Database for Mineral Districts in the State of Arizona

Edited by

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Based on

Metallic Mineral Districts of Arizona
By Stanley B. Keith, Don E. Gest, and Ed DeWitt

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The districts delineated in this report are based on Metallic Mineral Districts of Arizona (Arizona Geological Survey Map 18) [Keith et al.,1983a], which served as a starting point for this database. The mineral districts attempt to identify mineralized areas based on geologic character and age of mineralization. This database is an attempt to assign accurate spatial locations to the districts shown on the Keith et al. [1983a] map, and to provide more in depth information on the geology of the districts. The districts are classified according to the system elaborated in Keith et al. [1983b], a report which was published in conjunction with the Keith et al. [1983a] map. This report discusses definition of the districts, and has a summary of metal production reported to the U.S. Bureau of Mines, and in published sources available as of 1981 [Keith et al., 1983b]. The production data included in the table DistrictDataAZMIN are imported from a previous Arizona Geological Survey database [Welty et al., 1989] that contained the production data from the printed publication [Keith et al., 1983b]. Minor discrepancies with data reported in Keith et al [1983b] are the result of edits to that data made during final production of the published report and not updated in the database version that has been preserved, or are the result of edits, corrections and additions that have been made to this database since publication of the original production summary.

The districts ideally outline an area affected by a single hydrothermal system that operated over some discrete time interval. Stanley B. Keith defines a mineral district as 'an area of mine and prospect activity that contains alteration and metallization with consistent geochemical, mineralogical, and petrological (in terms of the spatially and temporally associated magmatism) characteristics that can be classified according to the magma-metal series system' [Keith, 2000, MagmaChem unpublished report]. The prototypical example is the alteration and mineralization associated with a particular intrusive body in a porphyry copper system. Note that this is a different sort of definition from that of historic mining districts, which were defined based on spatial clustering of mines of similar sorts for purposed of establishing rules for staking claims. Keith's definition assumes that metallic mineralization is always associated with magmatic activity, an assumption that is hotly debated in the economic geology community. From a descriptive perspective, a causal connection between mineralization and particular igneous activity is often difficult to establish conclusively. For many of the districts in Arizona, there is no obvious connection with an igneous system. For other districts, there is evidence strongly suggesting a composite history, involving overprinting of mineral systems of dramatically different ages and environments. Multiple intrusive events spanning several million years have been documented in all well studied porphyry copper systems. In some cases, hydrothermal activity is not necessarily associated with intrusive bodies (e.g. Buckskin Mountains, stratabound uranium). Multiple fluid release events, each with characteristic associated mineralization, may be associated with the cooling of a single magma body [Keith & Swan, 1996; Keith, 1999]. Because of this complexity, and accumulation of new data and concepts, the definition and delineation of mineral districts is an ongoing process, and the outlines presented here are the current hypothesis. This is a work in progress.

Many of the districts consist of several discrete areas of mineralization. In these cases, the interpretation is that the style and age of mineralization is similar, but there are separate discrete zones of alteration and mineralization. These loci of mineralization may be related to several contemporaneous igneous centers, reflect separate structurally favorable locations, or be the result of metal zoning on the district scale due to spatial evolution of a hydrothermal system.

PROCEDURE TO DELINEATE MINERAL DISTRICTS

The starting point for the delineation of mineral districts in this database was an already digitized version of the Keith et al. [1983a] map. This was used in conjunction with several point datasets that

identify mineralized sites, georeferenced USGS topographic maps, digital geologic map information compiled at scales ranging from 1:100,000 to 1:1,000,000, and reference to published paper maps and reports. The point data sets used are the USGS Mineral Resource Data System (MRDS), the USGS Mineral Industry Locator System database (originally compiled by the U.S. Bureau of Mines), and an in-progress compilation of abandoned mine locations provided by the Arizona State Mine Inspector's office (ASMI_AML). The MRDS database includes geologic information about some sites, lists of major and minor commodities associated with a site, synonym names for some sites, and production level for the site (none, small, medium, large). MILS classifies each site with one commodity, a status, type, and production level. Locations in these two databases have highly variable and unpredictable accuracy. The ASMI_AML locations generally appear to be the most accurate, and are classified according to whether they have been field-verified. Sites that have been field checked have some brief description of the nature of the workings there, but the database includes no information on geology or kind of mineralization. The other source used to determine the location of existing mineral exploration working was georeferenced scans of USGS topographic maps. 1:24000-scale quadrangle maps were used as a compilation base for those areas in UTM zone 12, which includes most of the state. For the western edge of the state, which is in UTM zone 11, the compilation base was as scanned, georeferenced 1:100,000-scale topographic map.

Digitized geologic map information at the most detailed scale available was used to provide geologic constraint on the delineation of the mineral districts. In northeastern Arizona, for areas on the Colorado Plateau, the geologic base used was a digital version of the Wilson et al. [1969] Geologic Map of Arizona [USGS, 2000], because this map provides a more accurate and detailed depiction of the stratigraphic units that control mineralization there. Digital data for four 30 by 60 minute quadrangles in northwestern Arizona were provided by the USGS Flagstaff office [ref.]. In the central part of the state, a digital preliminary version of the geologic map of the Prescott National Forest [DeWitt, and others, in prep, 2002] was used extensively. Digital versions of 1:100,000 geologic compilations for the Phoenix and most of the Mesa 2 degree quadrangles by the Arizona Geological survey were used in those areas. For other parts of the state, geologic data from a digital version of the Richard et al. [2000] Geologic Map of Arizona were used.

Each district outline was edited with reference to the above sources. Tracking records for each polygon include specifics for the data sources used in the delineation of the polygon, and in some cases, more particular information about delineation of a polygon is included in the Comment field for that polygon in the shapefile data table. Every district outline from the original digitized version of the Keith et al. [1983a] map has been modified though a combination of reshaping and translation, such that the polygons coincide to the extent possible, with the distribution of exposed mineralized rock. The actual delineation process is extremely subjective. Polygon outlines have been drawn to include all related mineral exploration workings that are located reliably by the source information, as well as regions of altered rock identified based on descriptions of the mineralized area referenced in the tracking records, or based on the editors experience. In districts where there appears to be a structural control on the distribution of the mineralization, the polygon outlines attempt to convey the orientation of the structural trends.

Modes of delineation:

1. Stratabound deposits in particular formations (mostly Uranium), defined by outcrop of the formation, distribution of mines & prospects, and distribution of Uranium anomalies where available
2. Single mine districts—districts defined by a single mine or prospect. Questionable if these should be called districts—does a single mineralized structure make a district? The outline was drawn to include the mine and an approximately 2 km-diameter buffer around the site.

3. Boundary defined by distribution of mapped (MRDS, MILS, ASMI_AML, topographic maps) mines & prospects. Generally the outline includes a 0.5-1 km buffer around the convex hull that encloses all the sites.
4. Boundary defined by overlapping post-mineralization rock
5. Boundary defined by fault juxtaposing non-mineralized rock
6. Boundary defined by mapped alteration. This approach was used in the rare cases that alteration maps were available, or the editor had personal knowledge of the extent of alteration.

DATABASE COMPONENTS

The structure of the database included here is a stripped down version of the data structure described by Richard and Orr [2001]. The reader is advised to study that document for a more in depth discussion of database design philosophy.

The core components of the structure are:

1. Classification Concept table(s). Tables with similar structure that define terminology. The essential elements of these ClassificationConcept tables are a unique identifier, a name, and a definition/description. The unique identifier follows the global unique identifier scheme described below. The name is a string that allows human identification of the concept (e.g. 'basalt'), and the definition/description is a free text field that defines the term or describes its meaning precisely. In this database, the MineralDistrictDefinition table is a ClassificationConcept table that defines that mineral districts depicted, as well as the higher level classification of districts used.
2. Relationship tables. These are tables that link data instances. The meaning of the link is defined by a relationship type attribute. Two sorts of relationship tables are present in this database. Hierarchy Relationship tables define parent-child relationships in hierarchies; these may be taxonomic (IsA) or meronymic (Part-Whole). Simple Relationship tables link data instances, which may have a sequence; typically these link description parts (e.g. image to rock description, age date to rock description, chemical analysis to location).
3. Description tables. These are tables tailored to particular kinds of descriptions. The production data table is a description table that is linked to the MineralDistrictDefinition table (a ClassificationConcept table) directly through the sharing of a unique identifier.

Identification Scheme

Unique identification of data instances in an internationally distributed data warehouse is achieved by partitioning responsibility for maintenance of unique identifiers. The Arizona geological Survey uses a 3-component composite key, consisting of 3 long (4 byte) integers. At the top level, each organization providing data to the system must be assigned a NameSpace by the overall system manager. Note that a NameSpace is a ClassificationConcept. The name string and an integer identifier for the NameSpace must be globally unique. Within each NameSpace, every data file must have a unique integer identifier, and should have a unique name string. The system manager for the NameSpace must assign a unique identifier number to each data table, geographic data set (coverage, shapefile, etc.), image, text file, etc. that will be used by the system. Information about each data file (called a DataSet here) is stored in a central DataSet table maintained within each NameSpace. This information must include a physical address (url) for each DataSet so that it can be located automatically when accessed. Within each DataSet, every data instance has a unique integer identifier number. The field containing this identifier is generally named with a string in the form 'DataSetName' & "ID". In summary, the unique, global identifier for any data instance is a tuple consisting of 3 integers: {NameSpaceID, DataSetID, ObjectID}. Because this system has not been adopted outside the Arizona Geological Survey at present, the

NameSpaceID is not explicitly included in tables here. Because some database software cannot joint on multiple fields, implementation considerations require generating a single UniqueID from the DataSet-ID and ObjectID under some conditions. This is done using the formula ID = (DataSetID * 10000000) + ObjectID.

Metadata

Feature level metadata is implemented by linking every data instance with an origin TrackingRecord, either as an attribute of the instance, or by inheriting origin tracking from the DataSet that contains the instance. The TrackingRecord defines a person, organization, and project (an 'activity) that generated the data instance. The tracking record may include a link to a formal data processing description for how the information was obtained and introduced to the database, but in this database these links are empty. Instead the tracking record description field text contains a narrative description of the processing method. Each TrackingRecord has links (through a SimpleRelationship instance in the DI23SimpleRelationship table) to one or more bibliographic citations.

Table naming conventions

Tables and fields are named following the conventions used by international standards efforts such as UML [OMG, 1999] and the Open GIS Consortium. Names are strings with no spaces. The first letter of separate words in the name is capitalized, and no underscore separates words in the name. Typing underscores is error-prone, and under many display conditions, the underscores may be difficult to see. Because of limitations in ArcInfo (v8.0.1) and ArcView (v.3.2) software, field names in spatial data native tables are limited to 10 characters.

DATA OVERVIEW AND ORGANIZATION

Infrastructure versus local databases

The DI23MinDist.mdb file contains tables with data specific to the mineral district database. Other Microsoft Access databases included with this report provide tables containing information that is used in all AZGS databases; these are referred to collectively as Infrastructure databases. The metadataInfrastructure.mdb file contains metadata information. Tables from the Infrastructure databases that are used for the DI23MinDist database have been imported into the DI23MinDist.mdb database included here; these may be identified by the prefix 'geo' or 'meta' in the table name.

Local Database Organization

The geospatial information in the database is contained in one ArcView shapefile. The MineDistricts polygon shapefile locates the mineral districts in the State of Arizona. These mineral districts are defined in the MineralDistrictDefinition ClassificationConcept table. A compound primary key consisting of a source-file identifier, DatasetID, and a unique identifier within that file, ObjectID, uniquely identifies each polygon in the MineralDistricts data set. Since the ObjectID identifier is a user-defined attribute, the user must enforce the uniqueness constraint. The ObjectID values in the tables in this database should not be edited unless the user fully understands the data structure and the ramifications of editing the primary key in a relational database table. All polygons also have a TrackingID attribute that joins with the *DI23TrackingRecord* table to show the source origination and tracking information for each polygon. The compound object key, ObjectID and DatasetID, and the compound source-tracking key, TrackingID and TrackingDS, are the minimal set of attributes fundamental to each spatial object.

A number of other attributes are also included in the MineralDistricts shapefile. DistrictID and DistrictDS, form a compound key that links each mineral district delineation polygon to the MineralDistrictDefinition record for that district. The classification confidence attribute, CConf, provides a subjective measure of the confidence level for the classification of the district (Low; Standard, High). The Name attribute provides the mineral district name for each mineral district polygon. The Comment attribute field provides the names of mines within each particular polygon, as well as text indicating specifics of how the polygon was delineated. The Description field contains text describing the geologic setting for the particular polygon. The Classification and Age fields contain the classification code and age interpretation for the particular polygon. The DistTypeID/DistTypeDS fields form a compound key that links to the definition of the district type indicated by the Classification text field. District types are defined in the District Definition table, and are directly from Keith et al. [1983]. That publication should be reviewed for further information on classification of the districts. In some cases, individual polygons are assigned a classification or age that is different from the classification or age assigned to the district as a whole. These fine-scale classifications indicate metal zoning within a district, and are based on the editor's interpretation.

Additional information for the mineral districts defined in Keith et al. [1983] is available in DistrictDataAZMIN table, which has been imported and adapted from the table 'AZMIN' from Welty et al. [1989]. This table includes all the production and district name synonym information contained in the District Index and District Production Table of Keith et al. [1983]. Records in this table are joined to the Mineral District definition using MinDistID/MinDistDS compound key. This table includes a 'BIBLIO' field that is a string of comma-separated numbers; each number is the REFNUM for a reference citation in the AZMINBIB table. The AZMINBIB table is a copy of the table included in Welty et al. [1989].

SPATIAL DATA

Shapefile

This database includes one ESRI shapefile that spatially locates the mineral districts in the state of Arizona. This shapefile, and the user-defined features included in its feature attribute table, is summarized in Table 1.

Table 1. Shapefile summary showing fields, field definitions, and associated database tables. The ObjectID field, along with the DataSetID field, is the compound primary key for the shapefile. For fields that join to a lookup table, the lookup table name is shown adjacent to the field in the last column.

Shapefile Name	Type	Field Name	Data Type	Width	Lookup Tables
MineralDistricts	Polygon	ObjectID	Integer	16	
		DataSetID	Integer	16	DataSetAZ
		DistrictID	Integer	16	MineralDistrictDefinition
(field definitions start on page 7)		DistrictDS	Integer	16	DataSetAZ
		DistTypeID	Integer	16	MineralDistrictDefinition
		DistTypeDS	Integer	16	DataSetAZ
		CConf	Character	16	"Low", "Standard", "High"
		Name	Character	30	
		Comment	Character	254	
		Descriptio	Character	254	
		Classifica	Character	3	
		Age	Character	6	
		TrackingID	Integer	16	TrackingRecord
		TrackingDS	Integer	16	DataSetAZ

MineralDistricts Shapefile

The **MineralDistricts** shapefile contains polygons that represent the spatial extent of mineral districts in Arizona.

Arc Attributes

- **ObjectID**: Integer, width 16. First part of the compound primary key. Uniquely identifies each polygon in the MineDistricts data set. Each polygon has a different value. Domain: Integers >0 and $<10^{16}$, no duplicates.
- **DataSetID**: Integer, width 16. Second part of the compound primary key. Uniquely identifies the MineDistricts data set. All polygons in the data set have the same value. Domain: Single value (typically), the DataSetID for this table in the *DataSetAZ* data set.
- **DistrictID**: Integer, width 16. First part of compound key that links each mineral district delineation polygon to the MineralDistrictDefinition record for that district. Domain: 0-599.
- **DistrictDS**: Integer, width 16. Specifies the data set that contains the data object identified by ConceptID. Domain: 481 = the DataSetID for the *MineralDistrictDefinition* table.
- **DistTypeID**: Integer, width 16. First part of compound key that links to the definition of the district type indicated by the Classification text field. District types are defined in the MineralDistrictDefinition table, and are directly from Keith et al. [1983]. That publication should be reviewed for further information on classification of the districts. Domain: 600-650
- **DistTypeDS**: Integer, width 16. Specifies the data set that contains the data object identified by ConceptID. Domain: 481 = the DataSetID for the *MineralDistrictDefinition* table.
- **CConf**: Character, width 16. Assigns a qualitative confidence level to the classification of the object. Domain: 'low', 'standard', or 'high'.
- **Name**: Character, width 30. Contains strings that identify each polygon with a unique mineral district name. Domain: Free text.
- **Comment**: Character, width 254. Generally used to discuss delineation of a particular polygon. Domain: Free text.
- **Descriptio**: Character, width 254. Generally used to describe geologic aspects of mineralization within the polygon. Domain: Free text.

- **Classifica**: Character, width 3. Text string defined by Keith et al. [1983] to classify district types, with the addition of 'I' for industrial mineral districts, and '13' for placer gold districts. The text '10*' has been substituted for '10a*'. Domain: Abbreviations used in Keith et al. [1983], with minor modifications.
- **Age**: Character, width 3. Age abbreviations from Keith et al. [1983a] Domain: Abbreviations used in Keith et al. [1983a].
- **TrackingID**: Integer, width 16. Uniquely identifies the origin tracking for each object. It is a foreign key that joins to the TrackingID field of the *DI23TrackingRecord* table. Domain: Integers >0 and $<10^{16}$, no duplicates.
- **TrackingDS**: Integer, width 16. Specifies the data set that contains the data object identified by TrackingDS. Domain: Single value (typically), the DataSetID for the *DI23TrackingRecord* table.

THEMATIC GEOLOGY DATABASE TABLES

Additional tables may be included that contain classification concepts and descriptions specific to a particular geologic data set. These tables, summarized in **Table 2**, are included as part of a Microsoft Access database. By default, each data set field below references a table that is included in the Arizona Geological Survey namespace.

Table 2. Microsoft Access database table summary showing fields, field definitions, and associated database tables. For fields that join to a lookup table, the lookup table name is shown adjacent to the field in the last column.

Table Name	Field Name	Data Type	Width	Lookup Tables
Mineral District Definitions Table	MinDistID	Number	Long Integer	
	DataSetID	Number	Long Integer	DataSetAZ
	TypeID	Number	Long Integer	
	TypeDS	Number	Long Integer	DataSetAZ
	Name	Text	64	
	Description	Memo		
	Classifica	Text	3	
	Age	Text	4	
	TrackingID	Number	Long Integer	DI23TrackingRecord
	TrackingDS	Number	Long Integer	DataSetAZ
AZMINBIB	REFNUM	Number	Long Integer	
	Authors	Text	120	
	DATE	Text	4	
	TITLE1	Text	254	
	TITLE2	Text	150	
	GENCTY	Text	60	

Table Name	Field Name	Data Type	Width	Lookup Tables
DistrictDataAZMIN	MinDistID	Number	Long Integer	MineralDistrictDefinition
	DataSetID	Number	Long Integer	DataSetAZ
	DISTRICT	Text	22	
	COUNTIES	Text	16	
	LAT	Number	Single	
	LONG	Number	Single	
	YEARS	Text	9	
	COMMODITY	Text	22	
	TONNAGE	Number	Single	
	CU	Number	Single	
	PB	Number	Single	
	ZN	Number	Single	
	AG	Number	Single	
	AU	Number	Single	
	MO	Number	Single	
	OTHER_TONS	Number	Single	
	MN	Number	Single	
	W	Number	Single	
	U	Number	Single	
	V	Number	Single	
	AGE	Text	32	
	Cox_SingerClass	Text	15	
	CLASS	Text	6	
	BIBLIO	Text	254	
	Comments	Memo	-	
	TrackingID	Number	Long Integer	DI23TrackingRecord
	TrackingDS	Number	LongInteger	DataSetAZ

Mineral District Definitions Table

The **MineralDistrictDefinitions** table provides geologic and mineral information about polygons in the *MineDistricts* shapefile.

Database Table Fields

- **MinDistID**: Number, long integer. First part of the compound primary key. Uniquely identifies each mineral district in the data set. Domain: Integers >0 and $<10^{16}$, no duplicates.
- **DataSetID**: Number, long integer. Second part of the compound primary key. Uniquely identifies the data set. Domain: Single value (typically), the DataSetID for this table in the *DataSetAZ* data set.
- **TypeID**: Integer, width 16. First part of compound key that links to the definition of the district type indicated by the Classification text field. District types are defined in the MineralDistrictDefinition table, and are directly from Keith et al. [1983]. That publication should be reviewed for further information on classification of the districts. Domain: 600-650
- **TypeDS**: Integer, width 16. Specifies the data set that contains the data object identified by ConceptID. Domain: 481 = the DataSetID for the *MineralDistrictDefinition* table.
- **Name**: Text, width 32. Identifies the mineral district name. Domain: Restricted to Mineral District names for the State of Arizona.
- **Definition**: Memo. Geologic description of the mineral district. Domain: Free text.
- **Classifica**: Character, width 3. Text string defined by Keith et al. [1983] to classify district types, with the addition of 'I' for industrial mineral districts, and '13' for placer gold districts. The text '10*' has been substituted for '10a*'. Domain: Abbreviations used in Keith et al. [1983], with minor modifications.

- **Age**: Character, width 3. Age abbreviations from Keith et al. [1983] Domain: Abbreviations used in Keith et al. [1983].
- **TrackingID**: Number, long integer. Uniquely identifies the origin tracking for each record. It is a foreign key that joins to the TrackingID field of the *DI23TrackingRecord* table. Domain: Integers >0 and $<10^{16}$.
- **TrackingDS**: Number, long integer. Specifies the data set that contains the data object identified by TrackingID. Domain: Single value (typically), the DataSetID for the *DI23TrackingRecord* table.

AZMINBIB Table

The **AZMINBIB** table provides citations to publications cited numerically in the BIBLIO field of the DistrictDataAZMIN table. This table is imported from Welty et al. [1989].

Database Table Fields

- **REFNUM**: Number, long integer. Unique numeric identifier for each citation record. These are the numbers listed (as a text string) in the BIBLIO field of the DistrictDataAZMIN table. Domain: Integers >0 and <2749.
- **Authors**: Text, width 120. Name of the author(s) of the publication.
- **DATE**: Text, width 4. Year of publication as a text string. Domain: 1864-1989; "XXXX" if publication is not dated.
- **TITLE1**: Text, width 254. Title and citation for publication. Domain: Free text.
- **TITLE2**: Text, width 150. Continuation of Title and citation text, if necessary. 162 records contain non-null strings in this field. Domain: free text.
- **GENCTY**: Text, width 60. Names of Arizona county or counties in which the geologic features discussed in the publication are located. Domain: Arizona county names, separated by ", " if there is more than one.

DistrictDataAZMIN Table

The **DistrictDataAZMIN** table provides additional information on the geology and production of each mineral district defined by Keith et al. [1983]. Districts that are new in this report do not have records in this table.

Database Table Fields

- **MinDistID**: Number, long integer. First part of the compound primary key. Uniquely identifies each mineral district in the data set. Domain: Integers >0 and $<10^{16}$, no duplicates.
- **DataSetID**: Number, long integer. Second part of the compound primary key. Uniquely identifies the data set. Domain: Single value (typically), the DataSetID for this table in the *DataSetAZ* data set.
- **DISTRICT**: Text, width 22. Name of the Mineral District. Value is 'no name' if the district is newly defined in this work and not yet named. Domain: free text.
- **COUNTIES**: Text, width 16. Name of the county or counties in which the district is located. Domain: Arizona county names, ", " as delimiter between names.
- **LAT**: Number, single. Approximate latitude, in decimal degrees of the center of the district. Domain: 31.3 < LAT < 37.0.
- **LONG**: Number, single. Approximate west longitude, in decimal degrees, of the center of the district. Domain 109.0 < LONG < 114.7.

- **YEARS**: Text, width 9. First and last year for reported production included in the production summary numbers, in the format "yyyy-yyyy". If production reported only for one year, the value is that year in the format "yyyy" (where 'y' is a integer between 0 and 9). Domain: text formatted as described.
- **COMMODITY**: Text, width 22. Comma delimited list of one or two letter standard chemical element abbreviations indicating the commodities produced in significant amount from the district. Domain: Text string consisting of standard chemical element abbreviations, separated by ", " if more than one is included.
- **TONNAGE**: Number, single. Total ore processed to yield the reported production, in Tons. Domain: 0 < TONNAGE < 978753000. Values less than 0 indicate no data.
- **CU**: Number, single. Total reported pounds of copper produced. Domain: 0 < CU < 12,002,900,000.
- **PB**: Number, single. Total reported pounds of lead produced. Domain: 0 < PB < 324255000.
- **ZN**: Number, single. Total reported pounds of zinc produced. Domain: 0 < ZN < 614000000
- **AG**: Number, single. Total reported Troy ounces of silver produced. Domain: 0 < AG < 102215000
- **AU**: Number, single. Total reported Troy ounces of gold produced. Domain: 0 < AU < 2792000
- **MO**: Number, single. Total reported pounds of molybdenum produced. Domain: 0 < MO < 290796000
- **OTHER_TONS**: Number, single. Total ore processed to yield the reported production of MN, W, U, or V, in short tons, except for Mn, reported in long tons. Domain: 0 < OTHER_TONS < 66,434,500. Values less than 0 indicate no data.
- **MN**: Number, single. Total reported pounds of manganese produced. Domain: 0 < MN < 126300000
- **W**: Number, single. Total reported short ton units of tungsten produced. Domain: 0 < W < 21020
- **U**: Number, single. Total reported pounds of U_3O_8 produced. Domain: 0 < U < 5445500
- **V**: Number, single. Total reported pounds of V_2O_5 produced. Domain: 0 < V < 21834000
- **AGE**: Text, width 32. Interpreted age of ore deposition for all Class types except stratabound deposits (1B, 6B, 9, 10B, 11B). Domain: valid ages from geologic time scale.
- **Cox_SingerClass**: Text, width 15. Abbreviations for mineral deposit models from Cox & Singer [1986], separated by a comma if more than one is applicable. Values with the prefix "AZGS" are deposit models apparently invented by Welty et al. [1989]. Domain: free text.
- **CLASS**: Text, width 6. Text string for district type classification of Keith et al. [1983a]. Domain: text string in form "NNxy", where NN is a one or two digit integer between 1 and 12, 'x' is one of {"a", "b", "*", ""), and 'y' is one of ("*", "").
- **BIBLIO**: Text, width 254. List of numbers that correspond to REFNUM values in the AZMINBIB tables, and link districts to publications containing information about the geology of the district and its mineralization. Domain: comma-delimited string of integers, or null.
- **Comments**: Memo. Text from the "Other Names" column in the 'District Index' table of Keith et al. [1983b], from footnotes to the 'District Production Table' of Keith et al. [1983], or comments added by Welty et al. [1989]
- **TrackingID**: Number, long integer. Uniquely identifies the origin tracking for each record. It is a foreign key that joins to the TrackingID field of the ***DI23TrackingRecord*** table. Domain: Integers >0 and $<10^{16}$.

- **TrackingDS**: Number, long integer. Specifies the data set that contains the data object identified by TrackingID. Domain: Single value (typically), the DataSetID for the *DI23TrackingRecord* table.

ARIZONA GEOLOGIC DATA SYSTEM TABLES

The lookup tables defined below contain supporting data maintained by the Arizona Geological Survey to support all databases within the organization. These tables, summarized in Table 3, are included as a Microsoft Access database. By default, each data set below references a table that is included in the Arizona Geological Survey namespace.

Table 3. Summary of general Microsoft Access database tables showing fields, field definitions, and associated database tables. If a field joins to a lookup table, the table name is shown adjacent to that field in the last column.

Table Name	Field Name	Data Type	Field Size	Lookup Tables
Activities	ActivityID	Number	Long Integer	
	DataSetID	Number	Long Integer	DataSetAZ
	Name	Text	255	
(field definitions start on page 16)	Comment	Memo		
	PersonOrgID	Number	Long Integer	
	PersonOrgDS	Number	Long Integer	DataSetAZ
	ProjectID	Number	Long Integer	
	ProjectDS	Number	Long Integer	DataSetAZ
	StartDate	Date/Time		
	EndDate	Date/Time		
azGeoBibCite	AzGeoBibID	Number	Long Integer	AzGeoBib [Trapp et al., 1996]
	DataSetID	Number	Long Integer	
	Authorship	Text	255	
(field definitions start on page 17)	Title	Text	255	
	Citation	Text	255	
	PublicationDate	Date/Time		
ClassificationConcept	ConceptID	Number	Long Integer	
MetadataClassification-Concepts	DataSetID	Number	Long Integer	DataSetAZ
	TrackingID	Number	Long Integer	ClassificationConcept
GeoClassficationConcepts	TrackingDS	Number	Long Integer	DataSetAZ
	Name	Text	255	
(field definitions start on page 14)	ParentID	Number	Long Integer	TrackingRecord
	ParentDS	Number	Long Integer	DataSetAZ
	OriginDate	Date/Time		
	Definition	Memo		

Table Name	Field Name	Data Type	Field Size	Lookup Tables
DataSetAZ	DataSetID	Number	Long Integer	
	NameSpace	Text	50	
	NameSpaceID	Number	Long Integer	ClassificationConcept
(field definitions start on page 17)	NameSpaceDS	Number	Long Integer	DataSetAZ
	DataSetName	Text	255	
	DataSetTypeID	Number	Long Integer	ClassificationConcept
	DataSetTypeDS	Number	Long Integer	DataSetAZ
	DataSetSubjectID	Number	Long Integer	ClassificationConcept
	DataSetSubjectDS	Number	Long Integer	DataSetAZ
	TrackingID	Number	Long Integer	TrackingRecord
	TrackingDS	Number	Long Integer	DataSetAZ
	SourceFileTypeID	Number	Long Integer	ClassificationConcept
	SourceFileTypeDS	Number	Long Integer	DataSetAZ
	PhysicalAddressTypeID	Number	Long Integer	ClassificationConcept
	PhysicalAddressTypeDS	Number	Long Integer	DataSetAZ
	PhysicalAddress	Text	255	
	IdentifierFieldName	Text	50	
	DataSetFieldName	Text	50	
	Comment	Memo		
SimpleRelationship	RelationshipID	Number	Long Integer	
MetadataSimpleRelation-ship	DataSetID	Number	Long Integer	DataSetAZ
	RelTypeID	Number	Long Integer	ClassificationConcept
DI23SimpleRelationship	RelTypeDS	Number	Long Integer	DataSetAZ
	FirstRoleID	Number	Long Integer	
(field definitions start on page 15)	FirstRoleDS	Number	Long Integer	DataSetAZ
	SecondRoleID	Number	Long Integer	
	SecondRoleDS	Number	Long Integer	DataSetAZ
	Comment	Memo		
	TrackingID	Number	Long Integer	TrackingRecord
	TrackingDS	Number	Long Integer	DataSetAZ
TrackingRecord	TrackingID	Number	Long Integer	
MetadataTrackingRecord	DataSetID	Number	Long Integer	DataSetAZ
DI23TrackingRecord	TrackingRecordTypeID	Number	Long Integer	ClassificationConcept
	TrackingRecordTypeDS	Number	Long Integer	DataSetAZ
(field definitions start on page 20)	Name	Text	255	
	LogDate	Date/Time		
	ActivityID	Number	Long Integer	Activities
	ActivityDS	Number	Long Integer	DataSetAZ
	DataProcMethodID	Number	Long Integer	ClassificationConcept
	DataProcMethodDS	Number	Long Integer	DataSetAZ
	Description	Memo		

Infrastructure Tables

Classification Concept Tables

ClassificationConcept tables are collection of terminology definitions – a term with a definition. These terms are used to classify other objects in all parts of the database. A unique identifier (ConceptID - DatasetID pair) identifies each concept. Thus the name of the concept may be changed without updating other links. The Arizona Geological Survey geologic information system has separate classification concept tables that are specific to different components of the system (e.g. Rock Unit Lexicon, Standard lithologic terms, etc.). Each of these classification concept tables has its own data set identifier defined in the DataSetAz table. This database includes two ClassificationConcept tables. Each has the same structure. The metaDataClassificationConcept table defines concepts used to classify relationships, dataset types, and other database-related concepts used by all AZGS databases. The

geoClassificationConcept table is included for completeness; it defines concepts related to Earth science. The MineralDistrictDefinition is a special kind of ClassificationConcept table that defines mineral districts, but includes more information that a simple text definition. (Return to Table 3.)

Database Table Fields

- **ConceptID**: Number, long integer. First part of the compound primary key. Uniquely identifies each classification object in the ClassificationConcept table. Domain: Integers >0 and $<10^{16}$, no duplicates.
- **DatasetID**: Number, long integer. Second part of the compound primary key. Uniquely identifies the ClassificationConcept data set. Domain: Integers >0 and $<10^{16}$; Many concepts are from the system ClassificationConcept table, with DataSetID = 1, but for specific geologic datasets, classification concepts may be included from other classification concept datasets (e.g. standard lithology, standard minerals, formal stratigraphic units, etc.) with other DataSetID's. Some concepts may be specific to a particular geologic dataset and will have DataSetID = the DataSetID for this particular ClassificationConcept table in the DataSetAZ table.
- **TrackingID**: Number, long integer. Uniquely identifies the origin tracking for each record. It is a foreign key that joins to the TrackingID field of the *TrackingRecord* table. Domain: Integers >0 and $<10^{16}$.
- **TrackingDS**: Number, long integer. Specifies the data set that contains the data object identified by TrackingID. Domain: Single value (typically), the DataSetID for the *TrackingRecord* table.
- **Name**: Text, width 255. Provides a descriptive name for each classification concept. Domain: Free text.
- **ParentID**: Number, long integer. Represents the concept type. Semantically this is equivalent to the parent of the concept and the links between classification concepts and parent concepts define the classification concept hierarchy. This hierarchy is represented by the *HierarchyRelationship* table for use in general database queries. Inclusion of this attribute with each classification concept facilitates management of a single, simple tree hierarchy for classification concepts, but future development may allow a more complex concept hierarchy with multiple parent links. The ParentID is a foreign key that joins to the ConceptID field in this same table. Domain: Integers >0 and $<10^{16}$.
- **ParentDS**: Number, long integer. Specifies the data set that contains the data object identified by ConceptTypeID. Domain: 1 = the DataSetID for the ClassificationConcept table.
- **OriginDate**: Date/Time. Records when the record was created. This information provides more detailed information on the time that records were originally entered, supplementing the information in the associated *TrackingRecord* table.
- **Definition**: Text, width 255. Defines each classification concept. Domain: Free text.

Simple Relationship Table

Two simpleRelationshipTables provide a general mechanism for semantic links between data instances. The 'MetaDataSimpleRelationships' table contains links between infrastructure data objects used by all AZGS databases, and the DI23SimpleRelationships table provides links between data objects specific to this database. These tables have the same structure. A RelType (relationship type) identifier links to a metadataClassificationConcept that defines the semantics of the relationship. In this database, this table is used to implement a many-to-many join between tracking records and citations. Other applications in a more developed database would include relationships like project hierarchy (large project with subprojects), organization successor (when an organization changes name), organi-

zation aggregation (to represent individual departments as part of a larger organization), StartDate and EndDate links between Person-Organization affiliations and a metadata dates entity, PersonOrg-ContactInformation links to allow multiple contact addresses and types (phone, internet, surface mail…), and Object-LogEntries to allow multiple tracking records to be related to any object, to track revisions, comments, etc. (Return to Table 3.)

Database Table Fields

- **RelationshipID**: Number, long integer. First part of the compound primary key. Uniquely identifies each record in the MetadataRelationship table. Although the compound key {RelTypeID, RelTypeDS, FirstRoleID, FirstRoleDS, SecondRoleID, SecondRoleDS} provides a unique key, the table has a standard {ObjectID, DatasetID} key to allow a relationship to play a role in another relationship using the standard relationship tables. Domain: Integers >0 and $<10^{16}$, no duplicates.
- **DataSetID**: Number, long integer. Second part of the compound primary key. Specifies the data set that contains the data object identified by MetadataRelationshipID. Domain: Single value (typically), the DataSetID for the MetadataRelationship table.
- **RelTypeID**: Number, long integer. Uniquely identifies the kind of relationship. This allows the MetadataRelationship table to represent any kind of relationship. The RelType defines the semantics of the relationship. It is a foreign key that joins to the ConceptID field of the *ClassificationConcept* table. Domain: 2535 = TrackingRecord-Citation link. The only relationship currently represented, is a link between records in the *TrackingRecord* table and citations in the *_azGeoBibCite* table, allowing a many-to-many relationship between citations and tracking records.
- **RelTypeDS**: Number, long integer. Specifies the data set that contains the data object identified by RelTypeID. Domain: 1 = the DataSetID for the *ClassificationConcept* table.
- **FirstRoleID**: Number, long integer. First part of compound foreign key that identifies the object in the first role of the metadata relationship. Because only the TrackingRecord-Citation relationship is represented in this database, this field is a foreign key that joins to the TrackingRecordID field of the *TrackingRecord* table. Domain: Integers >0 and $<10^{16}$.
- **FirstRoleDS**: Number, long integer. Second part of compound foreign key that identifies the object in the first role of the metadata relationship. Specifies the data set that contains the data object identified by FirstRoleID. Because only the TrackingRecord-Citation relationship is represented in this database, this field has only one value. Domain: Single value (typically), the DataSetID for the *TrackingRecord* table.
- **SecondRoleID**: Number, long integer. First part of compound foreign key that identifies the object in the second role of the metadata relationship. Because only the TrackingRecord-Citation relationship is represented in this database, this field is a foreign key that joins to the RefNum field of the *_azGeoBibCite* table. Domain: Integers >0 and $<10^{16}$.
- **SecondRoleDS**: Number, long integer. Second part of compound foreign key that identifies the object in the second role of the metadata relationship. Specifies the data set that contains the data object identified by SecondRoleID. Because only the TrackingRecord-Citation relationship is represented in this database, this field has only one value. Domain: 4 = the DataSetID for the *_azGeoBibCite* table.

MetaData Tables

Activities Table

The **Activities** table is a link to an activity responsible for update of, or addition to, the database. An activity is a particular person, working for a particular organization, under the auspices of a particular project. (Return to Table 3.)

Database Table Fields

- **ActivityID**: Number, long integer. First part of the compound primary key. Uniquely identifies each activity in the Activities table. Domain: Integers >0 and $<10^{16}$, no duplicates.
- **DatasetID**: Number, long integer. Second part of the compound primary key. Uniquely identifies the Activities data set. Domain: 2 = the DataSetID for the Activities table.
- **Name**: Text, width 255. Provides a unique name identifier for each activity. This is the string that is displayed in combo boxes on data entry forms. Domain: Free text.
- **PersonOrgID**: Number, long integer. Uniquely identifies the person and the organization that are associated with each activity. It is a foreign key that joins to the PersonOrgID field of the PersonOrg table (the PersonOrg table is described in the report on metadata data structure implementation [in preparation]). Domain: See Table 4.

Table 4. Example PersonOrg codes used in the Activities Table.

PersonOrgID	DataSetID	PersonName	Organization
1	15	Dr. Stephen M. Richard	Arizona Geological Survey
2	15	Mr. Tim R. Orr	Arizona Geological Survey
4	15	Mr. Null N Null	None
5	15	Mr. Jason . Brander	Bureau of Land Management
11	15	Dr. Philip A. Pearthree	Arizona Geological Survey
12	15	Ms. Ann . Youberg	Arizona Geological Survey
13	15	Mr. Ray C. Harris	Arizona Geological Survey

- **PersonOrgDS**: Number, long integer. Specifies the data set that contains the data object identified by PersonOrgID. Domain: Single value (typically), the DataSetID for the PersonOrg link table.
- **ProjectID**: Number, long integer. Identifies the project associated with each activity. It is a foreign key that joins to the ProjectID field of the Projects table (the Projects table is described in the report on metadata data structure implementation [in preparation]). Domain: See Table 5.

Table 5. Example ProjectID codes used in the Activities Table.

ProjectID	ProjectDS	Project_title	Prj_comment
1	17	Arizona NADM implementation development	Develop NADM 5.2 implementation and use for new geologic map of Arizona database
2	17	DI-8 Version 3 database development	Construct NADM-compliant database with geologic data compiled for Map 35.
3	17	Phoenix N, East Half Database development	Activities related to development of databases for east half of Phoenix North 30 by 60 minute quadrangle
4	17	Null	No project assigned
5	17	Digitize Geologic Map of Arizona, using MOSS	get 1:1,000,000 scale geologic map in digital form to assist management decisions

ProjectID	ProjectDS	Project_title	Prj_comment
8	17	Edit Map 26 Data to release as DI8 V.1	Get original MOSS version converted to ARC and into a form that could be released
10	17	Statemap 1999, Waterman Peak 1:24000 quad	Generate Statemap deliverable, geologic map of Waterman Peak quad
11	17	TheodoreRoosevelt100KGISV2	Generate final, complete 100K geology GIS for Theodore Roosevelt Lake 100K quad.
13	17	Statemap 1999 Surficial	Surficial Geologic maps of Avra Valley and Green Valley areas
16	17	AZ Geologic Map Index database conversion	conversion of DI-9 (AZ Map Index) to new AZ_NADM data structure
17	17	Statemap2000PhxDatabases	Project to complete 1:24k GIS databases for quads in phoenix area; includes preliminary development work on Waterman-Roskruge database also funded by this project
20	17	Statemap 1999, Roskruge/Waterman Digital Data	Digital geologic information for the Roskruge and Waterman Mountains

- **ProjectDS**: Number, long integer. Specifies the data set that contains the data object identified by ProjectID. Domain: Single value, typically 17 the DataSetID for the Projects table.
- **Comment**: Memo. Contains descriptive text about each activity, including the name of the person who conducted the activity, their employing organization, and the project they were working on. Domain: Free text.

Bibliographic Citations Table (_azGeoBibCite)

The **_azGeoBibCite** table is derived from the Arizona Geological Survey bibliographic database (AzGeoBib, Trapp et al. [1996], DataSetID = 4 in the *DataSetAZ* table), and provides a mechanism for citing published literature. In this database citations are related to tracking records through the *MetadataRelationship* table. This derivative table is included to replace links to the full AzGeoBib database. (Return to Table 3.)

Database Table Fields

- **REFNUM**: Number, long integer. First part of the compound primary key. Uniquely identifies each citation in the _azGeoBibCite table. Domain: Integers >0 and $<10^{16}$, no duplicates. The identifiers used here are the same as identifiers for the citation in AzGeoBib.
- **Cite**: Text, length 255. Author, year of publication, and Title of publication, truncated to 255 characters.
- **FullCitation**: Memo. Full citation for publication, Author, date, title, and bibliographic information..

DataSetAZ Table

The **DataSetAZ** table is a catalog of the data sets within the Arizona Geological Survey namespace. A data set is any collection of data that is held in an individual file or table. Examples include individual ArcInfo coverages, ESRI shapefiles, tables in Microsoft Access databases, dBase tables in individual .dbf files, and files containing images (e.g. tiff, jpeg). The contents of the **DataSetAZ** table define the 'Arizona Geological Survey' namespace. This table is analogous to an Open GIS Consortium 'Catalog'. (Return to Table 3.)

Database Table Fields

- **DataSetID**: Number, long integer. First part of the compound primary key. Uniquely identifies each data set in the DataSetAZ table. Domain: Integers >0 and $<10^{16}$, no duplicates.

- **NameSpace**: Text, width 50. Second part of the compound primary key. Identifies the agency or organization that owns or maintains the data set. Domain: 'Arizona Geological Survey'.
- **NameSpaceID**: Number, long integer. Classifies the NameSpace for each data set record in the DataSetAZ data set. There is a 1:1 correspondence between values in this field and values in the NameSpace field, i.e. they are redundant. Both a string value and an numeric value are included to facilitate implementation using the convention adopted for this database system that a data object within a particular namespace is identified by a compound primary key consisting of 2 long integers. NameSpaceID is a foreign key that joins to the ConceptID field of the *ClassificationConcept* table. Domain: 2541 = the ConceptID for the "Arizona Geological Survey" namespace.
- **NameSpaceDS**: Number, long integer. Specifies the data set that contains the data object identified by NameSpaceID. Domain: 1 = the DataSetID for the *ClassificationConcept* table.
- **DataSetName**: Text, width 255. Uniquely identifies each data set. Domain: Free text.
- **DataSetTypeID**: Number, long integer. Classifies each data set according to a data set type from the *ClassificationConcept* table. The data set type identifies the physical data structure of the data set (e.g. ArcInfo coverage, Microsoft Access table…). It is a foreign key that joins to the ConceptID field of the *ClassificationConcept* table. Domain: See Table 6.

Table 6. Example data set type codes used in the DataSetAZ table.

DataSetTypeID	Name
2744	Classification/Description/Definition Dataset
2761	Generic Attributed Relationship Dataset
2762	Description Container Dataset
2794	Geographic Dataset

- **DataSetTypeDS**: Number, long integer. Specifies the data set that contains the data object identified by DataSetTypeID. Domain: 1 = the DataSetID for the *ClassificationConcept* table.
- **DataSetSubjectID**: Number, long integer. Classifies each data set according to a subject classification term. The subject classification term identifies the domain of interest for the data in the data set. In future implementations, the data set subject will be used for error and consistency checking. A more complete key word index for data sets would need to be implemented through a correlation table allowing a many-to-many join between data sets and subjects. The DataSetSubjectID is a foreign key that joins to the ConceptID field of the *ClassificationConcept* table. Domain: See Table 7.

Table 7. Example data set subject codes used in the DataSetAZ table.

DataSetSubjectID	Name
2759	NADM Implementation Infrastructure
2767	AZ Cordlink base table
3306	Graphic Definition Tables
3336	Roskruge and Waterman Mountains and western Avra Valley

- **DataSetSubjectDS**: Number, long integer. Specifies the data set that contains the data object identified by DataSetSubjectID. Domain: 1 = the DataSetID for the *ClassificationConcept* table.
- **TrackingID**: Number, long integer. Uniquely identifies the origin tracking for each record. It is a foreign key that joins to the TrackingID field of the *TrackingRecord* table. Domain: Integers >0 and $<10^{16}$.

- **TrackingDS**: Number, long integer. Specifies the data set that contains the data object identified by TrackingID for each record. Domain: Single value (typically), the DataSetID for the *TrackingRecord* table.
- **SourceFileTypeID**: Number, long integer. Classifies each data set by its physical file type or format. It is a foreign key that joins to the ConceptID field of the *ClassificationConcept* table. Domain: See Table 8.

Table 8. Example source file type codes used in the DataSetAZ table.

SourceFileTypeID	Name
2542	Microsoft Access Database Table
2543	dBase Table
2544	ESRI coverage, point
2545	ESRI coverage, arc
2547	ESRI coverage, polygon
2548	AV shapefile, point
2549	AV shapefile, line

- **SourceFileTypeDS**: Number, long integer. Specifies the data set that contains the data object identified by SourceFileTypeID. Domain: 1 = the DataSetID for the *ClassificationConcept* table.
- **PhysicalAddressTypeID**: Number, long integer. Classifies the type of physical address that records where each data set is stored. It is a foreign key that joins to the ConceptID field of the *ClassificationConcept* table. Domain: 2726 = DOS-style path name; 2727 = Microsoft Network file path name.
- **PhysicalAddressTypeDS**: Number, long integer. Specifies the data set that contains the data object identified by PhysicalAddressTypeID. Domain: 1 = the DataSetID for the *ClassificationConcept* table.
- **PhysicalAddress**: Text, width 255. Identifies the actual physical location of the data set. Domain: Free text restricted to formats defined by PhysicalAddressTypeID.
- **IdentifierFieldName**: Text, width 50. Records the name of the field in the DataSet that contains the identifier component of the compound unique identifier for each record. Domain: Restricted to the indexed, primary key field names. This is typically the first field in each data set, and the field name is typically the table name or an object type name with “ID" appended. Identifier field names always end with the string “ID".
- **DataSetFieldName**: Text, width 50. Records the name of the field in the DataSet that contains the data set component of the compound unique identifier for each record. Domain: ‘DataSetID’, ‘Namespace’; typically the second field in each data set.
- **Comment**: Memo. Provides additional descriptive information about each data set. Domain: Free text.

Tracking Record Table

The **TrackingRecord** table keeps a record of the intellectual and physical sources for objects and data by defining links to tables that describe the processes and activities through which data was created. This database includes a MetadataTrackingRecord table that contains tracking information for the infrastructure records that are used by all AZGS databases, and a DI23TrackingRecord table that includes tracking information for data objects unique to this database. The structure of these tables is identical. (Return to Table 3.)

Database Table Fields

- **TrackingID**: Number, long integer. First part of the compound primary key. Uniquely identifies each record in the TrackingRecord data set. Domain: Integers >0 and $<10^{16}$, no duplicates.
- **DataSetID**: Number, long integer. Second part of the compound primary key. Uniquely identifies the TrackingRecord data set. Domain: Single value (typically), the DataSetID for this table.
- **TrackingRecordTypeID**: Number, long integer. Uniquely identifies the type of origin tracking record. It is a foreign key that joins to the ConceptID field of the *ClassificationConcept* table. Domain: See Table 9.

Table 9. Tracking Record Type codes used in the TrackingRecord table.

ConceptID	Name	Definition
2534	Origin Tracking Record	Tracking record that records the origin of a data object or data set
2742	Log Entry Tracking Record	Tracking record type for tracking records that add information about a data entity
2765	Termination Tracking Record	Tracking record that indicates a data object has been superceded by a newer object.
3210	Feature-level Origin Tracking Record	Use as supertype to group tracking records that document origin of individual feature records in data sets.
3211	Feature-Level Tracking for DI8 V3	Supertype to group feature tracking records for Geologic map of Arizona Database, v3
3228	Feature-Level Tracking for Infrastructure Objects	Tracking record type for records that track data objects in the infrastructure tables
3231	Dataset Origin Tracking	Tracking records that record facts about the origin of a Dataset, and are inherited by contents of data set unless feature-level tracking is included for data set

- **TrackingRecordTypeDS**: Number, long integer. Specifies the data set that contains the data object identified by TrackingRecordTypeID. Domain: 1 = the DataSetID for the *ClassificationConcept* table.
- **Name**: Text, width 255. Uniquely identifies each origin tracking record and is included for simplification purposes. Domain: Free text.
- **LogDate**: Date/Time. Records when an entry was created. Format: '*mm/dd/yy*'.
- **ActivityID**: Number, long integer. A foreign key that links ActivityID field of the *Activities* table. Domain: See Table 10.

Table 10. Example Activity ID codes used in the TrackingRecord table.

ActivityID	Name	Comment
1	SMRDataModelDevelopment	Stephen M. Richard, Arizona Geological Survey, Arizona NADM implementation development
2	SMR-DI8V3DevelopmentActivity	Stephen M. Richard, Arizona Geological Survey, DI-8 Version 3 database development
4	Null	No Activity assigned; Null N Null, None, Null
5	BLMMOSSdigitizeMap26	BLM activity to produce MOSS version of Reynolds, 1988, AZGS Map26; Jason . Brander, Bureau of Land Management, Digitize Geologic Map of Arizona, using MOSS
8	SMRDI8V1	Convert MOSS data to ARC, adjust to match ALRIS state outline, minor editing to correct obvious linework problems, edit faults to match contacts better, reclassify some polygons; Stephen M. Richard, Arizona Geological Survey, Edit Map 26 Data to release a
38	TRODataModelDevelopment	Tim R. Orr, Arizona Geological Survey, Arizona NADM implementation development
39	AY-GreenValleyUnitAssignment	assignment of map unit names to geologic polygons; Ann Youberg, Arizona Geological Survey, Statemap 1999 Surficial
40	TRORoskrugeWatermanDatabaseDevelopment	project specific database construction; Tim R. Orr, Arizona Geolog-

ActivityID	Name	Comment
		ical Survey, Statemap2000PhxDatabases
45	RCHRoskrugeWatermanDI	Digitizing, editing, and attribution of geologic information by Ray Harris from data collected for Statemap 1999 contract; Ray C. Harris, Arizona Geological Survey, Statemap 1999, Roskruge/Waterman Digital Data
82	PAPRoskrugeWatermanDI	DI database contributions by Phil Pearthree

- **ActivityDS**: Number, long integer. Specifies the data set that contains the data object identified by ActivityID. Domain: 2 = the DataSetID for the *Activities* table.
- **DataProcMethodID**: Number, long integer. It is a foreign key that links to a data processing name and definition in the *ClassificationConcept* table. A complete data processing object defines the steps in developing a particular data item (digitized spatial feature, record in a data table). In this database the processing steps are not described at a feature level. Domain: 2748 = MS Access Database Construction; 2764 = no processing.
- **DataProcMethodDS**: Number, long integer. Specifies the data set that contains the data object identified by DataProcMethodID. Domain: 1 = the DataSetID for the *ClassificationConcept* table.
- **Description**: Memo. Contains a description of the people and processes that define each tracking record. Domain: Free text.

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