19119 metadata. The profile provides guidance for the population of ISO19139 dataset and dataset series documents to enable interoperability of catalog service clients with multiple servers conforming to this profile.

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1 Introduction

A key component of a distributed information network is a catalog system, a collection of resources that allow data and service providers to register resources, and data consumers to locate and use those resources. Currently, many online catalogs are web pages with collections of URLs for services, or services are discovered accidently or by word of mouth. The vision is to enable a web client (portal) to search across one or more metadata registries without having to configure the client individually for each of the registries that will be searched. Thus, metadata providers can focus on data development, without having to also develop web clients to enable search of that metadata.

The Open Geospatial Consortium (OGC) Catalog Service for the Web (CSW) specification defines a collection of basic operations for searching catalogs of metadata via the web. Engineering the desired interoperability requires adding additional constraints on CSW operation; one of the major constraints is selection of the xml schema that will be used to encode metadata for the service. The core CSW specification requires use of a basic xml schema that includes content defined by the Dublin Core Metadata specification. This document concerns use of the ISO19115/ISO19115 content models implemented using the ISO19139 xml schema for encoding of metadata content. Some more specific constraints on use of this implementation may be included in the separate document (planned) describing metadata constraints for different kinds of resources.

A set of other USGIN resource registry and discovery service profile documents discuss the other constraints and best practices to enable catalog interoperability. These include a profile for use of the CSW specification, providing details on how requests and search criteria should be encoded. A profile that describes metadata content required for different resources adds additional detail for specific resources. Finally vocabularies for categorizing resources and specifying other metadata properties are documented in a separate document; these vocabularies will need to be published in a web accessible registry to make them accessible.

1.1 Normative References

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 19115 designates these two normative references:

- ISO 19115:2005, *Geographic information - Metadata*

- ISO 19115/Cor.1:2006, *Geographic information – Metadata, Technical Corrigendum*

ISO 19119 designates these normative references:

- ISO 19119:2005, *Geographic information - Services*

- ISO 19119:2005/Amd 1:2008, *Extensions of the service metadata model ISO 19108 designates*:

- ISO 19108:2005, *Geographic information – Temporal Schema*

ISO 639-2, Codes for the representation of names of languages - Part 2: Alpha-3 code control ISO 8601, Data elements and interchange formats - Information interchange - Representation of dates and times

ISO/TS 19139:2007, Geographic information - Metadata – XML Schema Implementation

OGC 07-006r1¸ OpenGIS Catalog Services Specification version 2.0.2, Corrigendum 2 release, 2007

OGC 07-045, OpenGIS Catalogue Services Specification 2.0.2 - ISO Metadata Application Profile, Version 1.0.0, 2007

INCITS 453-2009, North American Profile of ISO 19115:2003 – Geographic Information – Metadata (NAP-Metadata), 2009, American National Standards Institute, Inc.

ISO 10646-1, Information technology — Universal Multiple-Octet Coded Character Set (UCS) — Part 1: Architecture and Basic Multilingual Plane

45   **RFC 2119,** Key words for use in RFCs to Indicate Requirement Levels, Network Working Group, 1997.

46 1.2 Purpose

47   The USGIN development team is proposing to use the North American Profile of ISO 19115/19119 metadata
48   as the content model (INCITS 453-2009), and the ISO 19139 xml schema for encoding this content in xml
49   documents that will be provided by USGIN CSW services. This profile document is meant to provide guidance
50   on the use of the ISO19139 XML schema to encode metadata for geoscience resources, with sufficient
51   guidance that developers of client or server applications using this service can produce interoperable
52   implementations of the OGC Catalog Service for the Web (CSW).

53 1.3 Terminology

54   The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT",
55   "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in Internet
56   RFC 2119.

57

58   **Application profile**: a schema that consists of data elements drawn from one or more namespaces,
59   combined together by implementers, and optimized for a particular local application. (Rachel Heery and
60   Manjula Patel, 2000, http://www.ariadne.ac.uk/issue25/app-profiles/)

61   **Catalog application**: Software that implements a searchable metadata registry. The application must support
62   the ability to register information resources, to search the registered metadata, to support the discovery and
63   binding to registered information resources within an information community.

64   **Code list**: a controlled vocabulary that is used to populate values for an xml element. Codelists are
65   distinguished by the fact that (in the context of this profile) they are built into xml schema, thus use of valid
66   codelist values is verified by simple xml validation against the schema.

67   **Data product specification**: a definition of the data schema and value domains for a dataset. The data
68   schema specifies entities (features), properties associated with each entity, the data type used to specify
69   property values, cardinality for property values, and if applicable, other logical constraints that determine data
70   validity. Value domains are specified for simple data types—strings or numbers, and may include controlled
71   vocabularies for terminology required to specify some properties.

72   **Dataset series**: collection of datasets sharing the same product specification (ISO 19115). ISO 19115 does
73   not define product specification. For the purposes of USGIN, a product specification defines a data schema,
74   any required controlled vocabularies, and recommended practices for use of schema.

75   **Dataset**: an identifiable collection of data (ISO19115). USGIN refines this concept to represent a collection of
76   data items in which individual data items are identified and accessible. DCMI definition is "Data encoded in a
77   defined structure" with additional comment "Examples include lists, tables, and databases. A dataset may be
78   useful for direct machine processing." The container may be a stand-alone digital file (mdb, spreadsheet, table
79   in a word document), a web service, or an enterprise database. Metadata for the collection is a different type
80   than metadata for individual items in the collection (dataset vs. features). Criteria for what unifies the collection
81   are variable (topic, area, author...). Synonym: structured data collection. This resource type represents the
82   intellectual artifact--the information content and organization (data schema); the dataset may have more than
83   one manifestation (format)--as a list, a table, or one or more databases that use different software
84   implementations.

85   **Interoperability**: "The capability to communicate, execute programs, or transfer data among various functional
86   units in a manner that requires the user to have little or no knowledge of the unique characteristics of those
87   units." ISO/IEC 2382-01 (SC36 Secretariat, 2003)

88   **Metadata element**: a discrete unit of metadata (ISO 19115), an attribute of a metadata entity. A metadata
89   element contains some content specifying the value of the element; this content may be simple—a number or
90   string, or may be another metadata entity.

91   **Metadata entity**: a named set of metadata elements describing some aspect of a resource.

92 **Metadata register**: an information store that contains a collection of registered metadata records, maintained
93 by a metadata registry. (ISO 11179)

94 **Metadata registry**: an information system for assignment of unambiguous identifiers to administered
95 metadata records. (ISO 11179)

96 **Metadata section**: Part of a metadata document consisting of a collection of related metadata entities and
97 metadata elements (ISO 191115).

98 **Metadata**: data about a resource in some context. Generalize from ISO 11179 definition of metadata, which
99 constrains the scope to data about data. For USGIN purposes, metadata may describe any resource—
100 including electronic, intellectual, and physical artifacts. Metadata represent resource characteristics that can
101 be queried and presented for evaluation and further processing by both humans and software.

102 **Profile**: set of one or more base standards and - where applicable - the identification of chosen clauses,
103 classes, subsets, options and parameters of those base standards that are necessary for accomplishing a
104 particular function [ISO 19101, ISO 19106]

105 **Resource**: An identifiable thing that fulfills a requirement. Usage here is closer to definition used in RDF
106 (www.w3.org/TR/REC-rdf-syntax*),* generalized from ISO19115, which defines resource as an 'asset or means
107 that fulfills a requirement' without defining asset or means. "An object or artifact that is described by a record in
108 the information model of a catalogue" (OGC 07-006r1)

109 **Service metadata**: metadata describing the operations and information available from a server.

110 **Source Specification**: The specification or standard that is being profiled.

111 **User Community**: A group of users, e.g. within a supply-chain industry, the members of which decide to make
112 a similar usage of the source specification in order to be able to interoperate.

113

114 1.4 ISO Schemas Location

115 ISO I9139 xml schemas are in an online repository at http://schemas.opengis.net/iso/19139/. Two versions are
116 posted: 20060504 and 20070417. In general the 20070417 should be preferred. Unfortunately, these two
117 directories both contain schema with the same target namespace, so there is no clear way to distinguish
118 applications that are based on one or the other. The medatadaEntity.xsd in the two directories is identical;
119 other schema have not been compared (but see http://lab.usgin.org/groups/csw-debug-blog/ogc-schema-
120 issues-relation-csw). The 20070417 directory contains schema implementing ISO Technical Specification
121 19139:2007 (dated 2007 Apr 17), which appear to include the changes from ISO 19115:2003 Cor 1;2006(E),
122 but this is not declared in any included documentation (need metadata on the metadata schema!).

2 Overview of the Profile

2.1 General Objectives

The Profile defines:

- mandatory and conditional metadata sections, metadata entities, and metadata elements
- the minimum set of metadata elements for any resource in order to conform to the Profile
- the core metadata for geographic datasets
- optional metadata elements that allow for a more extensive standard description of resources
- some recommended practices to increase the utility and interoperability of metadata.

2.2 Requirements

M (mandatory). Metadata element must have a valid value.

C (conditional). Metadata element is mandatory based on values of other metadata elements in the metadata record.

O (optional). Metadata element may be null in a valid document.

2.3 Use cases to be supported

This section includes a number of user scenarios that motivate development of a catalog application for the US Geoscience Information Network. At its heart, the problem is to find resources of interest via the internet, based on criteria of topic, place, or time, and learn how to access and use those resources.

Basic search — A user specifies a geographic bounding box and one or more text keywords to constrain the resources of interest, and searches a metadata catalog using these criteria. The user is presented with a web page containing a list of resources that meet the criteria, with links for each resource that provide additional detailed metadata, and direct access to the resource if an online version is accessible, e.g. as a web page, Adobe Acrobat document, or online application.

A portal application provides user with a map window that contains some simple base map information (political boundaries, major roads and rivers). User wishes to assemble a variety of other data layers for a particular area to view in the portal map view, e.g. slope steepness, geologic units, bedding orientation, and vegetation type for a hazard assessment. User centers map view on area of interest, then using an 'add data' tab, accesses a catalog application that allows them to search for web map services that display the desired datasets. After obtaining the results and reviewing the metadata for the located services, user selects one or more to add to the table of contents for the portal map viewer. Response from catalog has sufficient information to enable the portal application to load and display the resource (e.g. serviceType, ServiceOperation, OnlineResourceLinkage).

User searches for boreholes in an area. Returned metadata records have links to metadata for related information, like logs of different types, core, water quality data, etc. that the user can follow to browse related resources.

Complex search examples:

- Search based on related resources, for example a search for boreholes that have core for which photographs are available online.
- Boreholes that penetrate the Escabrosa formation.
- Sample locations for samples with uranium-lead geochronologic data.

164   •   Find links to pdf's of publications by Harold Drewes.

165   •   Find geologic maps at scale < 100,000 in the Iron Mountains.

166   •   Who has a physical copy of USGS I-427?

167 A catalog operator wishes to import and cache catalog records from a collaborating catalog that have been
168 inserted or updated during the last month (harvest).

169 2.4 Resources of interest

170 Table 1 summarizes the geoscience information resources of interest to the community that can be registered and discovered using this metadata profile.
171 Note that this collection of resource types includes several kinds of resources that are not typically associated with ISO19115/ISO19119, which were
172 created specifically for geospatial resources.

173 *Table 1. Summary of resource types described by metadata for US Geoscience Information Network catalogs. Resource type **names in bold** have been prioritized for*
174 *implementation in version one catalogs. The Resource type names include the type hierarchy encoded with the broader (parent) resource type indicated in the Broader*
175 *Resoure Type column.*

Resource Type hierarchy	Broader Resource Type	Source	Definition
Collection		DCMI resource Types http://dublincore.org/documents/dcmi-type-vocabulary/	An aggregation of resources. A collection is described as a group; its parts may also be separately described. (from http://www.ukoln.ac.uk/metadata/dcmi/collection-application-profile/): The term "collection" can be applied to any aggregation of physical or digital items. Those items may be of any type, so examples might include aggregations of natural objects, created objects, "born-digital" items, digital surrogates of physical items, and the catalogs of such collections (as aggregations of metadata records). The criteria for aggregation may vary: e.g. by location, by type or form of the items, by provenance of the items, by source or ownership, and so on. Collections may contain any number of items and may have varying levels of permanence. A "collection-level description" provides a description of the collection as a unit: the resource described by a collection-level description is the collection, rather than the individual items within that collection. Collection-level descriptions are referred to in Michael Heaney's *An Analytical Model of Collections and their Catalogues* as "unitary finding-aids" [AMCC].

Dataset	Collection	DCMI resource Types http://dublincore.org/documents/dcmi-type-vocabulary/	A collection of data items in which individual data items are identified and accessible. DCMI definition is "Data encoded in a defined structure." with additional comment "Examples include lists, tables, and databases. A dataset may be useful for direct machine processing." The container may be a stand-alone digital file (mdb, spreadsheet, table in a word document), a web service, or an enterprise database. Metadata for the collection is a different type that metadata for individual items in the collection. Criteria for what unifies the collection are variable (topic, area, author...). Synonym: structured data collection. This resource type represents the intellectual artifact--the information content and organization; the dataset may have more than one manifestation (format)--as a list, a table, databases, using different software implementations.
Catalog	Dataset	USGIN	a collection of data items that index resources, as in metadata records; a metadata registry. The resource represents the information content and organization. Catalogs are accessed using other resources, like an interactiveResource or Service, and may have different formats.
Physical artifact collection	Collection	USGIN	a collection of identifiable physical objects, unified based on some criteria. Criteria for defining a collection may be who collected, where curated, why collected, kind of material....
Document		USGIN	a packaged body of intellectual work; has an author, title, some status with respect to Review/authority/quality. USGS peer reviewed would be a 'status property'. Have to account for gray literature, unpublished documents, etc. A document may have a variety of physical manifestations (pdf file, hardbound book, tiff scan, Word processor document...), and versions may exist as the document is traced through some publication process. May be map, vector graphics, text. Sound, moving images are included as document types.
Image	Document	DCMI resource Types http://dublincore.org/documents/dcmi-type-vocabulary/	A visual representation other than text. Comment: Examples include images and photographs of physical objects, paintings, prints, drawings, other images and graphics, animations and moving pictures, film, diagrams, maps, musical notation. Note that Image may include both electronic and physical representations.
StillImage	Image	DCMI resource Types http://dublincore.org/documents/dcmi-type-vocabulary/	A static visual representation. Comment: Examples include paintings, drawings, graphic designs, plans and maps. Recommended best practice is to assign the type Text to images of textual materials if the intent of the image is to capture the textual content as opposed to the appearance of the medium containing the text. Instances of the type Still Image must also be describable as instances of the broader type Image. Subtype of Image.
Human-generated image	StillImage	USGIN	Image produced by human drawing or painting, using any media. May be entirely product of human imagination, human perception of the world, or a human-modified photographic image.

Photograph	StillImage	USGIN	Image produced by optical device with chemical or electronic image capture; represents things in the field of view directly as captured by the device. Photographs may be modified by human processing; there is a continuum between photographs and human-generated image. Distinction between the two is largely based on intention
Remote sensing Earth image	StillImage	USGIN	Image of earth surface acquired by an air born or earth-orbiting sensor. May be georeferenced such that location in the image directly corresponds to location on the earth.
Map	StillImage	USGIN	Human-generated depiction of some part of the earth using a mathematical system of correspondence between geometry in the image and location on the earth.
MovingImage	Document	DCMI resource Types http://dublincore.org/documents/dcmi-type-vocabulary/	A series of visual representations imparting an impression of motion when shown in succession. Comment: Examples include animations, movies, television programs, videos, zoetropes, or visual output from a simulation. Instances of the type Moving Image must also be describable as instances of the broader type Image. Subtype of Image. [Commonly include sound]
Sound	Document	DCMI resource Types http://dublincore.org/documents/dcmi-type-vocabulary/	A resource primarily intended to be heard. Comment: Examples include a music playback file format, an audio compact disc, and recorded speech or sounds.
Text	Document	DCMI resource Types http://dublincore.org/documents/dcmi-type-vocabulary/	A resource consisting primarily of words for reading. Comment: Examples include books, letters, dissertations, poems, newspapers, articles, archives of mailing lists. Note that facsimiles or images of texts are still of the genre Text.
Hypertext document collection	Text	USGIN	A collection of files that contains http hyperlinks between them. Links to documents or other resources outside of the collection are possible. The criteria for determining membership in the collection are somewhat arbitrary, but in general the 'site' should contain related documents authored and managed by the same agent.
Event		DCMI resource Types http://dublincore.org/documents/dcmi-type-vocabulary/	A non-persistent, time-based occurrence. Metadata for an event provides descriptive information that is the basis for discovery of the purpose, location, duration, and responsible agents associated with an event. Examples include an exhibition, webcast, conference, workshop, open day, performance, battle, trial, wedding, tea party, and conflagration.
Project	Event	USGIN	Project represents a funded activity that has some purpose; projects have associated extents, which represent the area of interest for the project. This extent serves as a mechanism to filter descriptions and concepts in the information system for those that may be related to the project based on spatial relationships. Projects in a large organization will likely have hierarchical (part-whole) relationships.

Model		USGIN	algorithm, workflow; an abstract representation of a collection of related processes, objects and relationships. A model resource may be related to various kinds of document that portray the model, or to software that implements the model, or with datasets as input or output. Not clear that there is a compelling use case for cataloging models separately from the software or documents that are manifestations of the model.
Physical artifact		DCMI resource Types http://dublincore.org/documents/dcmi-type-vocabulary/	general category for physical resources that are indexed by metadata records; also root of an artifact type hierarchy. An identifiable physical object. Identification is always a function of some human intention, thus differentiating an artifact from other 'natural' things. Note that digital representations of, or surrogates for, these objects should use Image, Text or one of the other types.
Service		DCMI resource Types http://dublincore.org/documents/dcmi-type-vocabulary/	A system that provides one or more functions via a network interface designed for machine interaction. Comment: Examples include a photocopying service, a banking service, an authentication service, interlibrary loans, a Z39.50 or Web server. (RSS feed???). An implementation of an interface to some sort of digital resource, using a 'pull' model in which client requests some content from the service, and receives that content in a single 'response' package. Difficult to draw line on when service provides 'files' and when it provides 'data'. Responses are always(?) in a form that could be considered a file. [how to deal with layers, various feature types in service; what are identity properties]. An interface to a digital resource that provides a continuous (with some sampling interval?) feed of some sort of data. Uses push model--client establishes connection and monitors for posting/presentation of new data. [What are identity properties]
Software			A computer program in source or compiled form. Comment: Examples include a C source file, MS-Windows .exe executable, or Perl script.
Stand-Alone-Application	Software	DCMI resource Types http://dublincore.org/documents/dcmi-type-vocabulary/	Identifiable stand alone software application. Identity of resource is based on function performed, input and output requirements, and authorship. The same application may be packaged in different file formats to run in different software environments; thus an application will have one or more associated digital files. For the purposes of this catalog scheme, stand alone applications are software that can be packaged in a single file that can be transferred between machines, unpackaged and compiled or installed on a computer meeting specified hardware and software environment conditions, to execute the described function on that computer, independent of any network connection.

Interactive-Resource	Software	DCMI resource Types http://dublincore.org/documents/dcmi-type-vocabulary/	A resource requiring interaction from the user to be understood, executed, or experienced. Comment: Examples include forms on Web pages, applets, multimedia learning objects, chat services, or virtual reality environments. Interactive resources are software driven. From the point of view of the catalog, they are accessed by a URL to a web site that is the interface for operating the application. The application operates by interaction with one or more human participants. The application requires network connection to operate, is accessible via the internet, and requires human interaction.
Structured digital data item		USGIN	An individually identifiable item in a structured digital data collection. Characterized by a schema, and some particular values. In ISO11179 terms, this is an instance of a data element. Tagging, commenting, reviewing, rating community interaction with catalog will probably require metadata records about particular data items in cataloged datasets (including metadata items in catalogs.)
Sampling point, site, station	Structured digital data item	From ScienceBase item types, SMR redux	A resource that is a location-based container/base for observation data. Should this be generalized to OGC O&M samplingFrame to include other sampling geometry (borehole, image footprint)... Analogous in function to a keyword, but carries metadata on who located, when, why, how...

176

177   3   USGIN profile of ISO 19115

178   3.1 USGIN Core Metadata Elements

179   3.1.1 Spatial dataset and spatial dataset series

180 Table 2 is a listing of ISO19115 metadata elements used to describe datasets. These will be included in XML metadata documents that have the root
181 element MD_Metadata. Elements are discussed in the order that they appear in the metadata document.

182 *Table 2. Description best practices for ISO19139 metadata element in USGIN profile. This table includes base elements.*

ISO 19115 (M/C/O) xPath from MD_Metadata	NAP-USGIN M/C/O	Comments
Metadata file identifier (O) `fileIdentifier`	M-M	A unique File Identifier (GUID) must be included to allow CSW operations such as GetRecordById or harvest transactions. USGIN as well as ANZLIC recommend the use of the UUID (Universally Unique Identifier) for the `fileIdentifier`. The `fileIdentifier` is used to identify duplicate copies of metadata records, to reference one metadata record from another (via `MD_DataIdentification/aggregationInfo`), or to reference metadata from a described resource (e.g. `DS_Dataset/has/MD_Metadata`). If there is a difference between the two metadata records then one can determine the appropriate version by the content of other elements in the metadata record. The authoritative metadata record should be the only one made publicly available in metadata search systems such as a catalog service.
Metadata language (M) `language`	M-M	NAP specifies that language string is composed of a language code (ISO639-2/T) and an alpha3 country code (ISO3166-1). The syntax is "<ISO639-2/T three letter language code><;><blank space><ISO3166-1 three letter country code>" Language code is given in lowercase. Country code is given in uppercase, e.g. fra; CAN However, most CSW client and server applications only support the three letter language code and USGIN recommends following
Metadata character set (C) `characterSet`	M-M	NAP specifies default is "utf8", codelist = napMD_CharacterSetCode. USGIN requires that a character set code is defined to facilitate CSW servers (deegree, etc.).
Parent metadata record (O) `parentIdentifier`	O-X	Not used in USGIN profile. Used in ISO19115 to inherit metadata properties from parent to child records; USGIN CSW service implementations do not require clients to be able to navigate parent links to obtain inherited metadata properties, or to process filters using parent links, so this element is not used. To represent relationships between described resources use `MD_Identification/aggregationInfo`.

ISO 19115 (M/C/O) xPath from MD_Metadata	NAP-USGIN M/C/O	Comments
Resource type (C) `hierarchyLevel`	M-M	Cardinality is 1...*. Default `hierarchyLevel.MD_ScopeCode@codeListValue` is "dataset" Mandatory for NAP and USGIN Metadata implementations. At least one napMD_ScopeCode codelist value is required. Codelist is {attribute, attributeType, collectionHardware, collectionSession, dataset, series, nonGeographicDataset, dimensionGroup, feature, featureType, propertyType, fieldSession, software, service, model, tile} This property essentially categorizes the indexed resource with types that determine the metadata content and the required behavior to access the indexed resource.
Resource hierarchy level name (C) `hierarchyLevelName`	O-M	ISO 19115 assumes that the metadata hierarchy level name defaults to "dataset" if it is not documented. NAP does not use it, recognizing that it is redundant. USGIN makes this property mandatory to identify the USGIN resource type from Table 1 (above). Default USGIN `hierarchyLevelName.CharacterString` is "Dataset." Encode hierarchy by including `hierarchyLevelName` elements for all broader resource categories. E.g. default should also include a `hierarchyLevelName`="Collection" element.
Metadata point of contact (M) `Contact/CI_ResponsibleParty`	M-M	Cardinality on contact is 1..*. USGIN requires at least one `CI_ResponsibleParty` to include a contact e-mail address (`electronicMailAddress`), in addition to the NAP rule that count of (individualName + organisationName + positionName) > 0. This element contains contact information (`role.CI_RoleCode@codeListValue` = "pointOfContact") for the metadata record, e.g. for users to report errors, updates to metadata, etc.
Metadata date stamp (M) `dateStamp`	M-M	USGIN profile requires use of `dateStamp/gco:DateTime.` This is the date when the metadata record was created or updated (following NAP). The `dateStamp` is assumed to be updated to reflect any change in the metadata record that the metadata publisher wishes to propagate through the USGIN catalog system. This is the time stamp that will be used by harvesters to determine if a metadata needs to be updated in a harvesting catalog.
Metadata standard name (O) `metadataStandardName`	M-M	NAP specifies "NAP - Metadata". US GIN profile conformant metadata is indicated by using " ISO-NAP-USGIN" Use is mandatory to indicate that the metadata record conforms to this profile.
Metadata standard version (O) `metadataStandardVersion`	O-M	For this version of the USGIN profile, use "1.0" Use is mandatory to specify the version of the profile used

ISO 19115 (M/C/O) xPath from MD_Metadata	NAP-USGIN M/C/O	Comments
DataSet Identifier (O) `dataSetURI`	O-C	For USGIN, this is a string that uniquely identifies the described resource. If the resource has an identifier, it should be included here; if the resource will be referenced from other metadata, it must have an identifier here. Any kind of resource (not only datasets) may have an identifier. The protocol for the identifier is not specified. ISO19115 and NAP both seem to use the content of the `dataSetURI` element as a URL for online access to the resource, which seems inconsistent with the element name as a dataset identifier. Some implementations place a URL for online access in the dataSetURI; for USGIN profile, the `MD_Distribution/transferOptions/MD_DigitalTransferOptions/online/CI_OnlineResource` is used to specify URLs for access to the resource. The dataSetURI should be considered an opaque identifier. This will avoid ambiguity about where to find URLs for online access to a described resource. If the dataset is coupled to a service, the value of the `MD_Metadata/dataSetURI` attribute is the unique resource identifier used by srv:coupledResource to link the service with the dataset.
Other languages (C) `locale`	C-C	Other languages used in metadata free text description. If description in more than one language is provided, this property should indicate what those languages are. The primary language used for metadata description is identified with `MD_Metadata/language` and `characterSet` and any additional languages are identified by `MD_Metadata/locale/PT_locale` elements, in which the language is provided according to ISO 639-2/T three-letter terminology codes in lowercase, and an optional country is provided according to ISO 3166-1 three-letter codes in uppercase, and mandatory characterEncoding.
[role] Resource spatial representation (O) `spatialRepresentationInfo`	O-O	Best practice is to include metadata for spatial representation if the described resource is a georeferenced dataset. Metadata is instantiated as one or more of `MD_GridSpatialRepresentation`, `MD_Vector-SpatialRepresentation`, `MD_Georectified`, or `MD_Georeferenceable` classes. USGIN profile follows NAP for spatial representation metadata. See INCITS 453.
[role] Resource's spatial reference system (O) `referenceSystemInfo`	(O)	Description of the spatial and/or temporal reference systems used in the dataset. NAP specifies { (identificationInfo/spatialRepresentationType = "vector") or (identificationInfo/spatialRepresentationType = "grid") or (identificationInfo/spatialRepresentationType = "tin") implies count `referenceSystemInfo` >= 1) }
Reference System identifier code `referenceSystemInfo/ MD_ReferenceSystem/ referenceSystemIdentifier/ RS_Identifier/code`	C-C	If `referenceSystemInfo` is included, then the `RS_Identifier` element must include at least a code value. For USGIN the code should be a value from the EPSG Geodetic Parameter Dataset register (http://www.epsg.org/) in the form "EPSG:nnnn" where nnnn is the EPSG code number for the CRS. If the CRS is not defined in the EPSG registry, then the procedure specified in the NAP profile should be followed, e.g. the CRS shall be described according to ISO 19111 and ISO/TS 19127, assigned an identifier, and registered with an authority such that it may be referenced here. The `RS_Identifier/ codespace` in this case should identify the registry authority where the CRS definition is registered, such that the definition can be located. Best Practice for USGIN purposes is to provide georeferenced data using one of the EPSG defined coordinate reference systems if this is possible.

ISO 19115 (M/C/O) xPath from MD_Metadata	NAP-USGIN M/C/O	Comments
Metadata extension information (O) `metadataExtensionInfo`	X-X	not used in this profile
Resource identification information (M) `identificationInfo`	M-M	Cardinality 1..*. The content of this element identifies the described resource. For resources that are not services, use `MD_DataIdentification`, otherwise `SV_ServiceIdentification` is required. `SV_ServiceIdentification` elements are not described here.
Resource citation (M) `identificationInfo[1]/ MD_DataIdentification/citation /CI_Citation`	M-M	The citation attribute provides information for citing the described resource. Citation is defined by Webster as "an act of quoting". The precise semantics of what an identification/citation is supposed to be are not very well articulated in ISO19115. For USGIN purposes, this should be viewed as information to identify the intellectual origin of the content in the described resource, along the lines of a citation in a scientific journal. Required content for a `CI_Citation` element are `title`, `date`, and 'responsibleParty'.
Resource title (M) `identificationInfo[1]/ MD_DataIdentification/citation /CI_Citation/title`	M-M	USGIN recommends using titles that inform the human reader about the dataset's content as well as its context.
Resource reference date (M) `identificationInfo/ MD_DataIdentification/ citation/CI_Citation/ date/CI_Date/date/`	M-M	Best practice is to include at least the date of publication or creation of the resource. The date of the resource reported in the citation corresponds to the resource's last update version according to its update frequency. `CI_Date` content includes a `date` and `dateType`. Date for USGIN profile uses xs:date data type, defined thus "date uses the date/timeSevenPropertyModel, with hour, minute, and second required to be *absent*. `timezoneOffset`· remains optional" (http://www.w3.org/TR/xmlschema11-2). Example date encoding: 2000-12-12+13:00, 2006-10-01. If the month or day is not known, encode as '00', for example '2006-00-00'. `DateType` is from napCI_DateTypeCode which identifies the event used for the temporal aspect of the resource. This date is distinct from the `dateStamp` for the metadata record, or the `EX_Extent/temporalElement` that specifies the time period to which the resource content is applicable.

ISO 19115 (M/C/O) xPath from MD_Metadata	NAP-USGIN M/C/O	Comments

Unique resource identifier (O)
`identificationInfo/`
`MD_DataIdentification/`
`citation/CI_Citation/`
`identifier/MD_Identifier`
	C-C	NAP makes `MD_Identifier` mandatory for dataset and dataset series. For USGIN, if the Citation has an identifier that is different from the identifier for the described resource (`MD_Metadata/dataSetURI`), it must be included here.
		For USGIN purposes, this element content value should be only considered an identifier for the citation, without any assumption that it will use http protocol. The identifier may be resolvable to a URL, if a protocol prefix specifies an identifier scheme that is resolvable (e.g. http, urn…), but this is not necessary for a valid document, and should not be assumed when processing metadata documents.
		The USGIN profile requires the use of MD_Identifier element to identify resources. RS_Identifier may substitute for MD_Identifier in the ISO19139 schema, but the USGIN profile requires use of MD_Identifer. If additional codespace and version content is associated with the identifier, it should be encoded as `MD_Identifier/authority/CI_Citation/alternateTitle` and `MD_Identifier/authority/-`
		`CI_Citation/edition`

Resource responsible party (O)
`identificationInfo/`
`MD_DataIdentification/`
`citation/CI_Citation/`
`citedResponsibleParty`
	M-M	CI_Citation cardinality exactly one required. USGIN requires at least one `CI_ResponsibleParty` following the NAP rule that count of (individualName + organisationName + positionName) > 0. The `CI_ResponsibleParty/role/CI_RoleCode@codeListValue` is from napCI_RoleCode. For most intellectual content, the responsible party is what would normally be considered the author of a work. Best practice is to include point of contact information for the resource in `MD_DataIdentification/pointOfContact/-`
		`CI_ResponsibleParty`. Guidance on use of role codes would be helpful for consistency, but has not been developed as yet.

Resource presentation form (O)
`identificationInfo/`
`MD_DataIdentification/`
`citation/CI_Citation/`
`presentationForm`
	O-C	The form in which the resource is available. USGIN prescribes that unless there is a difference between the presentation format of the cited item and distribution format for the resource described by the metadata, use `distributionInfo/MD_Distribution/distributionFormat/MD_Format` to avoid ambiguity. `presentationForm` uses CodeList = napCI_PresentationFormCode < documentDigital, documentHardcopy, imageDigital , imageHardcopy, mapDigital, mapHardcopy, modelDigital, modelHardcopy, profileDigital, profileHardcopy, tableDigital, tableHardcopy, videoDigital, videoHardcopy, audioDigital, audioHardcopy, multimediaDigital, multimediaHardcopy, diagramDigital, diagramHardcopy >

Resource series (O)
`identificationInfo/`
`MD_DataIdentification/`
`citation/CI_Citation/series`
	O-O	Information about the (publication) series or collection of which the resource is a part. NAP rule: (name + issueIdentification) > 0.

Resource other citation details (O)
`identificationInfo/`
`MD_DataIdentification/`
`citation/CI_Citation/`
`otherCitationDetails`
	O-?	"Other information to complete a citation." NAP

ISO 19115 (M/C/O) xPath from MD_Metadata	NAP-USGIN M/C/O	Comments

Resource collective title (O)
`identificationInfo/`
`MD_DataIdentification/`
`citation/CI_Citation/`
`collectiveTitle`
	O-C	Title of the combined resource that the cited resource is part of, for example the cited resource may be a paper in an anthology, in which case the anthology title would be the collective title. Required if the cited resource is part of such a collective work.

Resource abstract (M)
`identificationInfo/`
`MD_DataIdentification/abstract`
	M-M	A free text summary of the content, significance, purpose, scope, etc. of the resource. Exactly one value.

Resource purpose (O)
`identificationInfo/`
`MD_DataIdentification/purpose`
	O-O	"Summary of the intentions for which the dataset was developed. Purpose includes objectives for creating the dataset and what the dataset is to support." NAP

Resource status (O)
`identificationInfo/`
`MD_DataIdentification/status`
	M-M	Value is from napMD_ProgressCode codelist: <completed, historicalArchive, obsolete, onGoing, planned, required, underDevelopment, proposed>. Obsolete is synonymous with deprecated.

Resource point of contact (O)
`identificationInfo/`
`MD_DataIdentification/`
`pointOfContact`
	O-C	CI_ResponsibleParty element here would contain information for point of contact to access the resource. This information is mandatory for physical resources such as core, cuttings, samples, manuscripts. USGIN rule that count of (individualName + organisationName + positionName) > 0. The `CI_ResponsibleParty/role/CI_RoleCode@codeListValue` is from napCI_RoleCode.

Resource maintenance (O)
`identificationInfo/`
`MD_DataIdentification/`
`resourceMaintenance`
	O-O	This element provides information about the maintenance schedule or history of the resource (or some subset/part of the resource specified by the scope and scope description) described by the metadata record. 0 to many `MD_MaintenanceInformation` elements may be included. Different `MD_MaintenanceInformation` elements are required to have different napMD_ScopeCode or `MD_ScopeDescription`. Usage of `MD_ScopeDescription` is poorly described, and no actual examples of usage could be found; it would appear to allow identification of a set of attribute or features (by name?), or feature instances or attribute instances (identified how?), or a dataset, to which the maintenance information applies.

ISO 19115 (M/C/O) xPath from MD_Metadata	NAP-USGIN M/C/O	Comments

Graphic overview of resource (O)
`identificationInfo/`
`MD_DataIdentification/`
`graphicOverview`
	O-O	Highly recommended to include a URL providing a web-accessible visual representation of the resource if it is applicable to the described resource, particularly for geographic datasets that may be represented by maps. If `MD_BrowseGraphic` is included, `MD_BrowseGraphic/filename` character string is mandatory. USGIN Recommended practice is to provide a complete URL as a gco:characterString value for the `filename` property. Use napMD_FileFormatCode code values (http://www.fgdc.gov/nap/metadata/-register/codelists.html#IC_115) in `fileType/CharacterString`. See section 4.15.3 Codelists for details on the encoding.
		Repeatable element; multiple values may present different resolutions, or different parts of resource. Names associated with overview should provide sufficient information for user to distinguish these.

Resource format (O)
`identificationInfo/`
`MD_DataIdentification/`
`resourceFormat`
	X-X	This element is not used by NAP or USGIN; this information is encoded in `MD_Metadata/distributionInfo/MD_Distribution/` in USGIN metadata (see 4.12 Use of MD_Distribution and MD_Distributor). A registry for distribution formats needs to be established with a codelist type approach to `MD_Format/name` for the distribution format in order to enable better interoperability.

Resource keywords (O)
`identificationInfo/`
`MD_DataIdentification/`
`descriptiveKeywords/`
`MD_Keyword`
	O-O	Best Practice for USGIN profile metadata is to supply keywords to facilitate the discovery of metadata records relevant to the user.
		USGIN Keywords: USGIN keyword vocabularies are in development. Future versions of this profile may include required keyword vocabularies.
		Other Keywords: Keyword Type - allowed values from napMD_KeywordTypeCode: <discipline, place, stratum, temporal, theme, product, subTopicCategory>
		NAP MD_Keyword only requires that the keyword string be included. USGIN requires that `MD_Keyword/keyword` contain a `CharacterString` (see section 4.15). USGIN best practice is to include keywords in English.

Condition applying to access and use of resource (O)
`identificationInfo/`
`MD_DataIdentification/`
`resourceConstraints/`
	O-O	Restrictions on the access and use of a resource or metadata. Follow NAP for specification of `resourceConstraints`. This attribute provides information for access control to the described resource itself. In some situations, the `metadataConstraints` may allow a user to learn of the existence of a resource that they may not actually be able to access without further clearance. Constraints may be represented by `MD_Constraint`, `MD_LegalConstraint`, or `MD_SecurityConstraint`.

ISO 19115 (M/C/O) xPath from MD_Metadata	NAP-USGIN M/C/O	Comments
Aggregation information (O) `identificationInfo/ MD_DataIdentification/ aggregationInfo/ MD_AggregateInformation`	O-O	The citation for or name of an aggregate dataset, the type of aggregate dataset, and optionally the activity that produced the dataset. `MD_AggregateInformation` requires either `aggregateDataSetName/CI_Citation` or `aggregateDataSetIdentifier/MD_Identifier`. `associationType` is mandatory, from napDS_AssociationTypeCode: <crossReference, largerWorkCitation, partOfSeamlessDatabase, source, stereoMate, isComposedOf>. If the related resource has an associated metadata record, USGIN recommended practice is to include the identifier for that metadata record in `aggregateDataSetIdentifier/MD_Identifier`. For related resources that do not have a metadata record, `aggregateDataSetName/CI_Citation` may be used; this element is optional if `aggregateDataSetIdentifier` has a value. For USGIN profile, this property, rather than `MD_Metadata/parentIdentifier`, should be used to indicate relationships between described resources.
Resource spatial resolution (O) `MD_DataIdentification/ spatialResolution/ MD_resolution/ equivalentScale/ MD_RepresentativeFraction/ denominator`	C-C	USGIN requires use of `equivalentScale/../denominator` to express spatial resolution, in order to be more easily interoperable. ISO19139 schema requires `MD_resolution` to be specified by an `equivalentScale/MD_RepresentativeFraction/denominator` or a `distance` (or both), so if a `distance` is available, that should be supplied as well. The resolution distance represents the smallest length between two resolvable points in the dataset. To calculate `equivalentScale` given a resolution distance, recommended practice is to divide the resolution distance in meters by 0.0005. This assumes that the smallest distance resolvable in a map display for human usage is 0.5 mm.
Resource language (O) `identificationInfo/ MD_DataIdentification/ language`	M-M	Language for content of described resource. The mandatory optionality is inherited from NAP, although it does not make sense for non-language based content like images or physical samples. Default value is 'eng'. If language is not applicable to the described resource use 'zxx'. Multiple instances of this element indicate that the linguistic content of the resource is available in multiple languages. Three-letter language code followed by an optional three-letter country code: <ISO 639-2/T three letter language code>{<;><blank space><ISO 3166-1 three letter country code>} Language code is given in lowercase. Country code is given in uppercase. ISO 639 codelists are available at http://www.loc.gov/standards/iso639-2/php/code_list.php. ISO 3166-1 codelists are at http://www.iso.org/iso/english_country_names_and_code_elements.
Topic category `identificationInfo/ MD_DataIdentification/ topicCategory`	C-C	NAP specifies that topicCategory code shall be provided when hierarchyLevel is set to "dataset" or "dataset series". Codes are from napMD_TopicCategoryCode: <farming, biota, boundaries, climatologyMeterologyAtmosphere, economy, elevation, environment, geoscientificInformation, health, imageryBaseMapsEarthCover, intelligenceMilitary, inlandWater, location, oceans, planningCadastre, society, structure, transportation, utilitiesCommunication>. Most USGIN resources will have topicCategory="geoscientificInformation", which is the default value for this profile. More specific topic categorization should be done using keywords. NAP declares not applicable to services.

ISO 19115 (M/C/O) xPath from MD_Metadata	NAP-USGIN M/C/O	Comments
Resource content extent identificationInfo/ MD_DataIdentification/ extent/EX_Extent	C-C	Defines the spatial (horizontal and vertical) and temporal region to which the content of the resource applies. For USGIN, the spatial extent is a rectangle that bounds the geographic extent to which resource content applies. NAP specifies required when hierarchyLevel is set to 'dataset'. Best Practice for USGIN is to include an extent for any resource with content related to some geographic or temporal location. For geoscience resources, the temporal extent may be expressed using time ordinal eras from a geologic time scale if the resource is related to some particular geologic time. USGIN specifies count(description + geographicElement + temporalElement) >0
Resource content extent description identificationInfo/ MD_DataIdentification/ extent/EX_Extent/description	C-C	Free text that describes the spatial and temporal extent of the dataset. USGIN specifies that description is mandatory if a geographicElement or temporalElement is not provided. Note that if geographic place names are used to express the geographic extent, USGIN profile specifies that these should be encoded using keyword with keyword type code = 'place.' Geographic names may be duplicated in the EX_Extent/description.
Resource content extent bounding box identificationInfo/ MD_DataIdentification/extent/ EX_Extent/geographicElement/ EX_GeographicBoundingBox	O-C	USGIN profile requires that if an EX_Extent/geographicElement is supplied, it include a geographic bounding box with bounding latitude and longitude expressed using WGS 84 decimal degrees. The corner coordinates for the geographic bounding box must not coincide in one point, because this may result in fatal errors with some CSW implementations. Point locations must thus be represented as tiny rectangles. USGIN recommended practice is to place the actual point location in the lower left corner of the rectangle.
Resource content extent geographic description identificationInfo/ MD_DataIdentification/extent/ EX_Extent/geographicElement/ EX_GeographicDescription	C-X	Not used by USGIN profile, use keyword with type code = 'place'. This ISO19115 element provides an MD_Identifier element that identifies a geographic location by name. MD_Identifier provides an authority/CI_Citation that specifies the authority for a location name, and a code, which is a text string identifying the location. For the purposes of USGIN metadata, this information should be encoded using keywords, for which the napMD_KeywordTypeCode = 'place'; the thesaurus/CI_Citation has the same content as EX_GeographicDescription/authority/CI_Citation, and the keyword is the same as the EX_GeographicDescription/code.
Resource content extent bounding polygon identificationInfo/ MD_DataIdentification/extent/ EX_Extent/geographicElement/ EX_BoundingPolygon	C-X	Not used by USGIN profile. To improve interoperability, USGIN mandates the use of Geographic Bounding Box instead of bounding polygon. "An element which describes inclusions or exclusions in a resource. The enclosed boundary of the dataset expressed in x-y coordinates." NAP mandates this element if no other Geographic Bounding Box, Geographic Description, Temporal Element, or Vertical Element are not provided.

ISO 19115 (M/C/O) xPath from MD_Metadata	NAP-USGIN M/C/O	Comments

Resource temporal extent (O)
 	
`identificationInfo/`
`MD_DataIdentification/extent/`
`EX_Extent/temporalElement/`
`EX_TemporalExtent/extent/`
`TimePeriod`
	O-O	Property contains information about temporal extent to which resource is applicable. For many geoscience resources, this would be the geologic time period(s) to which the resource applies. Although `TM_Primitive` allows the description of an instant, USGIN requires a TM_Period (`TimePeriod`) for temporal extent. USGIN requires the values for `beginPosition@frame` and `endPosition@frame` to be populated using numeric time coordinates in Ma, measured positive increasing older with an origin at 1950 CE (see Temporal extents). The default frame attribute value for geologic time coordinates is "urn:cgi:trs:CGI:StandardGeologicTimeMa"

Resource spatio-temporal extent (O)
 	
`identificationInfo/`
`MD_DataIdentification/extent/`
`EX_Extent/temporalElement/`
`EX_SpatialTemporalExtent/`
	O-X	Not used. Although use of `EX_SpatialTemporalExtent` is allowed by ISO19139 and NAP, USGIN mandates encoding space time location with `EX_TemporalExtent` and `EX_GeographicBoundingBox`.

Resource vertical extent (O)
 	
`identificationInfo/`
`MD_DataIdentification/extent/`
`EX_Extent/verticalElement/`
`EX_VerticalExtent`
	O-O	Vertical extent is used to provide elevation location for resources that have an explicit vertical location. Most common example will be samples related to vertical location in a borehole. The borehole trace is the vertical CRS within which the sample will be located, typically using coordinates measured in linear distance from the collar (or ground level, or Kelly bushing) of the borehole. `EX_VerticalExtent` has `minimumValue`, `maximumValue` that are real numbers, and a `verticalCRS` `verticalCRS` has (minimally) an xlink:href attribute which references an EPSG registry code (http://www.epsg-registry.org/). For interoperability, USGIN mandates use of a VerticalCRS with origin at World mean sea level (MSL), with elevations measured up positive in meters; the URI for this VerticalCRS is "urn:ogc:def:crs:EPSG::5714"

ISO 19115 (M/C/O) xPath from MD_Metadata	NAP-USGIN M/C/O	Comments
[role] Content information (O) `contentInfo`	O-O	Characteristics describing the feature catalog, coverage, or image data. `MD_ContentInformation` is an abstract class. One or more of `MD_FeatureCatalogueDescription` or `MD_CoverageDescription` or `MD_ImageDescription` elements may be used to specify this content. `MD_FeatureCatalogueDescription` describes content in a feature service or dataset like an ESRI geodatabase that may have more than one feature, e.g. geologic unit outcrop polygons, fault line features, and point observation locations for strike and dip data. The `MD_FeatureCatalogueDescription` only provides a `CI_Citation` link to the full feature catalog, which may use ISO19110 or ISO11179. `MD_CoverageDescription` is for datasets that are one of the types listed in napMD_CoverageContentTypeCode: image, thematicClassification, physicalMeasurement. A coverage is a data structure that acts as a function to return values from its range for any direct position within its spatiotemporal domain (OGC 07-067r5). Image coverages return values for light intensity in a given wavelength range, thematicClassification coverages return codes corresponding to some domain concept, and physicalMeasurement coverages return values representing some physical quantity like magnetic susceptibility, density, resistivity. USGIN currently makes no recommendation for use of contentInfo; follow NAP recommendations (see INCITS 453).
[role] Resource distribution information (O) `distributionInfo`	O-O	This element provides information to inform users how to obtain or access the described resource. Cardinality is 0..1. US GIN profile specifies that if distribution information is included (`MD_Distribution` is not null), then at least one `MD_Distribution/distributionFormat` and one `MD_Distribution/transferOptions` element is required, and the specified format is available via the specified transfer options. See section 4.12 'Use of MD_Distribution and MD_Distributor' for instructions for more complicated combinations of distributor, format, transfer options, and ordering instructions.

Resource distribution format (O)
`distributionInfo/`
`MD_Distribution/`
`distributionFormat`
	O-O	Information on the format or physical manifestation of the resource. If the resource is a physical resource, like a book, rock sample, paper document, the `distributionFormat/MD_Format/name` is mandatory, and must be from the USGIN distribution format codelist (see 8.1 Distribution format).

Resource distributor information (O)
`distributionInfo/`
`MD_Distribution/distributor/`
`MD_Distributor/`
	O-C	*USGIN differs from NAP* in this case (but not with ISO19115) by allowing multiple distributors, and binding between distributors, transfer options, and formats. For USGIN profile, each `distributor/MD_Distributor` is a binding between one or more transfer options and the distributor formats that are available through that/those transfer options (`MD_DigitalTransferOptions/onLine/CI_OnlineResource` in particular). If different formats are available from the same distributor, or have different transfer options, these should be represented as different `distributor/MD_Distributor` instances. See section 4.12 'Use of MD_Distribution and MD_Distributor' for instructions on use of these elements.

ISO 19115 (M/C/O) xPath from MD_Metadata	NAP-USGIN M/C/O	Comments

Resource distributor responsible party
 	
`distributionInfo/`
`MD_Distribution/`
`distributor/MD_Distributor/`
`distributorContact/`
`CI_ResponsibleParty`
	C-C	If `distributionInfo` is not null, `MD_Distributor` is required, which requires one `CI_ResponsibleParty`. For responsible party, count of (`individualName` + `organisationName` + `positionName`) > 0, and napCI_RoleCode is required. RoleCodes applicable in this context include: <resourceProvider, custodian, owner, distributor, pointOfContact, publisher, author, editor, rightsHolder>.

Resource distributor order process (O)
 	
`distributionInfo/`
`MD_Distribution/distributor/`
`MD_Distributor/`
`distributionOrderProcess/`
`MD_StandardOrderProcess`
	(O-O)	Information on the availability of the service which includes at least one of fees, available date and time, ordering instructions, or turnaround.

Resource distributor format (O)
 	
`distributionInfo/`
`MD_Distribution/distributor/`
`MD_Distributor/`
`distributorFormat/MD_Format`
	(O-C)	See section 4.12 'Use of MD_Distribution and MD_Distributor' for instructions on use of these elements. If the resource is a physical resource, like a book, rock sample, paper document, the USGIN requires `distributorFormat/MD_Format/name` with a value from the USGIN distributionFormatCode list.

Resource distributor online distribution linkage (O)
 	
`distributionInfo/`
`MD_Distribution/distributor/`
`MD_Distributor/`
`distributorTransferOptions/`
`MD_DigitalTransferOptions/`
`online/CI_OnlineResource/`
`linkage`
	M-M	Digital transfer options are "Technical means and media by which a dataset is obtained from the distributor." NAP requires `CI_OnlineResource/linkage` and `CI_OnlineResource/protocol` in `CI_OnlineResource`. The protocol element defines a valid internet protocol used to access the resource. NAP recommended best practice is that the protocol should be taken from an official controlled list such as the Official Internet Protocol Standards published on the Web at http://www.rfc-editor.org/rfcxx00.html or the Internet Assigned Numbers Authority (IANA) at http://www.iana.org/numbers.html. 'ftp' or 'http' are common values.
		The `linkage` element should contain the complete URL to access the resource directly (see section 4.12). `CI_OnlineResource` requires a `Linkage` element that is a `gmd:URL`. The `CI_OnlineResource/name` element may duplicate the file name if the URL is a link to a file, but it is recommended to provide a user-friendly label for the file that could be presented in a user interface.

ISO 19115 (M/C/O) xPath from MD_Metadata	NAP-USGIN M/C/O	Comments
Resource distributor online distribution application profile (O) `distributionInfo/ MD_Distribution/distributor/ MD_Distributor/ distributorTransferOptions/ MD_DigitalTransferOptions/ online/CI_OnlineResource/ applicationProfile`	C-C	`applicationProfile` is required if the `CI_OnlineResource/linkage` does not connect to a web page, and another software application is needed to use the indicated file resource. The `applicationProfile` character string should specify the software using the following recommended syntax: "vendor:application name/application version", e.g. "Microsoft:Word/2007", or "ESRI:ArcGIS/9.3"
Resource distributor online distribution function (O) `distributionInfo/ MD_Distribution/distributor/ MD_Distributor/ distributorTransferOptions/ MD_DigitalTransferOptions/ online/CI_OnlineResource/ function`	O-C	`CI_OnlineResource/function` is required by USGIN to indicate how linkage is to be used. Valid values for napCI_OnlineFunctionCode in this role are summarized in Table 1. If the resource is accessible as a web service, the metadata for the service should be separate metadata record with the dataset(s) exposed through the service identified in the service metadata record as coupledResources.
Resource distribution transfer options (O) `distributionInfo/ MD_Distribution/ transferOptions/ MD_DigitalTransferOptions`	C-C	`MD_DigitalTransferOptions` provides information on digital distribution of resource. See section 4.12 'Use of MD_Distribution and MD_Distributor' for instructions on use of this element. Details on encoding for MD_DigitalTransferOptions are above in the distributorTransferOptions elements description.

ISO 19115 (M/C/O) xPath from MD_Metadata	NAP-USGIN M/C/O	Comments
[role] Data quality information (O) `dataQualityInfo`	C-C	NAP requires either `dataQualityInfo/DQ_DataQuality/report` or `dataQualityInfo/DQ_DataQuality/lineage` if `dataQualityInfo/DQ_DataQuality/scope/DQ_Scope/level` = 'dataset'. `dataQualityInfo/DQ_DataQuality/scope` is required, with NAP provision that value is from napMD_ScopeCode: <attribute, attributeType, collectionHardware, collectionSession, dataset, series, nonGeographicDataset, dimensionGroup, feature, featureType, propertyType, fieldSession, software, service, model, tile>. `dataQualityInfo` has cardinality 0..*; each `DQ_DataQuality` instance may describe a different sub element of a composite resource, for instance a dataset within a series, a featureType within a dataset that includes multiple featureTypes, an attributeType for a particular featureType. Because there is no way to establish binding between second level 'child' elements, it does not make sense to include data quality statements for other that direct subelements of a resource. Thus, if `MD_Metadata/hierarchyLevel/scopeCode` is series, the `dataQualityInfo` instances should have scope 'dataset', but it would not make sense to for them to have scope 'attributeType' for attributes within a dataset because there is no mechanism to indicate to which dataset the quality of that attribute type applies.

Data quality scope (O)
`dataQualityInfo/`
`DQ_DataQuality/scope`
	C-C	Mandatory if `DQ_DataQuality` is not null. Specifies the extent of characteristics for which data quality information is reported.

Data quality scope level description (O)
`dataQualityInfo/`
`DQ_DataQuality/scope/`
`levelDescription`
	C-C	NAP provision is that `DQ_DataQuality/scope/levelDescription` is mandatory if `scope/DQ_Scope/level` is not equal to 'dataset' or 'series'. USGIN adds requirement that `DataQuality/scope/levelDescription` is mandatory if `DQ_DataQuality/scope/DQ_Scope/level/MD_ScopeCode@codeListValue` is not equal to `MD_MetadataHierarchy/hierarchyLevel/MD_ScopeCode@codelistvalue` level. `levelDescription` specifies the class of information covered by the information (sic!). NAP BP: One and only one of the following must be entered: attributes, features, featureInstances, attributeInstances, dataset, or other as appropriate. Encoding of the values for the `levelDescription` element is unclear from the ISO or INCITs documentation.

Data quality report (O)
`dataQualityInfo/`
`DQ_DataQuality/report`
	C-C	If a `DQ_DataQuality/report` element is included, at least one of the 15 possible data quality elements must be present, and multiple report elements are allowed within each `DQ_DataQuality` element. Each of these *AbstractDQ_element* subtypes has optional `nameOfMeasure`, `measureIdentification`, `measureDescription`, `evaluationMethodType`, `evaluationMethodDescription`, `evaluationProcedure`, and `dateTime` elements, and one or two required result elements. The *AbstractDQ_element* /result is either a `DQ_ConformanceResult` or a `DQ_QuantitativeResult`, each of which has required and optional subelements. Inclusion of this report metadata should follow recommendations in NAP.

ISO 19115 (M/C/O) xPath from MD_Metadata	NAP-USGIN M/C/O	Comments
Data quality lineage (O) `dataQualityInfo/ DQ_DataQuality/lineage`	C-C	INSPIRE makes general `lineage/LI_Lineage/statement` mandatory. USGIN follows NAP rule that count(`lineage/LI_Lineage/source` + `lineage/LI_Lineage/sourceStep` + `lineage/LI_Lineage/statement`) >0 for spatial dataset and spatial dataset series. Not applicable to services. USGIN recommended practice is described in section 4.17.
Data quality lineage source (O) `dataQualityInfo/ DQ_DataQuality/lineage/ LI_Lineage/source`	C-C	Each `source/LI_Source` element describes a source data resource that is input into a processStep. NAP provision is that `LI_Source/description` is mandatory if `LI_Source/sourceCitation` and `LI_Source/sourceExtent` are not provided. The attribute description includes the source medium name code (CodeList napMD_MediumNameCode) followed by <;><blank space> and a free text description, e.g. "dvd; source satellite image." If the source is part of a processing chain, the `LI_Source/processStep/LI_ProcessStep` provides "Information about an event related to the creation process for the source data." (INCITS 453). This is interpreted to mean that the link from a source to a process step is to a process step for which the described source is an output. USGIN recommended practice is described in section 4.17.
Data quality lineage process step (O) `dataQualityInfo/ DQ_DataQuality/lineage/ LI_Lineage/processStep`	C-C	An event in the development of the dataset. Each step requires a free text description, and may have a free text `rationale`, `dateTime` stamp when process was complete, 0 to many `CI_ResponsibleParty` elements identifying parties involved in the process, and finally 0 to many `source/LI_Source` associations to identify data that is input into the process step. Best practice recommended for USGIN is that source association from a process step is to inputs to a process, and `processStep` associations from a source element link an output resource to a process step that produced it. See USGIN recommended practice is described in section 4.17.
[role] Portrayal catalog information (O) `portrayalCatalogueInfo`	O-O	`portrayalCatalogueInfo/MD_PortrayalCatalogReference/portrayalCatalogueCitation/CI_Citation` element identifying a catalogue that contains symbols and rules to depict a resource. A portrayal catalog is a collection of defined symbols used to depict, to humans, features on a map. No documentation in ISO19115 about how this is supposed to work. ISO 19117 defines the structure of a Portrayal Catalogue. No USGIN recommended practices here yet.

ISO 19115 (M/C/O) xPath from MD_Metadata	NAP-USGIN M/C/O	Comments
[role] Metadata constraint information (O) `metadataConstraints`	O-O	This element specifies use constraints for access to the metadata record. Use constraints for accessing the describe resource are in `resourceConstraint/MD_Constraint` in `MD_DatasetIdentification` or `MD_ServiceIdentification`. Follow NAP for specification of access constraints. NAP provision is that `metadataConstraints/MD_Constraints/useLimitation` is mandatory when `MD_Constraints` is used to specify `metadataConstraints`. When one of the subtypes `MD_LegalConstraints` or `MD_SecurityConstraints` is used, `useLimitation` is optional. `MD_LegalConstraints` are specified by napMD_RestrictionCode, with values <copyright, patent, patentPending, trademark, license, intellectualPropertyRights, restricted, otherRestrictions, licenseUnrestricted, licenseEndUser, licenseDistributor, privacy, statutory, confidential, sensitivity>. `otherConstraints` is a free text element required by NAP if `accessConstraints` or `useConstraints` is set to "otherRestrictions." For an example: "Data only to be used for the purposes for which they were collected." `MD_SecurityConstraints` has various optional free text values, and a required `MD_SecurityConstraints/classification` from napMD_ClassificationCode: <unclassified, restricted, confidential, secret, topSecret, sensitive, forOfficialUseOnly>
[role] Application schema information (O) `applicationSchemaInfo`	O-O	Information about the information schema of the resource `applicationSchemaInfo/MD_Application-SchemaInformation` element has mandatory `name/CI_Citation`, `schemaLanguage` free text, and `constraintLanguage` free text. The `MD_ApplicationSchemaInformation` element also allows inclusion of an actual schema document as ASCII, or a binary `graphicsFile` or `softwareDevelopmentFile`. Multiple applicationSchemaInfo elements may be used for different presentations of a single schema, or for different kinds of schema (e.g. physical, logical, conceptual).
[role] Metadata maintenance information (O) `metadataMaintenance`	O-O	This element provides information about the maintenance schedule or history of the metadata record. Only one `MD_MaintenanceInformation` element may be included, with a required napMD_MaintenanceFrequencyCode: <continual, daily, weekly, fortnightly, monthly, quarterly, biannually, annually, asNeeded, irregular, notPlanned, unknown, semimonthly>
[role] Series information (O) `series`	X-X	The `MD_Metadata/series` element that appears in the ISO19139 schema appears to implement the metadata application model in ISO19115:2003 Figure 3, which is a UML class diagram defining the classes of geographic information to which metadata applies. The series role appears to allow modeling aggregation of datasets into various kinds of aggregation classes like DS_Series, DS_StereoMate, DS_Initiave … NAP does not mention it. Use case appears for bundling collections of related metadata records to allow simpler cross referencing and resolution of inherited property values. … Not Used by USGIN.
[role] Described resource (O) `describes`	X-X	The `MD_Metadata/describes` element that appears in the ISO19139 schema appears to implement the metadata application model in ISO19115:2003 Figure 3, which is a UML class diagram defining the classes of geographic information to which metadata applies. The `describes` association models the link from a metadata record to the described resource. … Not used by USGIN.

ISO 19115 (M/C/O) xPath from MD_Metadata	NAP-USGIN M/C/O	Comments
[role] Property type description (O) `propertyType`	X-X	The `MD_Metadata/propertyType` element that appears in the ISO19139 schema appears to implement the metadata application model in ISO19115:2003 Figure 3, which is a UML class diagram defining the classes of geographic information to which metadata applies. The `propertyType` association apparently models the fact that a metadata record might be attribute-level metadata—that is describe an individual property value assignment. … Not used by USGIN.
[role] Feature type description (O) `featureType`	X-X	Although an `MD_Metadata/featureType` element that appears in the ISO19139 schema appears to implement the metadata application model in ISO19115:2003 Figure 3, which is a UML class diagram defining the classes of geographic information to which metadata applies. The `featureType` association apparently models the fact that a metadata record might describe an individual feature. … Not used by USGIN.
[role] Feature attributes (O) `featureAttribute`	X-X	Although an `MD_Metadata/featureAttribute` element that appears in the ISO19139 schema appears to implement the metadata application model in ISO19115:2003 Figure 3, which is a UML class diagram defining the classes of geographic information to which metadata applies. The `featureAttribute` association apparently models the fact that a metadata record might be attribute-level metadata—that is describe an individual property value assignment; distinction between propertyType and featureAttribute is not explained. … Not used by USGIN.

₁₈₃ ### 3.1.2 USGIN specification constraints

₁₈₄ Summary of constraints to ISO19115, ISO119, ISO19139, and NAP (INCITS 453) introduced by USGIN
₁₈₅ profile. See Table 2. These may be summarized here in a later version as a convenience for
₁₈₆ implementers.

₁₈₇ ### 3.1.3 USGIN specification extensions

₁₈₈ Summary of extensions to ISO19115, ISO119, ISO19139, and NAP (INCITS 453) introduced by USGIN
₁₈₉ profile.

₁₉₀ USGIN `distributionFormatCode` list for `distributionFormat/name` introduced for categorization of
₁₉₁ resource types outside scope of ISO19115, mostly physical resources, like a book, rock sample, paper
₁₉₂ document.

193 4 Usage notes

194 Currently in no particular order… Additional information and discussion to supplement that in Table 1.
195 This will need to be expanded to discuss each resource type and any recommended practices for
196 metadata content specific to particular resources.

197 4.1 Metadata file identifier

198 `MD_Metadata/fileIdentifier` is unique identifier for the metadata file. Some metadata profiles suggest
199 that the metadata field UUID should be the same as the UUID for the described resource. This seems
200 problematic. In the USGIN scheme, the metadata record is considered an independently identified
201 resource from the resource it describes. The described resource identifier is the Unique resource identifier
202 (4.7, below).

203 4.2 Metadata hierarchy

204 The ISO19115 specification (especially Annex H) discusses the use of metadata hierarchy, in which a
205 resource that is for example a `dataset` in a dataset series, or a `featureType` in a dataset may inherit
206 metadata properties from parent metadata records in the hierarchy. Apparently the intention is that this
207 linkage would be made through `MD_Metadata/parentIdentifier`. This kind of nesting seems problematic
208 in a CSW environment in terms of how queries could be constructed, and the kind of client behavior that
209 would be required to navigate the parent links to acquire 'inherited' properties from 'parent' records. For
210 USGIN CSW purposes it is recommended that for metadata records returned by services, all inherited
211 properties in such a hierarchy should be included explicitly (by xlink where that is allowed by schema) in
212 the metadata document, as opposed to implicitly through the `parentIdentifier` link.

213 4.3 Resource title

214 Resource titles should provide sufficient information to distinguish the resource for other similar
215 resources. They are not required to be globally unique, but users will be presented only with the resource
216 title in CSW brief response documents. It is thus a disservice to have significant duplication of title strings.

217 4.4 Resource Abstract

218 Ideally the resource abstract provides a succinct summary of the content of the resource, the purpose for
219 which it was originally created, some indication of important quality parameters to help evaluate fitness for
220 other purposes, any significant constraints on use of the resource, and a list of distribution options.

221 4.5 Resource Type

222 The ISO 19115 `MD_Metadata/hierarchyLevel` property provides a high level categorization of resource
223 types. The European INSPIRE Implementing Rules (MD_IR_and_ISO_20090218) proscribes the code list
224 for the first hierarchyLevel xml element in an MD_Metadata document to be one of {dataset, service,
225 series}, or the metadata set will be considered out of scope for the directive. Thus, metadata meant to be
226 utilized by INSPIRE catalogs must follow this rule. The napMD_ScopeCode list has a wider (and more
227 useful) variety of resource categories; one or more hierarchyLevel elements using these codes could
228 follow the first one with an INSPIRE-valid code to maintain INSPIRE compliance.

229 Table 1 in this document includes a more domain-specific list of resource types, and values from this list
230 should be used in one or more `hierarchyLevelName` elements. The hierarchical categorization of the
231 resources is encoded using a syntax <broader category><:><narrower category>, that is colons separate
232 category names, the broadest category is first, with progressively narrower categories listed
233 subsequently. For example: "Document:Image:StillImage:Photograph". This approach allows category
234 type searches to find narrower subcategories without complex query processing.

4.6 Resource locator

URL's for online access to resources are encoded in USGIN ISO 19139 metadata documents in the element `MD_Distribution/transferOptions/MD_DigitalTransferOptions/online/CI_OnlineResource.` Consistent use of this rule eliminates ambiguity on where to locate the URL to access a resource.

4.7 Unique resource identifier

The `MD_Metadata/DataSetURI` property should be a globally unique identifier for the described resource. The protocol used for this identifier is not proscribed by the USGIN Profile, but if it does not have a know resolution service, the capabilities document for a CSW service providing the metadata should have at least a text explanation of how to resolve URI's used by the service. Protocols with available resolvers include http (use the WWW DNS system) and doi (http://dx.doi.org/). Some authorities using urn: protocols are also implementing or have resolver services in place.

4.8 Browse graphics

NAP profile (INCITS 453-2009) suggests adding codespace and codeListValue to the gmd:fileType element, but this doen not appear to be valid under the ISO-19139 xml schema. USGIN recommends use of napMD_FileFormatCode list (http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_115), and using the xsi:type attribute on fileType to indicate if an napMD_FileFormatCode is used to specify the file type (see following example). The ISO19139 schema specifies a gco:CharacterString, with its many possible substitutions as the data type for the file type.

```
<gmd:MD_BrowseGraphic>
    <gmd:fileName>
        <gco:CharacterString>http://publicdocs.mnr.gov.on.ca/View.asp?-
            Document_ID=9632&Attachment_ID=18204</gco:CharacterString>
    </gmd:fileName>
    <gmd:fileDescription>
        <gco:CharacterString>Base Map from OMNR</gco:CharacterString>
    </gmd:fileDescription>
    <gmd:fileType xsi:type="napm:napMD_FileFormatCode_PropertyType">
        <gco:CharacterString>jpg</gco:CharacterString>
    </gmd:fileType>
</gmd:MD_BrowseGraphic>
```

Code example 1. Encoding url, display name and file type for browse graphic. Note that napm: namespace must be declared in the root element of the document.

4.9 Resolution and equivalentScale

For spatial datasets, some indication of the resolution of the data is very useful for evaluating fitness for use. From a data perspective, resolution is specified by a distance that represents the smallest length between two resolvable points in the dataset. For a grid or coverage, this would be the average distance between sample points. From data portrayal perspective, an `equivalentScale` is reported, representing the scale at which the portrayal was intended to be viewed. To calculate `equivalentScale` given a resolution distance, recommended practice is to divide the resolution distance in meters by 0.0005. This assumes that the smallest distance resolvable in a map display for human usage is 0.5 mm.

4.10 Resource language

USGIN metadata is assumed to use American English and by default documents should be returned. Other localizations may be implemented, but in order to avoid complexity with `PT_Text` and `LocalizedCharacterString`, USGIN recommended practice is to implement services for different languages as different services, each of which serves `CharacterStrings` in the language specified by the `MD_Metadata/language` element.

281 4.11 Encoding of vertical extents

282 A vertical extent must specify the vertical CRS, which will typically be defined relative to a borehole trace.
283 For interoperability, vertical extents should be converted to meters measured vertically positive from
284 mean sea level. This puts the onus to convert down hole coordinates for deviated holes on the metadata
285 provider. Users searching for resources specific to some depth below the surface will have to convert this
286 to an elevation relative to sea level in order to query the CSW providing this metadata.

287 `EX_VerticalElement` has `minimumValue`, `maximumValue` that are real numbers, and a `verticalCRS/-`
288 `SC_VerticalCRS`. SC_VerticalCRS has (minimally):

289 a `name/RS_Identifier`,

290 a `scope` characterString,

291 exactly one `datum/CD_VerticalDatum`, which requires a `scope` CharacterString, and for USGIN an
292 `anchorDefinition` character string

293 exactly one `coordinateSystem/CS_VerticalCS`, which has a `name/RS_Identifier`, and one axis with
294 `axisAbbrev`, `axisDirection/CS_AxisDirection`, and `axisUnitID/UnitOfMeasure`.

295 4.12 Use of MD_Distribution and MD_Distributor

296 The ISO19115 model provides two possible paths for specifying information about how a resource is
297 distributed, i.e. how a user can access the resource. The `MD_Distribution` element may have 0 to many
298 `distributionFormat`, `distributor`, and `transferOptions` child elements (see Figure). On the other hand,
299 each of the `distributor` child elements may have 0 to many `distributorFormat` and
300 `distributorTransferOption` elements. Several major existing applications that consume ISO19139 xml
301 metadata files (ESRI GeoPortal Toolkit and GeoNetwork) are configured out of the box to expect format
302 and transfer option information to be at the `MD_Distribution/distributionFormat` and
303 `MD_Distribution/transferOptions` path. This works fine as long as there are not different format or
304 transfer options from different distributors, or different transferOptions for different formats. In these
305 cases, a binding between distributor, format, and transfer options necessitates use of the
306 `MD_Distribution/distributor/MD_Distributor` path to `distributorFormat` and
307 `distributorTransferOptions` (and `distributionOrderProcess`) information that works together.

308 In order to accommodate both existing applications that utilize content in the
309 `MD_Distribution/distributionFormat` and `MD_Distribution/transferOptions` elements, and situations
310 that require binding between distributor, order process, format, and transfer options, the USGIN profile
311 mandates that if multiple `MD_Distribution/distributionFormat` or `MD_Distribution/transferOptions`
312 elements are included in a document, all formats must be available via all the specified transfer options,
313 and the content of these elements should be included in line. If multiple `MD_Distribution/distributor`
314 elements are present, without child `MD_Distributor/distributorFormat` or
315 `MD_Distributor/distributorTransferOptions` elements, then all formats and transfer options are
316 available from all distributors.

317 To specify different bindings between distributor, order process, format, and transfer options, a separate
318 `distributor/MD_Distributor` instance is included. One `MD_Distributor/distributorFormat` and one
319 `MD_Distributor/distributorTransferOptions` element should be included for applications that expect
320 content in these elements, and the format and transfer options specified by these elements should apply
321 to the first `distributor/MD_Distributor` element. Repeated `CI_ResponsibleParty`,
322 `MD_StandardOrderProcess`, `MD_Format` or MD_DigitalTransferOption elements in the
323 `distributor/MD_Distributor` elements should be specified by reference (xlink:href to gml:id of first
324 occurrence of the element within the document). The implication is that the `distributionOrderProcess/`
325 `MD_StandardOrderProcess`, `distributorFormat/MD_Format`, and
326 `distributorTransferOptions/MD_DigitalTransferOptions` child elements of a single `MD_Distributor` are
327 all compatible with each other.

328 USGIN differs from NAP by allowing multiple `distributor` elements, but since this is schema valid under
329 ISO19139 xml schema, and the extra elements can be ignored by applications expecting only a single
330 `distributor` element, this should not cause incompatibility.

331
332
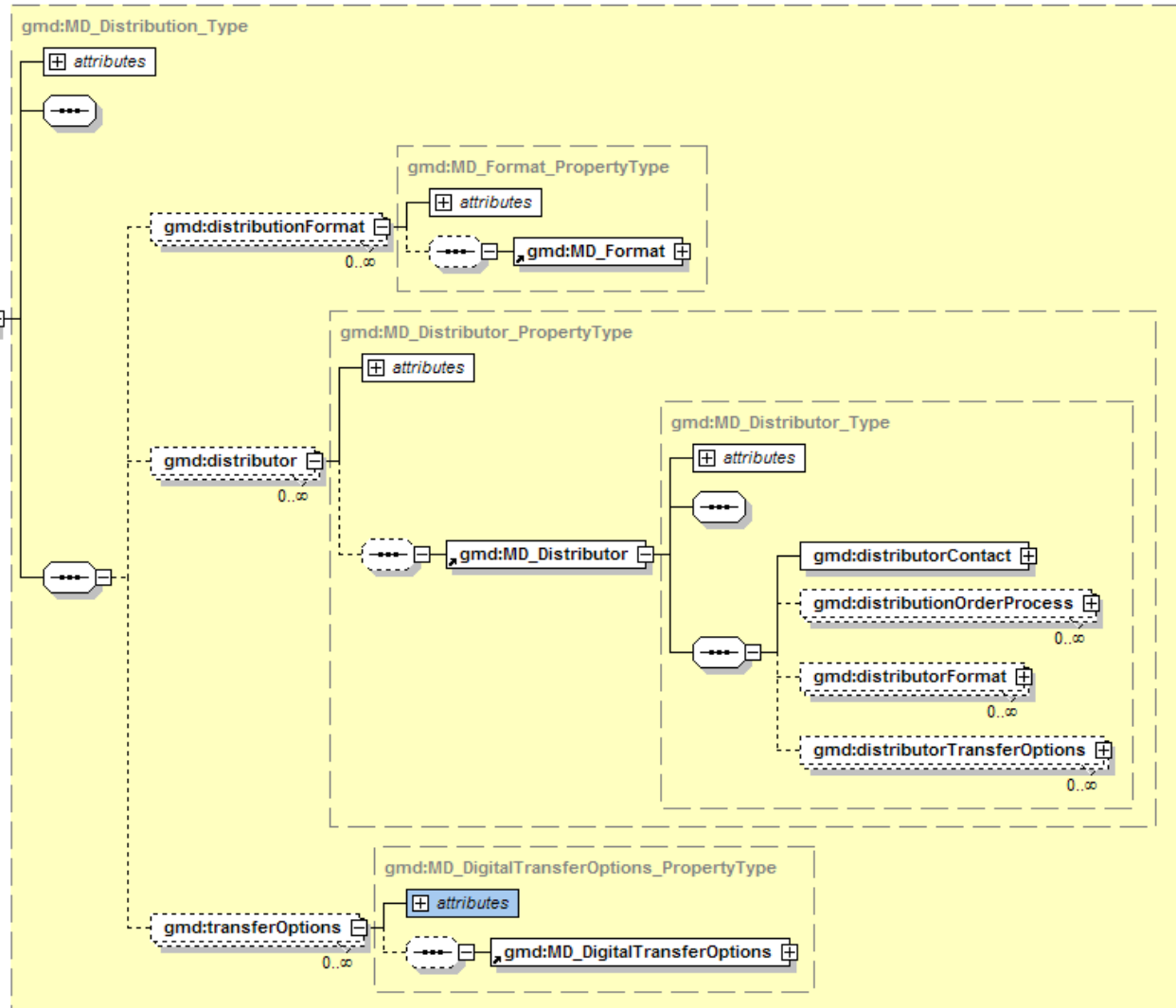
4.13 Distribution format

If the resource is a physical resource, like a book, rock sample, paper document, the `distributionFormat/name` is mandatory, and must be from the USGIN distribution format codelist.

Format types from NGGDPP….

Core

Cuttings

Paper manuscript

Film transparency

4.14 CI_OnlineResource

For USGIN profile, each `distributor/MD_Distributor` is a binding between one or more transfer options and the distributor formats that are available through that/those transfer options (`MD_DigitalTransferOptions/onLine/CI_OnlineResource` in particular). If different formats are available from the same distributor, but have different transfer options, these should be represented as different `distributor/MD_Distributor` instances.

347 In order to enable client applications to determine how to directly connect to a resource, there needs to be
348 agreement on what content is required in the `CI_OnlineResource` element, and how it will be encoded.
349 The linkage property provides a URL for accessing the resource. The role of the `protocol`,
350 `applicationProfile`, `name` and `function` properties is to provide sufficient additional information for a
351 client application to automatically connect a user with the online resource. The description property may
352 be used to provide information about the online resource, and more usefully, explanation of how the other
353 content of the `CI_OnlineResource` element is to be used to access the resource.

354 The ESRI GeoPortal toolkit looks for the presence of `MD_Metadata/distributionInfo/MD_Distribution/`
355 `transferOptions/MD_DigitalTransferOptions/online/CI_OnlineResource/function/`
356 `CI_OnlineFunctionCode/@codeListValue` attribute with a non-null value. Only one content type is allowed
357 for each resource. The values must either be an integer between 1 and 10, or a string from the codelist
358 (see Table 3). The value is made lower case, stripped of white space, and then converted to a numeric
359 value ranging from 001 to 010 if its numeric, or compared to see if it starts with a value from the codelist.
360 Thus 'live data', 'lIVe data', 'livE DataAnd maps ArcIMS image service' are all valid and would match
361 'livedata'. Note that this use of the codeListValue attribute is not consistent with its definition as an
362 identifier for the codelist entry (see section 4.15.3 Codelists).

363 *Table 3. OnlineFunctionCode values from NAP (INCITS 453) and ESRI Geoportal toolkit v. 3.1. ISO codelist terms*
364 *are indicated by '(ISO)' after the code in column 1. ESRI content types and codes are from the GeoPortal Toolkit v3.1*
365 *User Guide (2007); correlation of these with NAP OnlineFunctionCodes is based on the user guide and interpretation*
366 *by this profile.*

OnLineFunctionCode	USGIN profile usage	ESRI resource types	ESRI code
	Use case not documented	application	006
download?	Use case not documented	mapfile	009
browsing?	Use case not documented	geographicactivity	010
browsing	CI_OnlineResource/linkage is a valid URL for a web application that enables user to explore and seek information about the resource from a Web browser		
download (ISO)	CI_OnlineResource/linkage is a valid URL that will initiate transfer of data to the local system. ESRI GPT requires that file extension for file is one of .zip, .e00, .gz, .tgz, .dbf, .tar, .shp, .rar, .xls, .txt, .dwg, .dxf, .dgn	download, downloadabledata	002
Download (ISO)	ESRI GPT requires one of following file extensions: .gif, .jpg, .jpeg, .bmp, .pdf, .pmf, .tif, .tiff, .cal, .pct, .pict, .eps, .mxd, .av, .mpg, .mpeg, .wmv, .img, .rm.	staticmapimage	004
emailService	CI_OnlineResource/linkage is a valid URL that accesses instructions for connection to an email service providing the described resource content via emails		
fileAccess	CI_OnlineResource/linkage is a valid URL for direct retrieval of a file containing the described resource, typically through the use of http or ftp protocol (or their secure variants)		

information (ISO)	CI_OnlineResource/linkage is a valid URL that will access a web page providing information about the resource content.	Information, otherdocument, document	005
offlineAccess (ISO)	CI_OnlineResource/linkage is a valid URL that will access a web page providing instructions for requesting the resource from the provider.	offlinedata, offlineAccess	003
order (ISO)	CI_OnlineResource/linkage is a valid URL that will access a web page to initiate an ordering process for obtaining the resource.	order, geographicservice	007
search (ISO)	CI_OnlineResource/linkage is a valid URL that will access a search interface for seeking out specific information content contained by resource, e.g. the metadata describes a database, and this linkage accesses a search interface to search the database	search, clearinghouse	008
upload	CI_OnlineResource/linkage is a valid URL for a web interface to transfer data from a local storage device or system to be included in the described resource.		
webMapService	CI_OnlineResource/linkage is a valid URL for Web -based map request service, which may return custom georeferenced map images, streamed features, raster data, or surface data to a mapping client, e.g. ArcIMS, OCG WMS, WFS, WCS service	livedata	001
webService	CI_OnlineResource/linkage is a valid URL that accesses a standard web service description document with instructions for the connection to a Web service (other than a Web map service) providing direct online access to the described resource. Example description document may be a Web Services Description Language (WSDL) file or OGC getCapabilities file.		001

367

4.14.1 URLs for services

369 ArcIMS Image Service: http://<server>/image/<service_name>

370 ArcIMS Feature service: http://<server>/feature/<service_name>

371 ArcIMS OGC WxS: http://<Server>/.../com.esri.wxs<Servlet Path>

372 OGC service: http://<server>/WxS/<virtual path>

373 OGC service, embedded key-value pair for service: http://<service root>?version=n.n.n&Service=WxS

374 OGC WMS service with complete getMap request

375 URL specified as value of a key. Supported keys server=<Server name>, service=<name of ArcIMS
376   service, not required for OGC service>, servicename=<same as service>, servicetype=<'image' or
377   'feature' for ArcIMS, not required for OGC>

378 If web service is one of the distribution formats available for a resource, it is expected that there is a
379 corresponding metadata record for the web service that has an operatesOn element that points to this
380 metadata record.

381 4.15 Extensions to CharacterString.

382 4.15.1 Web extensions

383 ISO 19139 defines several extensions to `gco:CharacterString` in the gmx namespace. These are defined
384 as members of an xml substitution group for `gco:CharacterString`, and include `gmx:Anchor`,
385 `gmx:FileName`, and `gmx:MimeFileType`. `gmx:Anchor` is used for URL's linking to online web resources, and
386 include a URI attribute associated with the character string that is the human-readable label for the link.
387 `gmx:FileName` adds a filename URI attribute that specifies a machine-readable absolute path to the
388 location of the file, the human readable file name specified by the character string. `gmx:MimeFileType`
389 adds a MIME type/subtype attribute to a character string that specifies a human readable file type. The
390 gmx namespace is not imported into other ISO19139 schema in the normative schema. In order to create
391 schema-valid documents that use these extensions, explicit namespace-declaration must be made to the
392 gmx schema in instance documents. At the present time, use of these elements does not seem
393 widespread. The current version of Geonetwork, a commonly used catalog service implementation, does
394 not support use of `gmx:Anchor`. Thus, in this version of the USGIN profile, these extension classes are not
395 used.

396 4.15.2 Language localization

397 Another extension to `gco:CharacterString` allows substitution by `PT_FreeText` or
398 `LocalisedCharacterString`. `LocalisedCharacterString` adds a `locale/PT_Locale` property to the
399 `CharacterSTring` element that can specify the language, country, and character encoding for the string.
400 `PT_FreeText` allow substitution of a collection of `LocalisedCharacterString` elements for any
401 `CharacterString`, each localized to a different language/country.

402 These various possibilities create potential to break interoperability. To avoid this problem, Other
403 localizations may be implemented, but in order to avoid complexity with PT_Text and
404 LocalizedCharacterString, USGIN recommended practice is to implement services for different languages
405 as different services, each of which serves CharacterStrings in the language specified by the
406 `MD_Metadata/language` element.

407 4.15.3 Codelists

408 ISO 19139 defines a "CodeListValue_Type" XML Class Type with three attributes:

```
409 <xs:complexType name="CodeListValue_Type">
410     <xs:simpleContent>
411         <xs:extension base="xs:string">
412             <xs:attribute name="codeList" type="xs:anyURI" use="required"/>
413             <xs:attribute name="codeListValue" type="xs:anyURI" use="required"/>
414             <xs:attribute name="codeSpace" type="xs:anyURI"/>
415         </xs:extension>
416     </xs:simpleContent>
417 </xs:complexType>
```

418 The `codeList` attribute contains a URL that references a codeList definition within a registry or a codelist
419 catalogue.

420 The `codeListValue` attribute carries the identifier of the codelist value definition. This identifier is the
421 value expressed in the name column of the tables in ISO 19115, Annex B. The codelist catalogue (or
422 registry) is expected to contain an explicit name and definition of the value in the default language of the
423 metadata, as well as alternate expressions in different code spaces, some of them corresponding to the
424 different locales supported by the metadata.

425 The codeSpace attribute is an optional identifier (URI); when present it refers to the alternative
426 expression of the codelist value definition in the 'domainCode' column of the tables in ISO 19115, Annex
427 B. The codeSpace URI for the domain code is the string "domainCode". According to the example in
428 ISO19139, section 8.5.5.1 (p. 30), the value from the domainCode column in the codespace definition
429 table is included as the value of the xml CodeList element in this case.

430 Codelist elements in the ISO19139 XML schema are assigned to type CodeListValue_Type, and also
431 included in a substitution group for gco:CharacterString. These codeList elements are thus substitutable
432 for elements typed gco:CharacterString. Consequently, any CodeList instance is an XML element that
433 takes a string value and has three XML attributes defined by the special XML Class Type. A
434 corresponding XML Class Property Type is defined for each of these CodeList elements, and this
435 property type is used to restrict the values in XML CharacterString attributes to the code list.

436 The ISO specification uses an unfortunate choice of name for the 'codeListValue' attribute that is defined
437 to be a identifier, apparently with the intention that it is a language-neutral concept identifier that might be
438 associated with various language-localized labels for the concept. NAP CodeList registries
439 (http://www.fgdc.gov/nap/metadata/register) contrast with the codelists defined in the tables in ISO 19115,
440 Annex B in that the identifier (the 'name' column the ISO19115 Annex B tables) is an integer identifier
441 with the prefix 'RI_'. This would appear to correspond functionally to the 'domainCode' values in the
442 ISO19115 Annex B tables, which ISO19139 indicates should be the codeListValue when the
443 codeSpace="domainCode".

444 NAP and INSPIRE usage is consistent with the ISO19139 definition of codeListValue as an identifier, with
445 the name or label for the codeList concept included as the value of the CodeList element. The 'name'
446 column in ISO 19115, Annex B tables, which is described as the content for the codeListValue by
447 ISO19139, contains English words that are the same as the labels one would use in English. This creates
448 a temptation to encode the value *incompletely*, thus:

```
449 <gmd:CI_DateTypeCode
450     codeList=http://asdd.ga.gov.au/asdd/profileInfo/gmxCodelists.xml#CI_Dat
451     eTypeCode
452     codeListValue="creation"/>
453 or
454 <MD_CharacterSetCode
455     codeList="http://wis.wmo.int/2006/catalogues/gmxCodelists.xml#MD_Charac
456     terSetCode"
457     codeListValue="utf8" />.
```

458 For USGIN metadata, elements with a data type that is a CodeList_PropertyType, the following encoding
459 is to be used:

```
460 <gmd:CI_DateTypeCode
461     codeList="
462     http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Sche
463     mas/resources/Codelist/gmxCodelists.xml#CI_DateTypeCode"
464     codeListValue="creation">creation</gmd:CI_DateTypeCode>
465 and
466 <MD_CharacterSetCode
467     codeList="
468     http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Sche
469     mas/resources/Codelist/gmxCodelists.xml#MD_CharacterSetCode"
470     codeListValue="utf8">utf8</MD_CharacterSetCode>
```

471 Extensions to ISO codelists are implemented in two ways. If new values are added to an ISO codelist, the
472 CodeListProperty_Type still points at the ISO CodeList_Type, but the codeList attribute on instances of
473 this element points to the extended codelist. The following example shows use of a DateTypeCode added
474 to the ISO19115 date type code list in the North American Profile:

```
475 <gmd:date>
476     <gmd:CI_Date>
477         <gmd:date>
478             <gco:Date>1972-06-22</gco:Date>
```

```
479        </gmd:date>
480        <gmd:dateType>
481            <gmd:CI_DateTypeCode
482                codeList=http://www.fgdc.gov/nap/metadata/register/registerItemCl
483                asses.html#IC_87
484                codeListValue="RI_373">superseded</gmd:CI_DateTypeCode>
485        </gmd:dateType>
486      </gmd:CI_Date>
487 </gmd:date>
```

488 If a new codelist is created to restrict text in an ISO element whose type is simply CharacterString (e.g.
489 HierarchyLevelName), then characterString values are encoded by soft-typing the element that takes the
490 character string using the xsi:type attribute. The following example uses the FileFormatCodeList, which is
491 the only code list vocabulary added to the collection of codelists defined by ISO 19115 by the North
492 American Profile. A NAP-defined codelist property type is defined in a napm namespace, defined in an
493 xml schema made available by the profile developers.

```
494 <gmd:fileType xsi:type="napm:napMD_FileFormatCode_PropertyType"
495              codeList="http://www.fgdc.gov/nap/metadata/register/registerItemC
496              lasses.html#IC_115"
497              codeListValue="RI_711">
498    <gco:CharacterString>jpg</gco:CharacterString>
499 </gmd:fileType>
```

500 Schema fragment from the XML schema defining the napm namespace
501 (http://www.cits.rncan.gc.ca/html/brodeurj/.protege/napMetadata/tools/napXsd/napm/napm.xsd). This
502 fragment defines the property type used to restrict a value domain to the new code list in the xml fragment
503 above:

```
504 <xs:complexType name="napMD_FileFormatCode_PropertyType">
505    <xs:complexContent>
506       <xs:extension base="gco:CharacterString_PropertyType">
507          <xs:attribute name="codeList" type="xs:anyURI" use="required"/>
508          <xs:attribute name="codeSpace" type="xs:anyURI" use="optional"/>
509          <xs:attribute name="codeListValue" type="xs:anyURI" use="required"/>
510       </xs:extension>
511    </xs:complexContent>
512 </xs:complexType>
```

513 4.16 Geographic bounding box

514 USGIN profile requires that if an EX_Extent/geographicElement is supplied, it include a geographic
515 bounding box with bounding latitude and longitude expressed using WGS 84 decimal degrees.

516 The corner coordinates for the geographic bounding box must not coincide in one point, because this may
517 result in fatal errors with some CSW implementations. Point locations must thus be represented as tiny
518 rectangles. USGIN recommended practice is to place the actual point location in the lower left corner of
519 the rectangle.

520 4.17 Lineage

521 Lineage in data quality section has to do with processing steps that have altered the resource in some
522 fashion. Each step has some input resources, identified by source citations associated with the process
523 step. The LI_ProcessStep element does not directly identify its output resource, so in a lineage that
524 involves a chain of steps with intermediate resources, the sourceStep association from LI_Source links a
525 resource to a processing step that it is output from.

526 If a resource has simply been downloaded from some online repository, or copied from some physical
527 media (cd, dvd), with no modification, then it is considered an identical resource, and no lineage is
528 implied. The MD_DataIdentification/citation/CI_Citation should identify this source; the
529 MD_Metadata/distributionInfo should report information on how the data were obtained. Based on this

530 approach, a LI_Lineage that reports no processSteps, only a source link, does not make sense.
531 `LI_Lineage/source/LI_Source` is thus not used by USGIN metadata.

532 Thus, a GIS dataset originally digitized from a published geologic map, put online, obtained by an online
533 download, and reprojected would report one processStep with `source/LI_Source` that has a CI_Citation
534 for the downloaded data. This LI_Source would have a sourceStep pointing to an LI_ProcessStep for the
535 original digital conversion from the paper map, and the `LI_ProcessStep/source/LI_Source` would contain
536 the citation for the original paper map.

537 In order to enable xpath queries for any of the sources or processSteps in a processing chain, all related
538 LI_Source and LI_ProcessStep elements should be directly nested within the LI_Lineage element, and
539 the `processStep/source` and `LI_Source/sourceStep` associations should be by reference.

540

541 Code example 1: Simplified example of a complex processing and source history using LI_Lineage.

```xml
542 <?xml version="1.0" encoding="UTF-8"?>
543 <LI_Lineage
544 xmlns="http://www.isotc211.org/2005/gmd"
545 xmlns:gco="http://www.isotc211.org/2005/gco"
546 xmlns:xlink="http://www.w3.org/1999/xlink"
547 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
548 xsi:schemaLocation="http://www.isotc211.org/2005/gmd
549 http://schemas.opengis.net/iso/19139/20070417/gmd/dataQuality.xsd">
550        <statement>
551             <LocalisedCharacterString>The digital data described by this
552 metadata was originally compiled digitally from two published maps; this
553 digital dataset was then reprojected to produce the described resource.
554             </LocalisedCharacterString>
555        </statement>
556        <processStep>
557             <LI_ProcessStep id="1">
558                  <description>
559                       <LocalisedCharacterString>
560                            digital compilation of 2 maps
561                       </LocalisedCharacterString>
562                  </description>
563                  <source xlink:href="#10"/>
564                  <source xlink:href="#20"/>
565             </LI_ProcessStep>
566        </processStep>
567        <processStep>
568             <LI_ProcessStep id="2">
569                  <description>
570                       <LocalisedCharacterString>
571                       digital map compilation reprojected, should have some
572                       way to specify projection parameters?, output is
573                       LI_Source id=70
574                       </LocalisedCharacterString>
575                  </description>
576                  <source xlink:href="#40"/>
577             </LI_ProcessStep>
578        </processStep>
579        <source>
580             <LI_Source id="40">
581                  <description>
582                       <LocalisedCharacterString>
583                            a digital compilation of 2 maps, output of
584                       processStep ID=1, input into reprojection process
585                       </LocalisedCharacterString>
```

```
586                    </description>
587                    <sourceStep xlink:href="1"/>
588               </LI_Source>
589          </source>
590          <source>
591               <LI_Source id="10">
592                    <description>
593                         <LocalisedCharacterString>
594                              ultimate source--some published map
595                         </LocalisedCharacterString>
596                    </description>
597  <!--no source processing recorded for production of paper map so no
598  sourceStep-->
599               </LI_Source>
600          </source>
601          <source>
602               <LI_Source id="20">
603                    <description>
604                         <LocalisedCharacterString>
605                              another published map
606                         </LocalisedCharacterString>
607                    </description>
608               </LI_Source>
609          </source>
610          <source>
611               <LI_Source id="70">
612                    <description>
613                         <LocalisedCharacterString>
614                              a reprojected version of the digital compilation
615                         </LocalisedCharacterString>
616                    </description>
617                    <sourceStep xlink:href="2"/>
618               </LI_Source>
619          </source>
620  </LI_Lineage>
```

An `LI_Lineage` may be constructed that involves a number or resources and processing steps, and this lineage may be referenced by metadata for all the resources involved in the processing. The `LI_Lineage/source/LI_Source/sourceCitation/CI_Citation/identifier/MD_Identifier` is a reference to the `MD_Metadata/fileIdentifier` for the metadata for each resource in the chain. This approach allows the metadata record to record relationships through process steps between resources.

4.18 Temporal extents

Resource temporal extent (identificationInfo/MD_DataIdentification/extent/EX_Extent/-temporalElement/EX_TemporalExtent/extent/TM_PeriodTimePeriod) is used to specify the temporal interval to which the content of a resource applies.

<gml:endPosition indeterminatePosition="now"/> is the correct way to represent "Present" in ISO or GML as one of the boundaries of a timePeriod.

The ISO 19139 xml schema allows TM_PeriodTimePeriod to be quantified by a gml:TimeInstant or gml:TimePeriod element. In order to promote interoperability, the USGIN profile mandates use of gml:TimePeriod for specifying temporal for a resource. The time coordinates for the beginPosition and endPosition should be expressed numerically in Ma. This convention allows search for resources pertinent to intervals of geologic time using simple numeric comparisons instead of the complex hierarchical concept expansions that would be necessary to use named eras from a stratigraphic time scale. Encoding example:

```
<EX_TemporalExtent>
```

```
640        <extent>
641          <gml:TimePeriod gml:id="y34096">
642            <gml:beginPosition
643                frame="urn:CGI:TemporalCRS:cgi:standardGeologyMa">220
644                </gml:beginPosition>
645            <gml:endPosition
646                frame="urn:CGI:TemporalCRS:cgi:standardGeologyMa">140
647                </gml:endPosition>
648          </gml:TimePeriod>
649        </extent>
650   </EX_TemporalExtent>
```

651   The frame for the beginPosition and endPosition is a URI for standard geologic time, measured positive
652   getting older, with an origin at 1950 CE, in units of millions of years.

5 Abbreviations

CSW	Metadata Catalog for the Web. Also abbreviated as CS-W and CS/W
GeoSciML	
GML	Geographic Markup Language
GUID	Global Unique Identifier
IEC	International Electrotechnical Commission
ISO	International Organization for Standardization
UML	Unified Modelling Language
USGIN	U.S. Geoscience Information Network
WCS	Web coverage Service
WFS	Web Feature Service
XML	eXtensible Markup Language
XSD	XML Schema Definition
XSL	eXtensible Stylesheet Language
XSLT	XSL Transformations
XLink	XML Linking Language

654

655   6   References

656   6.1 Normative References

657   **[ISO 19115]**
658   **[ISO 19119]**
659   **[ISO 19139]**
660   **[ISO 639-2]**   Bibliographic code for the representation of names of languages
661   (http://www.loc.gov/standards/iso639-2/php/code_list.php)
662   **[AP ISO 1.0]**
663   **[OGC CSW 2.0.2]**
664

665 7 Examples

666 7.1 USGIN ISO 19139 Dataset Metadata

```
667  <?xml version="1.0" encoding="UTF-8"?>
668  <!--
669  ****************************************************************************************
670  **
671  *** Example USGIN ISO 19139 Dataset Metadata
672  *** USGIN Standards and Protocols Drafting Team
673  *** U.S. Geoscience Information System (USGIN) - http://lab.usgin.org
674  *** 11/19/2009
675  ***
676  *** Validated against http://www.isotc211.org/2005/gmd (ISO 19115, CSW 2.0.2 AP ISO 1.0)
677  *** Follows the USGIN ISO 19139 Dataset Metadata Profile v0.1
678  *** Based on the North American Profile (NAP)
679  ***
680  *** Key: (NAP-USGIN) - M/C/O/X (Mandatory, Conditional, Optional, Not Used)
681  ****************************************************************************************
682  *-->
683
684  <!-- USGIN ISO 19139 dataset metadata record -->
685  <gmd:MD_Metadata
686    xmlns:gmd="http://www.isotc211.org/2005/gmd"
687    xmlns:gco="http://www.isotc211.org/2005/gco"
688    xmlns:gml="http://www.opengis.net/gml"
689    xmlns:xlink="http://www.w3.org/1999/xlink"
690    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
691    xsi:schemaLocation="http://www.isotc211.org/2005/gmd
692  http://schemas.opengis.net/csw/2.0.2/profiles/apiso/1.0.0/apiso.xsd">
693    <gmd:fileIdentifier>
694      <!-- (M-M) USGIN recommends using a valid Universally Unique Identifier (UUID) -->
695      <gco:CharacterString>00000000-0000-0000-0000-000000000000</gco:CharacterString>
696    </gmd:fileIdentifier>
697    <gmd:language>
698      <!-- (M-M) <ISO639-2/T three letter language code - lower case><;><blank space><ISO3166-1
699  three letter country code - upper case>. This may not be interoperable - use 3 letter language
700  code instead.-->
701      <gco:CharacterString>eng</gco:CharacterString>
702    </gmd:language>
703    <gmd:characterSet>
704      <!-- (M-M) napMD_CharacterSetCode:  ucs2 , ucs4 , utf7 , utf8 , utf16 , 8859part1 , 8859part2
705  , 8859part3 , 8859part4 , 8859part5 , 8859part6 , 8859part7 , 8859part8 , 8859part9 , 8859part10
706  , 8859part11 , 8859part13 , 8859part14 , 8859part15 , 8859part16 , jis , shiftJIS , eucJP ,
707  usAscii , ebcdic , eucKR , big5 , GB2312 -->
708      <gmd:MD_CharacterSetCode
709        codeList="napMD_CharacterSetCode"
710        codeListValue="utf8"/>
711    </gmd:characterSet>
712    <!-- Define if this record is a: dataset (default), service, feature, software, etc. -->
713    <gmd:hierarchyLevel>
714      <!-- (M-M) napMD_ScopeCode codelist: attribute, attributeType, collectionHardware,
715  collectionSession, dataset, series, nonGeographicDataset, dimensionGroup, feature, featureType,
716  propertyType, fieldSession, software, service, model, tile-->
717      <gmd:MD_ScopeCode
718        codeList="napMD_ScopeCode"
719        codeListValue="dataset"/>
720    </gmd:hierarchyLevel>
721    <gmd:hierarchyLevelName>
722      <!-- (O-M) USGIN makes this property mandatory to identify the USGIN resource type. Default
723  USGIN CharacterString is "Collection:Dataset" -->
724      <gco:CharacterString>Collection:Dataset</gco:CharacterString>
725    </gmd:hierarchyLevelName>
726    <!-- (M-M) Point of contact for the metadata record, e.g. for users to report errors, updates
727  to metadata, etc. -->
728    <gmd:contact>
```

```
729      <!-- uuid is an optional attribute available on every object-with-identity, provided in the
730  GMD schemas that implement ISO 19115 in XML. May be used as a persistent unique identifier, but
731  only available within GMD context. -->
732      <gmd:CI_ResponsibleParty uuid="00000000-0000-0000-0000-000000000000">
733        <!-- (M-M) (individualName + organisationName + positionName) > 0 -->
734        <gmd:individualName>
735          <gco:CharacterString>Steven Richard</gco:CharacterString>
736        </gmd:individualName>
737        <gmd:organisationName>
738          <gco:CharacterString>Arizona Geological Survey</gco:CharacterString>
739        </gmd:organisationName>
740        <gmd:positionName>
741          <gco:CharacterString>Metadata Czar</gco:CharacterString>
742        </gmd:positionName>
743        <gmd:contactInfo>
744          <!-- uuid is an optional attribute available on every object-with-identity, provided in
745  the GMD schemas that implement ISO 19115 in XML. May be used as a persistent unique identifier,
746  but only available within GMD context. -->
747          <gmd:CI_Contact uuid="00000000-0000-0000-0000-000000000000">
748            <!-- Phone -->
749            <gmd:phone>
750              <gmd:CI_Telephone>
751                <gmd:voice>
752                  <gco:CharacterString>520.770.3500</gco:CharacterString>
753                </gmd:voice>
754                <gmd:facsimile>
755                  <gco:CharacterString>520.770.3505</gco:CharacterString>
756                </gmd:facsimile>
757              </gmd:CI_Telephone>
758            </gmd:phone>
759            <!-- Address -->
760            <gmd:address>
761              <gmd:CI_Address>
762                <gmd:deliveryPoint>
763                  <gco:CharacterString>416 W. Congress St., Suite 100</gco:CharacterString>
764                </gmd:deliveryPoint>
765                <gmd:city>
766                  <gco:CharacterString>Tucson</gco:CharacterString>
767                </gmd:city>
768                <gmd:administrativeArea>
769                  <gco:CharacterString>Arizona</gco:CharacterString>
770                </gmd:administrativeArea>
771                <gmd:postalCode>
772                  <gco:CharacterString>85701-1381</gco:CharacterString>
773                </gmd:postalCode>
774                <gmd:country>
775                  <gco:CharacterString>USA</gco:CharacterString>
776                </gmd:country>
777                <!-- (O-M) contact e-mail address -->
778                <gmd:electronicMailAddress>
779                  <gco:CharacterString>metadata@azgs.az.gov</gco:CharacterString>
780                </gmd:electronicMailAddress>
781              </gmd:CI_Address>
782            </gmd:address>
783            <!-- (O-O) online resources - this is the online resource to contact the metadata
784  person-->
785            <gmd:onlineResource>
786              <gmd:CI_OnlineResource>
787                <gmd:linkage>
788                  <gmd:URL>http://www.azgs.az.gov</gmd:URL>
789                </gmd:linkage>
790                <gmd:protocol>
791                  <gco:CharacterString>HTTP</gco:CharacterString>
792                </gmd:protocol>
793                <gmd:description>
794                  <gco:CharacterString>Arizona Geological Survey Web Site</gco:CharacterString>
795                </gmd:description>
796              </gmd:CI_OnlineResource>
797            </gmd:onlineResource>
798            <!-- (O-O) hours of service -->
799            <gmd:hoursOfService>
```

```
800            <gco:CharacterString>8 AM to 5 PM Mountain Standard time (no day light
801  savings)</gco:CharacterString>
802            </gmd:hoursOfService>
803            <!-- (O-O) contact instructions -->
804            <gmd:contactInstructions>
805              <gco:CharacterString>Contact Steve Rauzi [Steve.Rauzi@azgs.az.gov] or call Oil and Gas
806  Commission Staff at Arizona Geological Survey, 520-770-3500.</gco:CharacterString>
807            </gmd:contactInstructions>
808          </gmd:CI_Contact>
809        </gmd:contactInfo>
810        <!-- ISO 19139 Mandatory: contact role -->
811        <gmd:role>
812          <!-- MD_ScopeCode: resourceProvider, custodian, owner, user, distributor, originator,
813  pointOfContact, principalInvestigator, processor, publisher, author -->
814          <gmd:CI_RoleCode
815            codeList="MD_ScopeCode"
816            codeListValue="pointOfContact"/>
817        </gmd:role>
818      </gmd:CI_ResponsibleParty>
819    </gmd:contact>
820    <!-- (M-M) dateStamp/gco:DateTime metadata date stamp - the date when the metadata record was
821  created or updated -->
822    <gmd:dateStamp>
823      <!-- This is the time stamp that will be used by harvesters to determine if a metadata needs
824  to be updated in a harvesting catalog. Requires an extended ISO 8601 formatted combined UTC date
825  and time string (2009-11-17T10:00:00) -->
826      <gco:DateTime>2009-11-17T10:00:00</gco:DateTime>
827    </gmd:dateStamp>
828    <!-- (M-M) metadata standard - NAP specifies "NAP - Metadata". US GIN profile conformant
829  metadata is indicated by using " NAP - Metadata; USGIN" -->
830    <gmd:metadataStandardName>
831      <gco:CharacterString>NAP - Metadata; USGIN</gco:CharacterString>
832    </gmd:metadataStandardName>
833    <!-- (O-M) USGIN profile version -->
834    <gmd:metadataStandardVersion>
835      <gco:CharacterString>1.0</gco:CharacterString>
836    </gmd:metadataStandardVersion>
837    <!-- (O-C) Dataset Identifier - For USGIN, this is a string that uniquely identifies the
838  described resource. If the resource has an identifier, it should be included here; if this
839  resource will be referenced from other metadata, it must have an identifier here. If the dataset
840  is coupled to a service, the value of the MD_Metadata/dataSetURI attribute is the unique resource
841  identifier used by srv:coupledResource to link the service with the dataset. -->
842    <gmd:dataSetURI>
843      <gco:CharacterString>http://azgs.az.gov/resource/00000000-0000-0000-0000-
844  000000000000</gco:CharacterString>
845    </gmd:dataSetURI>
846    <!-- (C-C) Other Languages - If description in more than one language is provided, this
847  property should indicate what those languages are. The primary language used for metadata
848  description is identified with MD_Metadata/language and characterSet and any additional languages
849  are identified by MD_Metadata/locale/PT_locale elements, in which the language is provided
850  according to ISO 639-2/T three-letter terminology codes in lowercase, and an optional country is
851  provided according to ISO 3166-1 three-letter codes in uppercase, and mandatory
852  characterEncoding. -->
853    <gmd:locale>
854      <gmd:PT_Locale id="FR">
855        <gmd:languageCode>
856          <gmd:LanguageCode codeList="#LanguageCode" codeListValue="fra">French</gmd:LanguageCode>
857        </gmd:languageCode>
858        <gmd:characterEncoding>
859          <gmd:MD_CharacterSetCode codeList="#MD_CharacterSetCode" codeListValue="utf8">UTF
860  8</gmd:MD_CharacterSetCode>
861        </gmd:characterEncoding>
862      </gmd:PT_Locale>
863    </gmd:locale>
864    <!-- (O-O) Spatial Representation Information for the dataset (resource). Best practice is to
865  include metadata for spatial representation if the described resource is a georeferenced dataset.
866  -->
867    <gmd:spatialRepresentationInfo>
868      <gmd:MD_VectorSpatialRepresentation>
869        <gmd:topologyLevel>
870          <!-- MD_TopologyLevelCode: topology1D, planarGraph, fullPlanarGraph, surfaceGraph,
871  fullSurfaceGraph, topology3D, fullTopology3D, abstract -->
```

```
872              <gmd:MD_TopologyLevelCode codeList="MD_TopologyLevelCode" codeListValue="geometryOnly"/>
873            </gmd:topologyLevel>
874            <gmd:geometricObjects>
875              <gmd:MD_GeometricObjects>
876                <gmd:geometricObjectType>
877                  <!-- MD_GeometricObjectTypeCode: complex, composite, curve, point, solid, surface -->
878                  <gmd:MD_GeometricObjectTypeCode codeList="MD_GeometricObjectTypeCode"
879    codeListValue="surface"/>
880                </gmd:geometricObjectType>
881              </gmd:MD_GeometricObjects>
882            </gmd:geometricObjects>
883          </gmd:MD_VectorSpatialRepresentation>
884        </gmd:spatialRepresentationInfo>
885        <!-- (O) Resource's spatial reference system - Description of the spatial and/or temporal
886    reference systems used in the dataset.
887          NAP specifies { (identificationInfo/spatialRepresentationType = "vector") or
888    (identificationInfo/spatialRepresentationType = "grid") or
889    (identificationInfo/spatialRepresentationType = "tin") implies count referenceSystemInfo >= 1) }
890    -->
891      <gmd:referenceSystemInfo>
892        <gmd:MD_ReferenceSystem>
893          <!-- ISO 19115:2003 Corrigendum 1:2006 removes CRS and projection parameter information. It
894    uses the new ISO 19111 instead  -->
895          <gmd:referenceSystemIdentifier>
896            <gmd:RS_Identifier>
897              <!-- (C-C) Reference System identifier code - For USGIN the code should be a value from
898    the EPSG Geodetic Parameter Dataset register (http://www.epsg.org/) in the form "EPSG:nnnn" where
899    nnnn is the EPSG code number for the CRS. -->
900              <gmd:code>
901                <gco:CharacterString>EPSG:5701</gco:CharacterString>
902              </gmd:code>
903              <gmd:codeSpace>
904                <gco:CharacterString>urn:ogc:def:crs</gco:CharacterString>
905              </gmd:codeSpace>
906            </gmd:RS_Identifier>
907          </gmd:referenceSystemIdentifier>
908        </gmd:MD_ReferenceSystem>
909      </gmd:referenceSystemInfo>
910      <!-- *************** -->
911      <!-- (M-M) Resource identification information - At least one of MD_DataIdentification or
912    MD_ServiceIdentification is required.  -->
913      <gmd:identificationInfo>
914        <gmd:MD_DataIdentification>
915          <gmd:citation>
916            <!-- (M-M) Resource citation - For USGIN purposes, this should be viewed as information
917    to identify the intellectual origin of the content in the described resource, along the lines of
918    a citation in a scientific journal. -->
919            <gmd:CI_Citation>
920              <!-- (M-M) Resource title - USGIN recommends using titles that inform the human reader
921    about the dataset's content as well as its context. -->
922              <gmd:title>
923                <gco:CharacterString>Scanned Borehole Compensated Sonic Log for 0391, Kerr-McGee08
924    Navajo</gco:CharacterString>
925              </gmd:title>
926              <!-- (O) Alternate title -->
927              <gmd:alternateTitle>
928                <gco:CharacterString>some alternate title</gco:CharacterString>
929              </gmd:alternateTitle>
930              <!-- (M-M) Resource reference date - Best practice is to include at least the date of
931    publication or creation of the resource. -->
932              <gmd:date>
933                <gmd:CI_Date>
934                  <gmd:date>
935                    <!-- Requires an extended ISO 8601 formatted combined UTC date and time string
936    (2001-12-17T09:30:47) -->
937                    <gco:DateTime>2001-12-17T09:30:47</gco:DateTime>
938                  </gmd:date>
939                  <gmd:dateType>
940                    <!-- CI_DateTypeCode: creation, publication, revision -->
941                    <gmd:CI_DateTypeCode codeList="CI_DateTypeCode" codeListValue="publication"/>
942                  </gmd:dateType>
943                </gmd:CI_Date>
```

```
944              </gmd:date>
945              <!-- (C-C) Unique resource identifier  - NAP makes MD_Identifier mandatory for dataset
946      and dataset series.
947              For USGIN purposes, this element content value should be only considered an identifier
948      for the citation, without any assumption that it will use http protocol. The identifier may be
949      resolvable to a URL, if a protocol prefix specifies an identifier scheme that is resolvable (e.g.
950      http, urn…), but this is not necessary for a valid document, and should not be assumed when
951      processing metadata documents.
952              For USGIN, IF the Citation has an identifier that is different from the identifier for
953      the described resource (MD_Metadta/dataSetURI), it must be included here. RS_Identifier may
954      substitute for MD_Identifier in the ISO19139 schema, but the USGIN profile requires use of
955      MD_Identifer. If additional codespace and version content is associated with the identifier, it
956      should be encoded as MD_Identifier/authority/ CI_Citation/ alternateTitle and MD_Identifier/
957      authority/ CI_Citation/ edition  -->
958              <gmd:identifier>
959              <!-- NAP makes MD_Identifier mandatory for dataset and dataset series. For USGIN, if
960      the Citation has an identifier that is different from the identifier for the described resource
961      (MD_Metadta/dataSetURI), it must be included here.  -->
962              <gmd:MD_Identifier>
963                <gmd:code>
964                  <!-- ISBN 13 example -->
965                  <gco:CharacterString>urn:isbn:000-0-000-00000-0</gco:CharacterString>
966                </gmd:code>
967              </gmd:MD_Identifier>
968            </gmd:identifier>
969            <!-- (M-M) Resource responsible party - USGIN requires at least one CI_ResponsibleParty
970      following the NAP rule -->
971            <gmd:citedResponsibleParty>
972              <gmd:CI_ResponsibleParty>
973                <!-- (M-M) (individualName + organisationName + positionName) > 0 -->
974                <gmd:individualName>
975                  <gco:CharacterString>Steve Rauzi</gco:CharacterString>
976                </gmd:individualName>
977                <gmd:organisationName>
978                  <gco:CharacterString>Arizona Geological Survey</gco:CharacterString>
979                </gmd:organisationName>
980                <gmd:positionName>
981                  <gco:CharacterString>Oil and Gas Administrator</gco:CharacterString>
982                </gmd:positionName>
983                <!-- (O-O) Contact Information - -->
984                <gmd:contactInfo>
985                  <gmd:CI_Contact>
986                    <gmd:phone>
987                      <gmd:CI_Telephone>
988                        <gmd:voice>
989                          <gco:CharacterString>520-770-3500</gco:CharacterString>
990                        </gmd:voice>
991                        <gmd:facsimile>
992                          <gco:CharacterString>520-770-3505</gco:CharacterString>
993                        </gmd:facsimile>
994                      </gmd:CI_Telephone>
995                    </gmd:phone>
996                    <gmd:address>
997                      <gmd:CI_Address>
998                        <gmd:deliveryPoint>
999                          <gco:CharacterString>416 W. Congress St., Suite 100</gco:CharacterString>
1000                        </gmd:deliveryPoint>
1001                        <gmd:city>
1002                          <gco:CharacterString>Tucson</gco:CharacterString>
1003                        </gmd:city>
1004                        <gmd:administrativeArea>
1005                          <gco:CharacterString>Arizona</gco:CharacterString>
1006                        </gmd:administrativeArea>
1007                        <gmd:postalCode>
1008                          <gco:CharacterString>85701</gco:CharacterString>
1009                        </gmd:postalCode>
1010                        <gmd:country>
1011                          <gco:CharacterString>USA</gco:CharacterString>
1012                        </gmd:country>
1013                        <gmd:electronicMailAddress>
1014                          <gco:CharacterString>Steve.rauzi@azgs.az.go</gco:CharacterString>
1015                        </gmd:electronicMailAddress>
```

```
1016                          </gmd:CI_Address>
1017                        </gmd:address>
1018                      </gmd:CI_Contact>
1019                    </gmd:contactInfo>
1020                    <!-- ISO 19139 Mandatory: contact role - Guidance on use of role codes would be
1021          helpful for consistency, but has not been developed as yet. -->
1022                    <gmd:role>
1023                      <!-- The CI_ResponsibleParty/role/CI_RoleCode@codeListValue is from napCI_RoleCode
1024          (resourceProvider, custodian, owner, user, distributor, originator, pointOfContact,
1025          principalInvestigator, processor, publisher, author, collaborator, editor, mediator,
1026          rightsHolder) -->
1027                      <gmd:CI_RoleCode codeList="napCI_RoleCode" codeListValue="pointOfContact"/>
1028                    </gmd:role>
1029                  </gmd:CI_ResponsibleParty>
1030                </gmd:citedResponsibleParty>
1031                <!-- (O-C) Dataset Presentation Form - USGIN prescribes that unless there is a
1032          significant difference between the resource's presentation format and distribution format, use
1033          distributionInfo/MD_Distribution/distributionFormat/MD_Format instead. -->
1034                <!--
1035                <gmd:presentationForm>
1036                  <gmd:CI_PresentationFormCode codeListValue="mapDigital"
1037          codeList="napCI_PresentationFormCode"/>
1038                </gmd:presentationForm>
1039                 -->
1040                <!-- (O-O) Resource series - Information about the series or collection of which the
1041          resource is a part. Follow NAP rule (name + issueIdentification) > 0. -->
1042                <gmd:series>
1043                  <gmd:CI_Series>
1044                    <gmd:name>
1045                      <!-- Name of the publication series or aggregate dataset of which the referenced
1046          dataset is a part. -->
1047                      <gco:CharacterString>Borehole Collection</gco:CharacterString>
1048                    </gmd:name>
1049                    <gmd:issueIdentification>
1050                      <!-- Identification of the series' issue information. -->
1051                      <gco:CharacterString>Volume 10</gco:CharacterString>
1052                    </gmd:issueIdentification>
1053                    <gmd:page>
1054                      <!-- Identification of the articles' page number(s). -->
1055                      <gco:CharacterString>100-110</gco:CharacterString>
1056                    </gmd:page>
1057                  </gmd:CI_Series>
1058                </gmd:series>
1059                <!--
1060                <gmd:otherCitationDetails/>-
1061                <gmd:collectiveTitle/>
1062                -->
1063              </gmd:CI_Citation>
1064            </gmd:citation>
1065            <!-- (M-M) Resource Abstract - A free text summary of the content, significance, purpose,
1066          scope, etc. of the resource. Exactly one value. -->
1067            <gmd:abstract>
1068              <gco:CharacterString>Some narrative abstract.</gco:CharacterString>
1069            </gmd:abstract>
1070            <!--
1071            <gmd:purpose/>
1072            -->
1073            <!-- (M-M) Resource Status -  -->
1074            <gmd:status>
1075              <!-- Value is from napMD_ProgressCode codelist: <completed , historicalArchive , obsolete
1076          , onGoing , planned , required , underDevelopment , proposed>. Obsolete is synonymous with
1077          deprecated. -->
1078              <gmd:MD_ProgressCode codeList="napMD_ProgressCode" codeListValue="completed"/>
1079            </gmd:status>
1080            <!-- (O-C) Resource point of contact - CI_ResponsibleParty element here would contain
1081          information for point of contact to access the resource. This information is mandatory for
1082          physical resources such as core, cuttings, samples, manuscripts. -->
1083            <gmd:pointOfContact>
1084              <gmd:CI_ResponsibleParty>
1085                <!-- (M-M) (individualName + organisationName + positionName) > 0 -->
1086                <gmd:individualName>
1087                  <gco:CharacterString>Steve Rauzi</gco:CharacterString>
```

```
1088              </gmd:individualName>
1089              <gmd:organisationName>
1090                <gco:CharacterString>Arizona Geological Survey</gco:CharacterString>
1091              </gmd:organisationName>
1092              <gmd:positionName>
1093                <gco:CharacterString>Oil and Gas Administrator</gco:CharacterString>
1094              </gmd:positionName>
1095              <!-- (O-O) Contact Information - -->
1096              <gmd:contactInfo>
1097                <gmd:CI_Contact>
1098                  <gmd:phone>
1099                    <gmd:CI_Telephone>
1100                      <gmd:voice>
1101                        <gco:CharacterString>520-770-3500</gco:CharacterString>
1102                      </gmd:voice>
1103                      <gmd:facsimile>
1104                        <gco:CharacterString>520-770-3505</gco:CharacterString>
1105                      </gmd:facsimile>
1106                    </gmd:CI_Telephone>
1107                  </gmd:phone>
1108                  <gmd:address>
1109                    <gmd:CI_Address>
1110                      <gmd:deliveryPoint>
1111                        <gco:CharacterString>416 W. Congress St., Suite 100</gco:CharacterString>
1112                      </gmd:deliveryPoint>
1113                      <gmd:city>
1114                        <gco:CharacterString>Tucson</gco:CharacterString>
1115                      </gmd:city>
1116                      <gmd:administrativeArea>
1117                        <gco:CharacterString>Arizona</gco:CharacterString>
1118                      </gmd:administrativeArea>
1119                      <gmd:postalCode>
1120                        <gco:CharacterString>85701</gco:CharacterString>
1121                      </gmd:postalCode>
1122                      <gmd:country>
1123                        <gco:CharacterString>USA</gco:CharacterString>
1124                      </gmd:country>
1125                      <gmd:electronicMailAddress>
1126                        <gco:CharacterString>Steve.rauzi@azgs.az.go</gco:CharacterString>
1127                      </gmd:electronicMailAddress>
1128                    </gmd:CI_Address>
1129                  </gmd:address>
1130                </gmd:CI_Contact>
1131              </gmd:contactInfo>
1132              <!-- ISO 19139 Mandatory: contact role - Guidance on use of role codes would be helpful
1133       for consistency, but has not been developed as yet. -->
1134              <gmd:role>
1135                <!-- The CI_ResponsibleParty/role/CI_RoleCode@codeListValue is from napCI_RoleCode
1136       (resourceProvider, custodian, owner, user, distributor, originator, pointOfContact,
1137       principalInvestigator, processor, publisher, author, collaborator, editor, mediator,
1138       rightsHolder) -->
1139                <gmd:CI_RoleCode codeList="napCI_RoleCode" codeListValue="pointOfContact"/>
1140              </gmd:role>
1141            </gmd:CI_ResponsibleParty>
1142          </gmd:pointOfContact>
1143          <!-- (O-O) Resource Maintenance - This element provides information about the maintenance
1144       schedule or history of the resource (or some subset/part of the resource specified by the scope
1145       and scope description) described by the metadata record. 0 to many MD_MaintenanceInformation
1146       elements may be included.    -->
1147          <gmd:resourceMaintenance>
1148            <gmd:MD_MaintenanceInformation>
1149              <gmd:maintenanceAndUpdateFrequency>
1150                <gmd:MD_MaintenanceFrequencyCode codeList="napMD_MaintenanceFrequencyCode"
1151       codeListValue="asNeeded"/>
1152              </gmd:maintenanceAndUpdateFrequency>
1153            </gmd:MD_MaintenanceInformation>
1154          </gmd:resourceMaintenance>
1155          <!-- (O-O) Graphic overview of resource - USGIN best practice is to provide xlink:href URL
1156       to file if it is available online, as an attribute of the MD_BrowseGraphic element. If
1157       MD_BrowseGraphic is included, MD_BrowseGraphic/filename character string is mandatory.
1158       Recommended practice is to use the Anchor extension of CharacterString xml element from ISO19139,
1159       which provides a url as an attribute and a text string as a label for the link.   -->
```

```
1160          <gmd:graphicOverview>
1161            <gmd:MD_BrowseGraphic>
1162              <gmd:fileName>
1163                <gco:CharacterString>http://azgs.az.gov/resource/00000000-0000-0000-0000-
1164    000000000000/preview.jpg</gco:CharacterString>
1165              </gmd:fileName>
1166              <gmd:fileDescription>
1167                <gco:CharacterString>preview map</gco:CharacterString>
1168              </gmd:fileDescription>
1169              <gmd:fileType>
1170                <!-- When possible, use napMD_FileFormatCode code values
1171    (http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_115) -->
1172                <gco:CharacterString>jpg</gco:CharacterString>
1173              </gmd:fileType>
1174            </gmd:MD_BrowseGraphic>
1175          </gmd:graphicOverview>
1176          <!-- (O-O) Resource Format - Specifies the formats in which the resource is known to be
1177    presented. Each format has a required MD_Format/name and MD_Format/version. USGIN metadata does
1178    not use MD_Format/formatDistributor elements to avoid ambiguity on how to encode binding between
1179    different formats and multiple distributors. That information is encoded in MD_Metadata/
1180    distributionInfo/ MD_Distribution/distributor/ MD_Distributor/ distributorFormat in USGIN
1181    metadata. -->
1182          <gmd:resourceFormat>
1183            <gmd:MD_Format>
1184              <gmd:name>
1185                <!-- When possible, use napMD_FileFormatCode code values
1186    (http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_115) -->
1187                <gco:CharacterString>pdf</gco:CharacterString>
1188              </gmd:name>
1189              <gmd:version>
1190                <gco:CharacterString>8.0</gco:CharacterString>
1191              </gmd:version>
1192            </gmd:MD_Format>
1193          </gmd:resourceFormat>
1194          <!-- (O-O) Resource keywords - Best Practice for USGIN profile metadata is to supply
1195    keywords to facilitate the discovery of metadata records relevant to the user. USGIN requires
1196    that MD_Keyword/keyword contain a CharacterString. USGIN best practice is to include keywords in
1197    English -->
1198          <gmd:descriptiveKeywords>
1199            <gmd:MD_Keywords>
1200              <gmd:keyword>
1201                <gco:CharacterString>Scanned Gamma Ray Neutron</gco:CharacterString>
1202              </gmd:keyword>
1203              <gmd:keyword>
1204                <gco:CharacterString>NMAL</gco:CharacterString>
1205              </gmd:keyword>
1206              <gmd:keyword>
1207                <gco:CharacterString>borehole</gco:CharacterString>
1208              </gmd:keyword>
1209              <!-- Keyword Type - allowed values from napMD_KeywordTypeCode: <discipline, place,
1210    stratum, temporal, theme, product, subTopicCategory> -->
1211              <gmd:type>
1212                <gmd:MD_KeywordTypeCode codeList="napMD_KeywordTypeCode" codeListValue="theme"/>
1213              </gmd:type>
1214            </gmd:MD_Keywords>
1215          </gmd:descriptiveKeywords>
1216          <gmd:descriptiveKeywords>
1217            <gmd:MD_Keywords>
1218              <gmd:keyword>
1219                <gco:CharacterString>Frasian</gco:CharacterString>
1220              </gmd:keyword>
1221              <gmd:keyword>
1222                <gco:CharacterString>Upper Devonian</gco:CharacterString>
1223              </gmd:keyword>
1224              <gmd:keyword>
1225                <gco:CharacterString>Devonian</gco:CharacterString>
1226              </gmd:keyword>
1227              <gmd:keyword>
1228                <gco:CharacterString>Paleozoic</gco:CharacterString>
1229              </gmd:keyword>
1230              <!-- Keyword Type - allowed values from napMD_KeywordTypeCode: <discipline, place,
1231    stratum, temporal, theme, product, subTopicCategory> -->
```

```
1232              <gmd:type>
1233                <gmd:MD_KeywordTypeCode codeList="napMD_KeywordTypeCode" codeListValue="temporal"/>
1234              </gmd:type>
1235            </gmd:MD_Keywords>
1236          </gmd:descriptiveKeywords>
1237          <gmd:descriptiveKeywords>
1238            <gmd:MD_Keywords>
1239              <gmd:keyword>
1240                <gco:CharacterString>Arizona</gco:CharacterString>
1241              </gmd:keyword>
1242              <gmd:keyword>
1243                <gco:CharacterString>T41N R27E S22 NE NE</gco:CharacterString>
1244              </gmd:keyword>
1245              <!-- Keyword Type - allowed values from napMD_KeywordTypeCode: <discipline, place,
1246     stratum, temporal, theme, product, subTopicCategory> -->
1247              <gmd:type>
1248                <gmd:MD_KeywordTypeCode codeList="napMD_KeywordTypeCode" codeListValue="place"/>
1249              </gmd:type>
1250            </gmd:MD_Keywords>
1251          </gmd:descriptiveKeywords>
1252          <!-- (O-O) Condition applying to access and use of resource - Follow NAP for specification
1253     of resourceConstraints. -->
1254          <gmd:resourceConstraints>
1255            <gmd:MD_LegalConstraints>
1256              <gmd:useLimitation>
1257                <gco:CharacterString>none</gco:CharacterString>
1258              </gmd:useLimitation>
1259            </gmd:MD_LegalConstraints>
1260          </gmd:resourceConstraints>
1261          <!-- (O-O) Aggregation information - The citation for or name of an aggregate dataset, the
1262     type of aggregate dataset, and optionally the activity which produced the dataset. -->
1263          <gmd:aggregationInfo>
1264            <!-- MD_AggregateInformation requires either aggregateDataSetName/CI_Citation or
1265     aggregateDataSetIdentifier/MD_Identifier.   -->
1266            <gmd:MD_AggregateInformation>
1267              <!-- Related dataset name -->
1268              <gmd:aggregateDataSetName>
1269                <gmd:CI_Citation>
1270                  <gmd:title>
1271                    <gco:CharacterString>Related Resource's Title</gco:CharacterString>
1272                  </gmd:title>
1273                  <gmd:date>
1274                    <gmd:CI_Date>
1275                      <gmd:date>
1276                        <gco:DateTime>2001-12-17T09:30:47</gco:DateTime>
1277                      </gmd:date>
1278                      <gmd:dateType>
1279                        <gmd:CI_DateTypeCode codeList="CI_DateTypeCode" codeListValue="publication"/>
1280                      </gmd:dateType>
1281                    </gmd:CI_Date>
1282                  </gmd:date>
1283                </gmd:CI_Citation>
1284              </gmd:aggregateDataSetName>
1285              <!-- Data Set Identifier -->
1286              <gmd:aggregateDataSetIdentifier>
1287                <gmd:MD_Identifier>
1288                  <gmd:code>
1289                    <gco:CharacterString>00000000-0000-0000-0000-000000000000</gco:CharacterString>
1290                  </gmd:code>
1291                </gmd:MD_Identifier>
1292              </gmd:aggregateDataSetIdentifier>
1293              <!-- (M-M) Association Type is mandatory.. -->
1294              <gmd:associationType>
1295                <!-- Use napDS_AssociationTypeCode code list: <crossReference, largerWorkCitation,
1296     partOfSeamlessDatabase, source, stereoMate, isComposedOf> -->
1297                <gmd:DS_AssociationTypeCode codeList="napDS_AssociationTypeCode"
1298     codeListValue="crossReference"/>
1299              </gmd:associationType>
1300            </gmd:MD_AggregateInformation>
1301          </gmd:aggregationInfo>
```

```
1302        <!-- (C-C) Resource spatial resolution - USGIN requires use of
1303    equivalentScale/../denominator to express spatial resolution, in order to be more easily
1304    interoperable.   -->
1305        <gmd:spatialResolution>
1306          <gmd:MD_Resolution>
1307            <gmd:equivalentScale>
1308              <gmd:MD_RepresentativeFraction>
1309                <gmd:denominator>
1310                  <gco:Integer>100000</gco:Integer>
1311                </gmd:denominator>
1312              </gmd:MD_RepresentativeFraction>
1313            </gmd:equivalentScale>
1314          </gmd:MD_Resolution>
1315        </gmd:spatialResolution>
1316        <!-- (M-M) Resource language – Multiple instances of this element indicate that the
1317    linguistic content of the resource is available in multiple languages -->
1318        <gmd:language>
1319          <!-- Three-letter language code followed by an optional three-letter country code: <ISO
1320    639-2/T three letter language code>{<;><blank space><ISO 3166-1 three letter country code>}
1321    Language code is given in lowercase. Country code is given in uppercase. This may not be
1322    interoperable – use 3 letter language code instead. -->
1323          <gco:CharacterString>eng</gco:CharacterString>
1324        </gmd:language>
1325        <!-- (C-C) Topic category - NAP specifies that  topicCategory code shall be provided when
1326    hierarchyLevel is set to "dataset" or "dataset series". NAP declares not applicable to services.
1327    More specific topic categorization should be done using keywords.
1328        Codes are from napMD_TopicCategoryCode: <farming, biota, boundaries,
1329    climatologyMeterologyAtmosphere, economy, elevation, environment, geoscientificInformation,
1330    health, imageryBaseMapsEarthCover, intelligenceMilitary, inlandWater, location, oceans,
1331    planningCadastre, society, structure, transportation, utilitiesCommunication>. -->
1332        <gmd:topicCategory>
1333          <gmd:MD_TopicCategoryCode>geoscientificInformation</gmd:MD_TopicCategoryCode>
1334        </gmd:topicCategory>
1335        <!-- (C-C) Resource content extent - Defines the spatial (horizontal and vertical) and
1336    temporal region to which the content of the resource applies. For USGIN, the spatial extent is a
1337    rectangle that bounds the geographic extent to which resource content applies. NAP specifies
1338    required when hierarchyLevel is set to 'dataset'. USGIN specifies (description +
1339    geographicElement + temporalElement) > 0. -->
1340        <gmd:extent>
1341        <gmd:EX_Extent>
1342          <!-- (C-C) Resource Content extent description – Free text that describes the spatial
1343    and temporal extent of the dataset. USGIN specifies that description is mandatory if a
1344    geographicElement or temporalElement is not provided. Note that if geographic place names are
1345    used to express the geographic extent, USGIN profile specifies that these should be encoded using
1346    keyword with keyword type code = 'place.' Geographic names may be duplicated in the
1347    EX_Extent/description. -->
1348            <gmd:description>
1349              <gco:CharacterString>Some spatio-temporal description.</gco:CharacterString>
1350            </gmd:description>
1351            <!-- (O-C) Resource content extent bounding box -USGIN profile requires that if an
1352    EX_Extent/geographicElement is supplied, it include a geographic bounding box with bounding
1353    latitude and longitude expressed using WGS 84 decimal degrees. The corner coordinates for the
1354    geographic bounding box must not coincide in one point, because this may result in fatal errors
1355    with some CSW implementations. Point locations must thus be represented as tiny rectangles. USGIN
1356    recommended practice is to place the actual point location in the lower left corner of the
1357    rectangle. -->
1358            <gmd:geographicElement>
1359              <gmd:EX_GeographicBoundingBox>
1360                <gmd:extentTypeCode>
1361                  <gco:Boolean>1</gco:Boolean>
1362                </gmd:extentTypeCode>
1363                <gmd:westBoundLongitude>
1364                  <gco:Decimal>-109.911001</gco:Decimal>
1365                </gmd:westBoundLongitude>
1366                <gmd:eastBoundLongitude>
1367                  <gco:Decimal>-109.910999</gco:Decimal>
1368                </gmd:eastBoundLongitude>
1369                <gmd:southBoundLatitude>
1370                  <gco:Decimal>34.772899</gco:Decimal>
1371                </gmd:southBoundLatitude>
1372                <gmd:northBoundLatitude>
1373                  <gco:Decimal>34.772901</gco:Decimal>
```

```
1374            </gmd:northBoundLatitude>
1375          </gmd:EX_GeographicBoundingBox>
1376        </gmd:geographicElement>
1377        <!-- (C-X) Resource content extent geographic description - Not used by USGIN profile,
1378    use keyword with type code = 'place' (with thesaurus if necessary). -->
1379        <!--
1380        <gmd:geographicElement>
1381          <gmd:EX_GeographicDescription/>
1382        </gmd:geographicElement>
1383        -->
1384        <!-- (C-O) Resource content extent bounding polygon -  -->
1385        <!--
1386        <gmd:geographicElement>
1387          <gmd:EX_BoundingPolygon/>
1388        </gmd:geographicElement>
1389        -->
1390      </gmd:EX_Extent>
1391    </gmd:extent>
1392    <!-- (O-O) Resource temporal extent -  -->
1393    <gmd:extent>
1394      <gmd:EX_Extent>
1395        <gmd:temporalElement>
1396          <gmd:EX_TemporalExtent>
1397            <gmd:extent>
1398              <gml:TimePeriod gml:id="ID">
1399                <gml:name>Jurassic</gml:name>
1400                <!-- USGIN requires the beginPosition and endPosition's frame property to be
1401    defined. The default value is #ISO-8601. -->
1402                <gml:beginPosition frame="#ISO-8601">2007-05-28T00:00:00</gml:beginPosition>
1403                <gml:endPosition frame="#ISO-8601">2007-05-28T00:00:00</gml:endPosition>
1404              </gml:TimePeriod>
1405            </gmd:extent>
1406          </gmd:EX_TemporalExtent>
1407        </gmd:temporalElement>
1408      </gmd:EX_Extent>
1409    </gmd:extent>
1410    <!-- (O-X) Resource spatio-temporal extent - Although use of EX_SpatialTemporalExtent is
1411    allowed by ISO19139 and NAP, USGIN best practice is to encode space time location with
1412    EX_TemporalExtent and EX_GeographicBoundingBox. Other optional extent elements may be included,
1413    but they may be ignored by client implementations processing the metadata document. -->
1414    <!--
1415    <gmd:extent>
1416      <gmd:EX_Extent>
1417        <gmd:temporalElement>
1418          <gmd:EX_SpatialTemporalExtent/>
1419        </gmd:temporalElement>
1420      </gmd:EX_Extent>
1421    </gmd:extent>
1422    -->
1423    <!-- (O-O) Resource vertical extent -  -->
1424    <gmd:extent>
1425      <gmd:EX_Extent>
1426        <gmd:verticalElement>
1427          <gmd:EX_VerticalExtent>
1428            <gmd:minimumValue>
1429              <gco:Real>-100</gco:Real>
1430            </gmd:minimumValue>
1431            <gmd:maximumValue>
1432              <gco:Real>200</gco:Real>
1433            </gmd:maximumValue>
1434            <!-- Use EPSG register of geodetic parameters such as at http://www.epsg-
1435    registry.org/. The default VerticalCRS is World mean sea level (MSL), meters, measured positive
1436    upward: urn:ogc:def:crs:EPSG::5714  -->
1437            <gmd:verticalCRS xlink:href="urn:ogc:def:crs:EPSG::5714"/>
1438          </gmd:EX_VerticalExtent>
1439        </gmd:verticalElement>
1440      </gmd:EX_Extent>
1441    </gmd:extent>
1442  </gmd:MD_DataIdentification>
1443  </gmd:identificationInfo>
```

```
1444      <!-- (O-O) Content informnation - Characteristics describing the feature cataloguecatalog,
1445   coverage, or image data. USGIN currently makes no recommendation for use of contentInfo; follow
1446   NAP recommendations. -->
1447      <!--
1448      <gmd:contentInfo/>
1449      -->
1450      <!-- (O-O) Resource distribution information - This element provides information to inform
1451   users how to obtain or access the described resource.  NOTE: there are several ways elements can
1452   be nested within MD_Distribution  -->
1453      <gmd:distributionInfo>
1454        <gmd:MD_Distribution>
1455          <!-- (O-X)  Resource distribution format - US GIN profile specifies that if distribution
1456   information is included (MD_Distribution is not null), then distributor/MD_Distributor is
1457   required. The distributionFormat may be included in the document (its schema valid...), but
1458   distribution format information must be duplicated in a distributor/ MD_Distributor/
1459   distributorFormat element or the content can be lost. -->
1460          <!--
1461          <gmd:distributionFormat/>
1462          -->
1463          <!-- (O-C) Resource distributor information - USGIN makes Mandatory if distributionInfo is
1464   not null. USGIN differs from NAP in this case (but not with ISO 19115) by allowing multiple
1465   distributors, and binding between distributors, transfer options, and formats. -->
1466          <gmd:distributor>
1467            <!-- For USGIN profile, each distributor/MD_Distributor is a binding between one or more
1468   transfer options and the distributor formats that are available through that/those transfer
1469   options (MD_DigitalTransferOptions/onLine/CI_OnlineResource in particular). If different formats
1470   are available from the same distributor, but have different transfer options, these should be
1471   represented as different distributor/ MD_Distributor instances.-->
1472            <gmd:MD_Distributor>
1473              <gmd:distributorContact>
1474                <!-- (C-C) Distribution responsible party - For CI_ResponsibleParty, count of
1475   (individualName + organisationName + positionName) > 0 -->
1476                <gmd:CI_ResponsibleParty>
1477                  <gmd:organisationName>
1478                    <gco:CharacterString>Arizona Geological Survey</gco:CharacterString>
1479                  </gmd:organisationName>
1480                  <!-- (C-C) If CI_ResponsibleParty exists, the role element is required -->
1481                  <gmd:role>
1482                    <!-- Use napCI_RoleCode <resourceProvider, custodian, owner, distributor,
1483   pointOfContact, publisher, author, editor, rights-Holder> -->
1484                    <gmd:CI_RoleCode codeList="napCI_RoleCode" codeListValue="distributor"/>
1485                  </gmd:role>
1486                </gmd:CI_ResponsibleParty>
1487              </gmd:distributorContact>
1488              <!-- (O-O) Resource distributor order process -  -->
1489              <gmd:distributionOrderProcess>
1490                <gmd:MD_StandardOrderProcess>
1491                  <gmd:fees>
1492                    <gco:CharacterString>variable fees</gco:CharacterString>
1493                  </gmd:fees>
1494                  <gmd:orderingInstructions>
1495                    <gco:CharacterString>ordering instructions</gco:CharacterString>
1496                  </gmd:orderingInstructions>
1497                  <gmd:turnaround>
1498                    <gco:CharacterString>one to two weeks.</gco:CharacterString>
1499                  </gmd:turnaround>
1500                </gmd:MD_StandardOrderProcess>
1501              </gmd:distributionOrderProcess>
1502              <!-- (O-C) Resource distributor format - USGIN profile specifies that the
1503   distributionInfo/MD_Distribution/distributionFormat may be included in the document (its schema
1504   valid...), but distribution format information must be duplicated in a
1505   distributionInfo/distributor/MD_Distributor/distributorFormat element or the content can be lost
1506   -->
1507              <gmd:distributorFormat>
1508                <gmd:MD_Format>
1509                  <!-- When possible, use napMD_FileFormatCode code values
1510   (http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_115) -->
1511                  <gmd:name>
1512                    <gco:CharacterString>pdf</gco:CharacterString>
1513                  </gmd:name>
1514                  <gmd:version>
1515                    <gco:CharacterString>8.0</gco:CharacterString>
```

```
1516              </gmd:version>
1517            </gmd:MD_Format>
1518          </gmd:distributorFormat>
1519          <!-- Resource distributor transfer options - provides information about the technical
1520    means and media used by the distributor -->
1521          <gmd:distributorTransferOptions>
1522            <gmd:MD_DigitalTransferOptions>
1523              <gmd:onLine>
1524                <!-- (M-M) Resource distributor on-line distribution linkage - NAP requires
1525    CI_OnlineResource/linkage and CI_OnlineResource/protocol in CI_OnlineResource.   -->
1526                <gmd:CI_OnlineResource>
1527                  <gmd:linkage>
1528                    <!-- The linkage element should contain the complete URL to access the
1529    resource directly. CI_Online-Resource requires a Linkage element that is a gmd:URL. -->
1530                    <gmd:URL>http://azgs.az.gov/resource/00000000-0000-0000-0000-
1531    000000000000/borehole_report.pdf</gmd:URL>
1532                  </gmd:linkage>
1533                  <gmd:protocol>
1534                    <!-- The protocol element defines a valid internet protocol used to access the
1535    resource. 'ftp' or 'http' are the most likely values. -->
1536                    <gco:CharacterString>http</gco:CharacterString>
1537                  </gmd:protocol>
1538                  <!-- (C-C) Resource distributor online distribution application profile -
1539    applicationProfile is required if the CI_OnlineResource/linkage does not connect to a web page,
1540    and another software application is needed to use the indicated file resource. The
1541    applicationProfile character string should specify the software using the following recommended
1542    syntax: "vendor:application name/application version", e.g. "Microsoft:Word/2007", or
1543    "ESRI:ArcGIS/9.3" -->
1544                  <gmd:applicationProfile>
1545                    <gco:CharacterString>Adobe:Acrobat/8.0</gco:CharacterString>
1546                  </gmd:applicationProfile>
1547                  <gmd:name>
1548                    <!-- The CI_OnlineResource/name element may duplicate the file name if the URL
1549    is a link to a file.  -->
1550                    <gco:CharacterString>borehole_report.pdf</gco:CharacterString>
1551                  </gmd:name>
1552                  <gmd:description>
1553                    <gco:CharacterString>Downloadable PDF document</gco:CharacterString>
1554                  </gmd:description>
1555                  <!-- (O-M) Resource distributor online distribution function -
1556    CI_OnlineResource/function is required by USGIN to indicate how linkage is to be used. Valid
1557    values for napCI_OnlineFunctionCode in this role are: <download, information, search,
1558    emailService, browsing, fileAccess>. If the resource is accessible as a web service, the metadata
1559    for the service should be separate metadata record with a MD_ServiceIdentification element
1560    providing online access information, and the dataset(s) exposed through the service identified in
1561    the service metadata record as coupledResources. -->
1562                  <gmd:function>
1563                    <gmd:CI_OnLineFunctionCode codeListValue="download"
1564    codeList="napCI_OnlineFunctionCode">download</gmd:CI_OnLineFunctionCode>
1565                  </gmd:function>
1566                </gmd:CI_OnlineResource>
1567              </gmd:onLine>
1568            </gmd:MD_DigitalTransferOptions>
1569          </gmd:distributorTransferOptions>
1570        </gmd:MD_Distributor>
1571      </gmd:distributor>
1572      <!-- (C-X) Resource transfer options - Not used by USGIN. MD_DigitalTransferOptions
1573    provides information on digital distribution of resource. For USGIN catalogs, digital transfer
1574    options must be included in an MD_Distribution/distributor/ MD_Distributor/
1575    distributorTransferOptions/ MD_DigitalTransferOptions element.  This is to avoid ambiguity as to
1576    where this information should be included in the metadata, and to enforce binding between a
1577    distributor and transfer procedures for that distributor. Information for transfer options may be
1578    duplicated in this element if desired. -->
1579      <!--
1580      <gmd:transferOptions/>
1581      -->
1582    </gmd:MD_Distribution>
1583  </gmd:distributionInfo>
1584  <!-- (C-C) Data quality Information - NAP requires either dataQualityInfo/DQ_DataQuality/report
1585    or dataQualityInfo/ DQ_Data-Quality/lineage    if
1586    dataQualityInfo/DQ_DataQuality/scope/DQ_Scope/level = 'dataset'.   -->
1587  <gmd:dataQualityInfo>
```

```
1588         <gmd:DQ_DataQuality>
1589           <!-- (C-C) Data quality scope - Mandatory if DQ_DataQuality is not null.  Specifies the
1590       extent of characteristics for which data quality information is reported. -->
1591           <gmd:scope>
1592             <gmd:DQ_Scope>
1593               <gmd:level>
1594                 <!-- NAP provides that scope code value is from napMD_ScopeCode: <attribute,
1595       attributeType, collectionHardware, collectionSession, dataset, series, nonGeographicDataset,
1596       dimensionGroup, feature, featureType, propertyType, fieldSession, software, service, model,
1597       tile>. -->
1598                 <gmd:MD_ScopeCode codeList="napMD_ScopeCode" codeListValue="dataset"/>
1599               </gmd:level>
1600               <!-- (C-C) Data quality scope level description - NAP provision is that
1601       DQ_DataQuality/scope/levelDescription is mandatory if scope/DQ_Scope/level is not equal to
1602       'dataset' or 'series'. USGIN adds requirement that DataQuality/scope/levelDescription is
1603       mandatory if DQ_DataQuality/scope/DQ_Scope/level/MD_ScopeCode.codeListValue is not equal to
1604       MD_MetadataHierarchy/hierarchyLevel/MD_ScopeCode.codelistvalue level. -->
1605               <!--
1606               <gmd:levelDescription>
1607                 <gmd:MD_ScopeDescription>
1608                 --><!-- NAP BP: One and only one of the following must be entered: attributes,
1609       features, featureInstances, attributeInstances, dataset, or other as appropriate. Encoding of the
1610       values for the levelDescription element is unclear from the ISO or INCITs documentation. --><!--
1611                   <gmd:attributes></gmd:attributes>
1612                 </gmd:MD_ScopeDescription>
1613               </gmd:levelDescription>
1614               -->
1615             </gmd:DQ_Scope>
1616           </gmd:scope>
1617           <!-- (C-C) Data quality report - If a DQ_DataQuality/report element is included, at least
1618       one of the 15 possible data quality elements must be present, and multiple report elements are
1619       allowed within each DQ_DataQuality element.   -->
1620           <gmd:report>
1621             <gmd:DQ_CompletenessCommission>
1622               <gmd:nameOfMeasure>
1623                 <gco:CharacterString>Name of Measure</gco:CharacterString>
1624               </gmd:nameOfMeasure>
1625               <gmd:result>
1626                 <gmd:DQ_QuantitativeResult>
1627                 <gmd:valueUnit></gmd:valueUnit>
1628                   <gmd:value>
1629                     <gco:Record>a value</gco:Record>
1630                   </gmd:value>
1631                 </gmd:DQ_QuantitativeResult>
1632               </gmd:result>
1633             </gmd:DQ_CompletenessCommission>
1634           </gmd:report>
1635           <!-- (C-C) Data quality lineage - USGIN follows NAP rule that
1636       count(lineage/LI_Lineage/source + lineage/LI_Lineage/sourceStep + lineage/LI_Lineage/statement )
1637       >0  for spatial dataset and spatial dataset series. Not applicable to services. -->
1638           <gmd:lineage>
1639             <gmd:LI_Lineage>
1640               <gmd:statement>
1641                 <!-- Describe data creators and maintainers. -->
1642                 <gco:CharacterString>This dataset is maintained by the Arizona Geological
1643       Survey</gco:CharacterString>
1644               </gmd:statement>
1645               <!-- (C-X) Data quality lineage source -  -->
1646               <!--
1647               <gmd:source/>
1648               -->
1649               <!-- (C-C) Data quality lineage process step - An event in the development of the
1650       dataset. Best practice recommended for USGIN is that source association from a process step is to
1651       inputs to a process, and processStep associations from a source element link an output resource
1652       to a process step that produced it.   -->
1653               <!--
1654               <gmd:processStep>
1655                 <gmd:LI_ProcessStep>
1656                   <gmd:description>
1657                     <gco:CharacterString></gco:CharacterString>
1658                   </gmd:description>
1659                 </gmd:LI_ProcessStep>
```

```
1660              </gmd:processStep>
1661              -->
1662            </gmd:LI_Lineage>
1663          </gmd:lineage>
1664        </gmd:DQ_DataQuality>
1665      </gmd:dataQualityInfo>
1666      <!-- (O-O) Portrayal catalog information - A portrayal cataloguecatalog is a collection of
1667    defined symbols used to depict, to humans, features on a map. No documentation in ISO 19115 about
1668    how this is supposed to work. ISO 19117 defines the structure of a Portrayal Catalogue. No USGIN
1669    recommended practices here yet. -->
1670      <!--
1671      <gmd:portrayalCatalogueInfo/>
1672      -->
1673      <!-- (O-O) Metadata constraint information - This element specifies use constraints for access
1674    to the metadata record.  -->
1675      <gmd:metadataConstraints>
1676        <!-- Constraints -->
1677        <gmd:MD_Constraints>
1678          <!-- NAP provision is that metadataConstraints/MD_Constraints/useLimitation is mandatory
1679    when MD_Constraints is used to specify metadataConstraints.  -->
1680          <gmd:useLimitation>
1681            <gco:CharacterString>fair use</gco:CharacterString>
1682          </gmd:useLimitation>
1683        </gmd:MD_Constraints>
1684      </gmd:metadataConstraints>
1685      <gmd:metadataConstraints>
1686        <!-- Legal constraint -->
1687        <gmd:MD_LegalConstraints>
1688          <!-- When one of the subtypes MD_LegalConstraints or MD_SecurityConstraints is used,
1689    useLimitation is optional. -->
1690          <gmd:useLimitation>
1691            <gco:CharacterString>one</gco:CharacterString>
1692          </gmd:useLimitation>
1693          <gmd:accessConstraints>
1694            <!-- Coder list specified by napMD_RestrictionCode with values: <copyright, patent,
1695    patentPending, trademark, license, intellectualPropertyRights, restricted, otherRestrictions,
1696    licenseUnrestricted, licenseEndUser, licenseDistributor, privacy, statutory, confidential,
1697    sensitivity>. -->
1698            <gmd:MD_RestrictionCode
1699              codeListValue="otherRestrictions"
1700              codeList="napMD_RestrictionCode"/>
1701          </gmd:accessConstraints>
1702          <gmd:useConstraints>
1703            <!-- Coder list specified by napMD_RestrictionCode with values: <copyright, patent,
1704    patentPending, trademark, license, intellectualPropertyRights, restricted, otherRestrictions,
1705    licenseUnrestricted, licenseEndUser, licenseDistributor, privacy, statutory, confidential,
1706    sensitivity>. -->
1707            <gmd:MD_RestrictionCode
1708              codeListValue="otherRestrictions"
1709              codeList="napMD_RestrictionCode"/>
1710          </gmd:useConstraints>
1711          <gmd:otherConstraints>
1712            <gco:CharacterString>Data only to be used for the purposes for which they were
1713    collected.</gco:CharacterString>
1714          </gmd:otherConstraints>
1715        </gmd:MD_LegalConstraints>
1716      </gmd:metadataConstraints>
1717      <gmd:metadataConstraints>
1718        <!-- Security constraints -->
1719        <gmd:MD_SecurityConstraints>
1720          <gmd:classification>
1721            <!-- MD_SecurtyConstraints has various optional free text values, and a required
1722    MD_SecurityConstraints/classification from napMD_ClassificationCode: <unclassified, restricted,
1723    confidential, secret, topSecret, sensitive, forOfficialUseOnly> -->
1724            <gmd:MD_ClassificationCode codeListValue="unclassified"
1725    codeList="napMD_ClassificationCode"></gmd:MD_ClassificationCode>
1726          </gmd:classification>
1727        </gmd:MD_SecurityConstraints>
1728      </gmd:metadataConstraints>
1729      <!-- (O-O) Application schema information - Information about the conceptual schema of the
1730    dataset. -->
1731      <!--
```

```
1732     <gmd:applicationSchemaInfo>
1733       --><!-- (M-M) The applicationSchemaInfo/MD_ApplicationSchemaInformation element has mandatory
1734   name/CI_Citation, schemaLanguage free text, and constraintLanguage free text. --><!--
1735       <gmd:MD_ApplicationSchemaInformation>
1736         <gmd:name>
1737           <gmd:CI_Citation>
1738             <gmd:title>
1739               <gco:CharacterString>schema title string</gco:CharacterString>
1740             </gmd:title>
1741             <gmd:date>
1742               <gmd:CI_Date>
1743                 <gmd:date>
1744                   <gco:DateTime>2001-12-17T09:30:47</gco:DateTime>
1745                 </gmd:date>
1746                 <gmd:dateType>
1747                   <gmd:CI_DateTypeCode codeList="CI_DateTypeCode" codeListValue="publication"/>
1748                 </gmd:dateType>
1749               </gmd:CI_Date>
1750             </gmd:date>
1751           </gmd:CI_Citation>
1752         </gmd:name>
1753         <gmd:schemaLanguage>
1754           <gco:CharacterString>schema language</gco:CharacterString>
1755         </gmd:schemaLanguage>
1756         <gmd:constraintLanguage>
1757           <gco:CharacterString>constraint language</gco:CharacterString>
1758         </gmd:constraintLanguage>
1759       </gmd:MD_ApplicationSchemaInformation>
1760     </gmd:applicationSchemaInfo>
1761     -->
1762     <!-- (O-O) Metadata maintenance information - This element provides information about the
1763   maintenance schedule or history of the metadata record.  -->
1764     <gmd:metadataMaintenance>
1765       <gmd:MD_MaintenanceInformation>
1766         <gmd:maintenanceAndUpdateFrequency>
1767           <!-- Only one MD_MaintenanceInformation element may be included, with a required
1768   napMD_MaintenanceFrequencyCode: <continual, daily, weekly, fortnightly, monthly, quarterly,
1769   biannually, annually, asNeeded, irregular, notPlanned, unknown, semimonthly> -->
1770           <gmd:MD_MaintenanceFrequencyCode codeListValue="asNeeded"
1771   codeList="napMD_MaintenanceFrequencyCode"/>
1772         </gmd:maintenanceAndUpdateFrequency>
1773       </gmd:MD_MaintenanceInformation>
1774     </gmd:metadataMaintenance>
1775     <!-- (X-X) Series information - Not used by USGIN. -->
1776     <!--
1777     <gmd:series/>
1778     -->
1779     <!-- (X-X) Described resource - Not used by USGIN. -->
1780     <!--
1781     <gmd:describes/>
1782     -->
1783     <!-- (X-X) Property type description - Not used by USGIN. -->
1784     <!--
1785     <gmd:propertyType/>
1786     -->
1787     <!-- (X-X) Feature type description - Not used by USGIN -->
1788     <!--
1789     <gmd:featureType/>
1790     -->
1791     <!-- (X-X) Feature attributes - Not used by USGIN -->
1792     <!--
1793     <gmd:featureAttribute/>
1794     -->
1795   </gmd:MD_Metadata>
1796
```

¹⁷⁹⁷ # 8 Codelists

¹⁷⁹⁸ ## 8.1 Distribution format

1799   Book

1800   Rock sample

1801   Core

1802   Cuttings

1803   Paper map