

DIGITAL MAPPING TECHNIQUES 2016

The following was presented at DMT'16
(May 22-25, 2016 - Florida Geological Survey,
Tallahassee, FL)

The contents of this document are provisional

See Presentations and Proceedings
from the DMT Meetings (1997-2016)

<http://ngmdb.usgs.gov/info/dmt/>

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Geotagged Field Photos in a Geologic Map Database?

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For decades, geologists have been capturing volumes of photographs of important geologic features while mapping in their field areas. Some of these photos, whether captured on film or born digital, are used in geologic map publications, but most are relegated to file cabinets or digital storage media, never to be seen again.

In an effort to preserve a geologist's field photos—in context with a geologic map—I geotagged a sample of these digital photos and then investigated the current options for incorporating them into an ESRI ArcGIS v10.3.1 file geodatabase.

There are three primary methods of including geotagged images in a file geodatabase points feature class:

1. Hyperlinks to images stored in a separate folder, or URLs to images on a web server.
2. Images embedded as attributes in a raster type field in a points feature class.
3. Images embedded in a points feature class as attachments stored in a binary large object (BLOB) field.

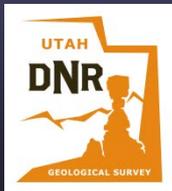
I conducted a simple trial of each method and evaluated the ArcMap user experience when accessing the photos and their attributes from the geodatabase; I then listed my perceived pros and cons of using each method. The most powerful and flexible method of the three is the third option. It allows the attachment of any number of digital images to a feature class point. In addition, these attachments can be any file type; e.g., image formats such as .jpg, .tif, .png; other file types such as PDFs, text documents, spreadsheets, or voice recordings; or even common video formats. Users access the attachments via the ArcMap HTML Popup tool. The photo attachments are opened directly in a formatted popup window within ArcMap; other types of attachments are opened in software compatible with the various file formats.

This system can easily accommodate sample location notes, well logs, scans of field notebook pages, related documents that may include URLs to web pages, or even audio or video descriptions of field observations of surrounding geology; use your imagination!

My 2016 Digital Mapping Techniques presentation is a summary of this trial. Speaker notes are included for each slide of the presentation.

Geotagged Field Photos In A Geologic Map Database?

Kent D. Brown
Utah Geological Survey



May 22-25, 2016
Tallahassee, Florida





What Should I Do With
All These Field Photos?











Let's Try To Preserve Photos In Context With Geologic Mapping



Geotagged Photos Can Be
Included In A GIS database!



First, Geotag Your Photos



First, Geotag Your Photos

This can be done many different ways; I'm not covering them here.



Next, Create Points From Geotagged Photos



Next, Create Points From Geotagged Photos

This is simple using Global Mapper,
not so much with ArcGIS.



Import Photo Points Into File Geodatabase

Open ArcMap Project

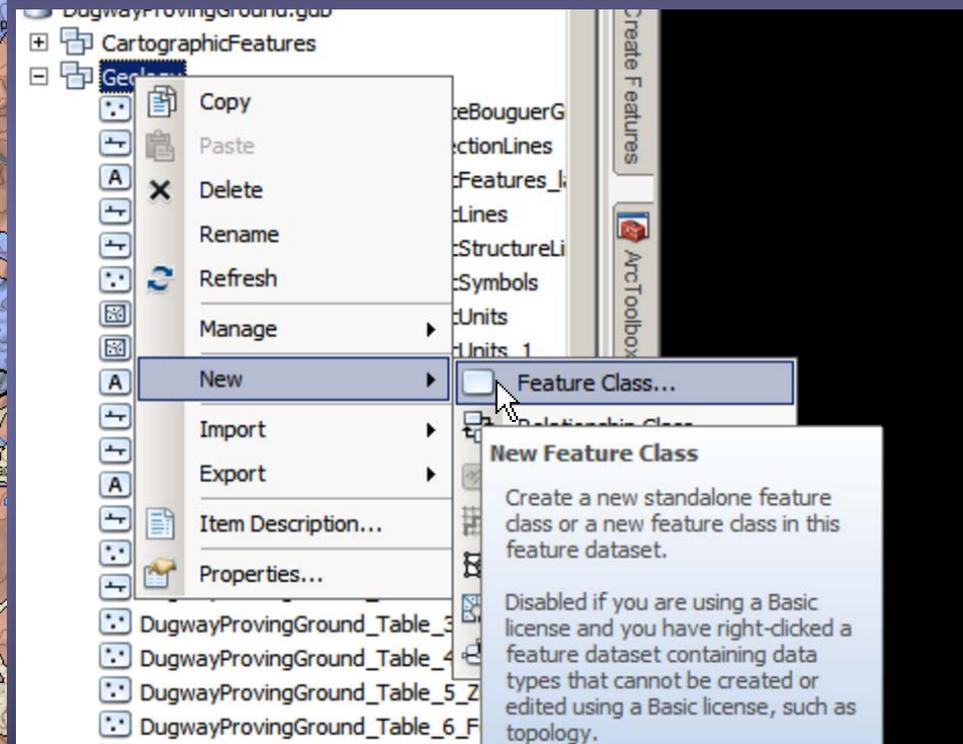
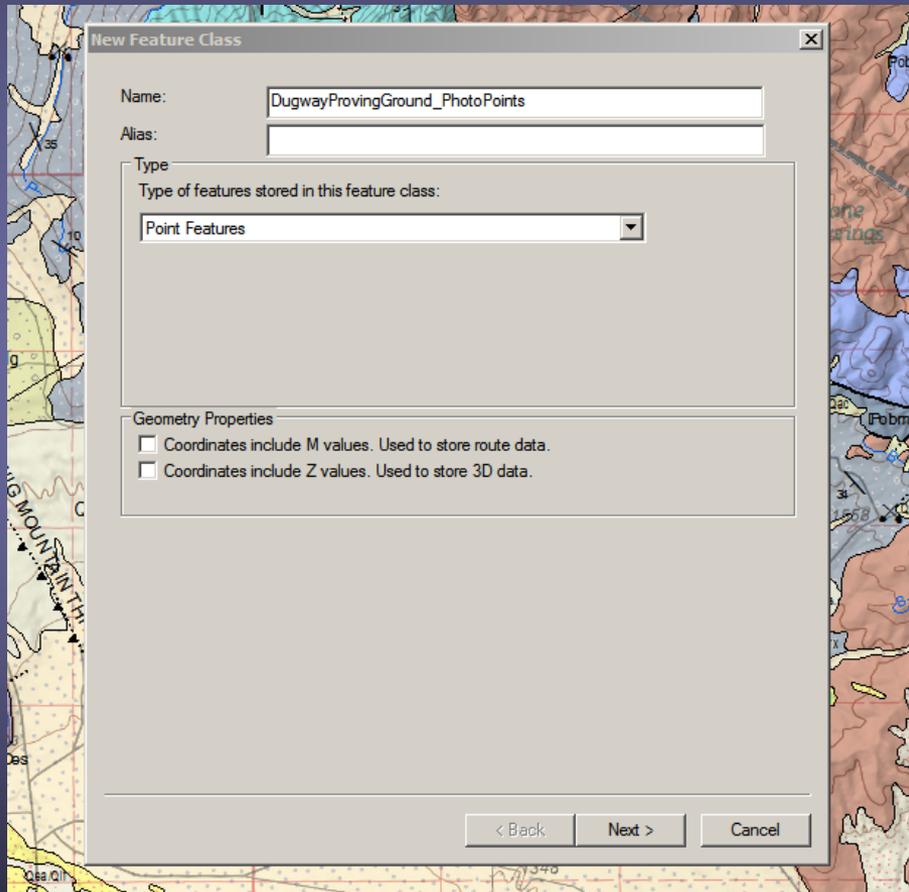
The screenshot displays the ArcMap interface for a project named "DugwayProvingGround_20151119.mxd". The main map area shows a geological map with various units and features. The Table of Contents on the left lists the following layers:

- DugwayProvingGround_GeologicUnits_Jab
- DugwayProvingGround_GeologicFeatures
- UtahTestAndTrainingRange_Labels
- NewPoints_BLOB
- NewPoints_RasterField
- Dugway Field Photos
- Dugway Sample Tables
- DugwayProvingGround_WellLogTable
- DugwayProvingGround_GeologicSymbols
- Dugway Gravity Contours
- DugwayProvingGround_CrossSectionLines
- DugwayProvingGround_ShorelineMask
- DugwayProvingGround_MapBoundary
- DugwayProvingGround_GeologicUnits_Jea
- DugwayProvingGround_GeologicLines
- DugwayProvingGround_GeologicStructure
- DugwayProvingGround_PaleoChannels
- DugwayProvingGround_boundary
- UtahTestAndTrainingRange_boundary
- CedarMtnWildernessArea
- DugwayProvingGround_GeologicUnits
- DugwayProvingGround_mashup_201509c
- DugwayProvingGround_mashup_201511c
- DugwayProvingGround_mashup_201511i
- DugwayProvingGround_mashup_201511j
- DugwayMappingProject_DRG.tif

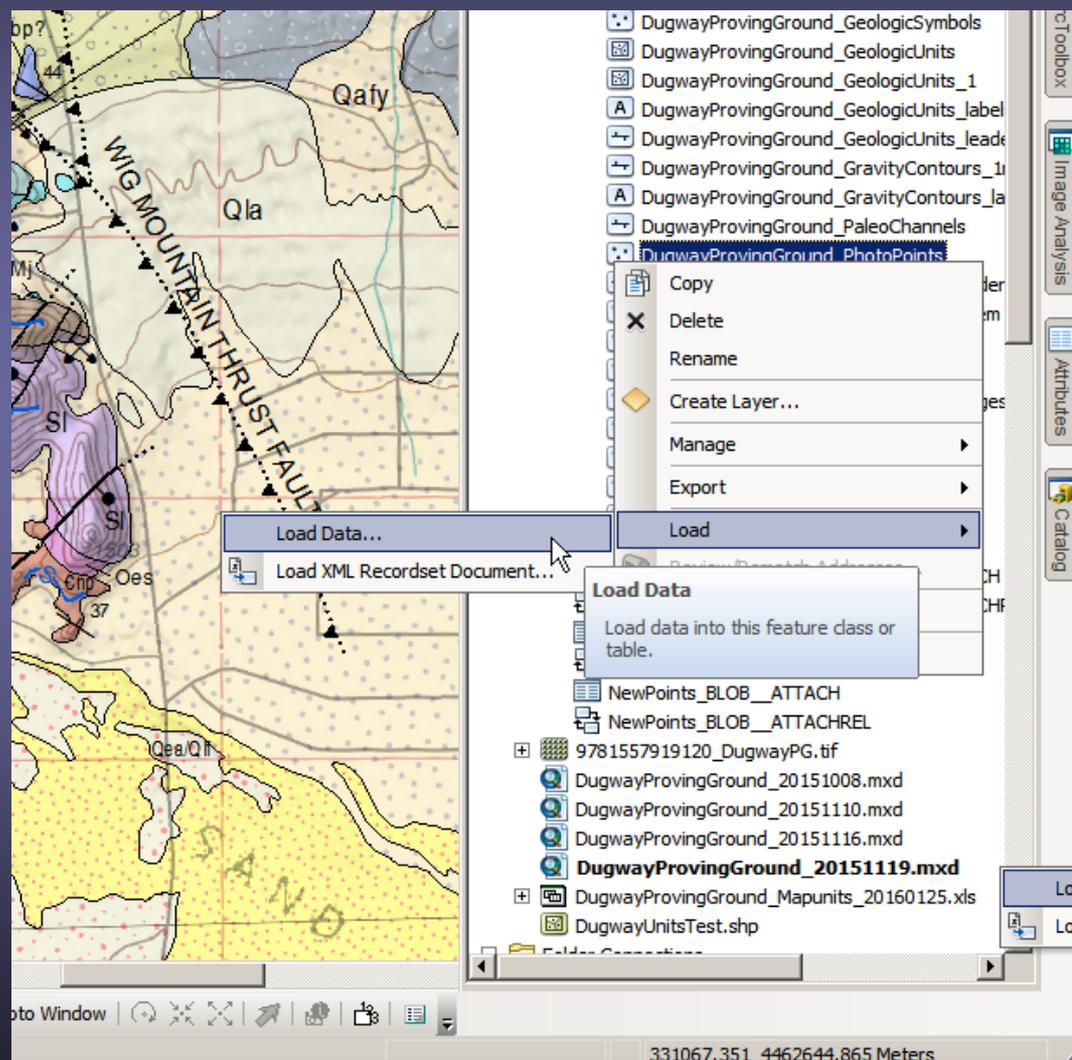
The map shows geological units such as Qlg, Qafy, Qla, Qed, Qes/Qla, Qac, Qad, Qab, Qbc, Qbd, Qbe, Qbf, Qbg, Qbh, Qbi, Qbj, Qbk, Qbl, Qbm, Qbn, Qbo, Qbp, Qbq, Qbr, Qbs, Qbt, Qbu, Qbv, Qbw, Qbx, Qby, Qbz, Qca, Qcb, Qcc, Qcd, Qce, Qcf, Qcg, Qch, Qci, Qcj, Qck, Qcl, Qcm, Qcn, Qco, Qcp, Qcq, Qcr, Qcs, Qct, Qcu, Qcv, Qcw, Qcx, Qcy, Qcz, Qda, Qdb, Qdc, Qdd, Qde, Qdf, Qdg, Qdh, Qdi, Qdj, Qdk, Qdl, Qdm, Qdn, Qdo, Qdp, Qdq, Qdr, Qds, Qdt, Qdu, Qdv, Qdw, Qdx, Qdy, Qdz, Qea, Qeb, Qec, Qed, Qee, Qef, Qeg, Qeh, Qei, Qej, Qek, Qel, Qem, Qen, Qeo, Qep, Qeq, Qer, Qes, Qet, Qeu, Qev, Qew, Qex, Qey, Qez, Qfa, Qfb, Qfc, Qfd, Qfe, Qff, Qfg, Qfh, Qfi, Qfj, Qfk, Qfl, Qfm, Qfn, Qfo, Qfp, Qfq, Qfr, Qfs, Qft, Qfu, Qfv, Qfw, Qfx, Qfy, Qfz, Qga, Qgb, Qgc, Qgd, Qge, Qgf, Qgg, Qgh, Qgi, Qgj, Qgk, Qgl, Qgm, Qgn, Qgo, Qgp, Qgq, Qgr, Qgs, Qgt, Qgu, Qgv, Qgw, Qgx, Qgy, Qgz, Qha, Qhb, Qhc, Qhd, Qhe, Qhf, Qhg, Qhi, Qhj, Qhk, Qhl, Qhm, Qhn, Qho, Qhp, Qhq, Qhr, Qhs, Qht, Qhu, Qhv, Qhw, Qhx, Qhy, Qhz, Qia, Qib, Qic, Qid, Qie, Qif, Qig, Qih, Qij, Qik, Qil, Qim, Qin, Qio, Qip, Qiq, Qir, Qis, Qit, Qiu, Qiv, Qiw, Qix, Qiy, Qiz, Qja, Qjb, Qjc, Qjd, Qje, Qjf, Qjg, Qjh, Qji, Qjj, Qjk, Qjl, Qjm, Qjn, Qjo, Qjp, Qjq, Qjr, Qjs, Qjt, Qju, Qjv, Qjw, Qjx, Qjy, Qjz, Qka, Qkb, Qkc, Qkd, Qke, Qkf, Qkg, Qkh, Qki, Qkj, Qkk, Qkl, Qkm, Qkn, Qko, Qkp, Qkq, Qkr, Qks, Qkt, Qku, Qkv, Qkw, Qkx, Qky, Qkz, Qla, Qlb, Qlc, Qld, Qle, Qlf, Qlg, Qlh, Qli, Qlj, Qlk, Qll, Qlm, Qln, Qlo, Qlp, Qlq, Qlr, Qls, Qlt, Qlu, Qlv, Qlw, Qlx, Qly, Qlz, Qma, Qmb, Qmc, Qmd, Qme, Qmf, Qmg, Qmh, Qmi, Qmj, Qmk, Qml, Qmm, Qmn, Qmo, Qmp, Qmq, Qmr, Qms, Qmt, Qmu, Qmv, Qmw, Qmx, Qmy, Qmz, Qna, Qnb, Qnc, Qnd, Qne, Qnf, Qng, Qnh, Qni, Qnj, Qnk, Qnl, Qnm, Qnn, Qno, Qnp, Qnq, Qnr, Qns, Qnt, Qnu, Qnv, Qnw, Qnx, Qny, Qnz, Qoa, Qob, Qoc, Qod, Qoe, Qof, Qog, Qoh, Qoi, Qoj, Qok, Qol, Qom, Qon, Qoo, Qop, Qoq, Qor, Qos, Qot, Qou, Qov, Qow, Qox, Qoy, Qoz, Qpa, Qpb, Qpc, Qpd, Qpe, Qpf, Qpg, Qph, Qpi, Qpj, Qpk, Qpl, Qpm, Qpn, Qpo, Qpp, Qpq, Qpr, Qps, Qpt, Qpu, Qpv, Qpw, Qpx, Qpy, Qpz, Qqa, Qqb, Qqc, Qqd, Qqe, Qqf, Qqg, Qqh, Qqi, Qqj, Qqk, Qql, Qqm, Qqn, Qqo, Qqp, Qqq, Qqr, Qqs, Qqt, Qqu, Qqv, Qqw, Qqx, Qqy, Qqz, Qra, Qrb, Qrc, Qrd, Qre, Qrf, Qrg, Qrh, Qri, Qrj, Qrk, Qrl, Qrm, Qrn, Qro, Qrp, Qrq, Qrr, Qrs, Qrt, Qru, Qrv, Qrw, Qrx, Qry, Qrz, Qsa, Qsb, Qsc, Qsd, Qse, Qsf, Qsg, Qsh, Qsi, Qsj, Qsk, Qsl, Qsm, Qsn, Qso, Qsp, Qsq, Qsr, Qss, Qst, Qsu, Qsv, Qsw, Qsx, Qsy, Qsz, Qta, Qtb, Qtc, Qtd, Qte, Qtf, Qtg, Qth, Qti, Qtj, Qtk, Qtl, Qtm, Qtn, Qto, Qtp, Qtq, Qtr, Qts, Qtt, Qtu, Qtv, Qtw, Qtx, Qty, Qtz, Qua, Qub, Quc, Qud, Que, Quf, Qug, Quh, Qui, Quj, Quk, Qul, Qum, Qun, Quo, Qup, Quq, Qur, Qus, Qut, Quu, Quv, Quw, Qux, Quy, Quz, Qva, Qvb, Qvc, Qvd, Qve, Qvf, Qvg, Qvh, Qvi, Qvj, Qvk, Qvl, Qvm, Qvn, Qvo, Qvp, Qvq, Qvr, Qvs, Qvt, Qvu, Qvv, Qvw, Qvx, Qvy, Qvz, Qwa, Qwb, Qwc, Qwd, Qwe, Qwf, Qwg, Qwh, Qwi, Qwj, Qwk, Qwl, Qwm, Qwn, Qwo, Qwp, Qwq, Qwr, Qws, Qwt, Qwu, Qwv, Qww, Qwx, Qwy, Qwz, Qxa, Qxb, Qxc, Qxd, Qxe, Qxf, Qxg, Qxh, Qxi, Qxj, Qxk, Qxl, Qxm, Qxn, Qxo, Qxp, Qxq, Qxr, Qxs, Qxt, Qxu, Qxv, Qxw, Qxx, Qxy, Qxz, Qya, Qyb, Qyc, Qyd, Qye, Qyf, Qyg, Qyh, Qyi, Qyj, Qyk, Qyl, Qym, Qyn, Qyo, Qyp, Qyq, Qyr, Qys, Qyt, Qyu, Qyv, Qyw, Qyx, Qyy, Qyz, Qza, Qzb, Qzc, Qzd, Qze, Qzf, Qzg, Qzh, Qzi, Qzj, Qzk, Qzl, Qzm, Qzn, Qzo, Qzp, Qzq, Qzr, Qzs, Qzt, Qzu, Qzv, Qzw, Qzx, Qzy, Qzz.

The status bar at the bottom shows the drawing tool set to "Drawing" and the coordinate system as "Georgia". The scale is 1:50,000. The status bar also displays the coordinates 331234.496 4464580.553 Meters.

Create New GDB Point Feature Class



Load Photo Points Into Feature Class



Add Photo Points To Map

The screenshot displays the ArcMap interface for a project titled "DugwayProvingGround_20151119.mxd". The software window includes a menu bar (File, Edit, View, Bookmarks, Insert, Selection, Geoprocessing, Customize, Windows, Help), a toolbar with various mapping tools, and a status bar at the bottom. The main map area shows a topographic map of the Dugway Proving Ground, featuring contour lines, rivers, and various geological units labeled with codes like Qlg, Pofc, Mo, Qafy, and Qla. Two green circular markers represent photo points, one near a location labeled "Tiac" and another near "Devils Postpile".

On the left side, the "Table of Contents" window is open, showing a list of layers. The "Layers" section is expanded, and the "DugwayProvingGround_PhotoPoints" layer is selected and highlighted in blue. Below this, a list of other layers is visible, including "Dugway Sample Tables", "DugwayProvingGround_WellLogTable", "DugwayProvingGround_GeologicSymbols", "Dugway Gravity Contours", "DugwayProvingGround_CrossSectionLines", "DugwayProvingGround_ShorelineMask", "DugwayProvingGround_MapBoundary", "DugwayProvingGround_GeologicUnits_lea", "DugwayProvingGround_GeologicLines", "DugwayProvingGround_GeologicStructure", "DugwayProvingGround_PaleoChannels", "DugwayProvingGround_boundary", "UtahTestAndTrainingRange_boundary", "CedarMtnWildernessArea", "DugwayProvingGround_GeologicUnits", "DugwayProvingGround_mashup_2015090", "DugwayProvingGround_mashup_2015110", "DugwayProvingGround_mashup_2015111", "DugwayProvingGround_mashup_2015111", and "DugwayMappingProject_DRG.tif".

Change Map Symbols

The screenshot shows the ArcMap interface for a project named 'DugwayProvingGround_20151119.mxd'. The main map area displays a geological map with various units and features. The Table of Contents on the left lists the following layers:

- DugwayProvingGround_GeologicUnits_lab
- DugwayProvingGround_GeologicFeatures
- UtahTestAndTrainingRange_labels
- Dugway Field Photos
 - DugwayProvingGround_PhotoPoints
- DugwayProvingGround_PhotoPoints_1
- Dugway Sample Tables
- DugwayProvingGround_WellLogTable
- DugwayProvingGround_GeologicSymbols
- Dugway Gravity Contours
- DugwayProvingGround_CrossSectionLines
- DugwayProvingGround_ShorelineMask
- DugwayProvingGround_MapBoundary
- DugwayProvingGround_GeologicUnits_lea
- DugwayProvingGround_GeologicLines
- DugwayProvingGround_GeologicStructure
- DugwayProvingGround_PaleoChannels
- DugwayProvingGround_boundary
- UtahTestAndTrainingRange_boundary
- CedarMtnWildernessArea
- DugwayProvingGround_GeologicUnits
- DugwayProvingGround_mashup_201509C
- DugwayProvingGround_mashup_2015110
- DugwayProvingGround_mashup_2015111
- DugwayProvingGround_mashup_2015111
- DugwayMappingProject_DRG.tif

The map area shows geological units such as Qlg, Pofc, Mo, Qafy, Qla, and Dg. It also features topographic contours, a grid, and labels for 'Wig Mountain' and 'Devils Postpile'. The interface includes a menu bar (File, Edit, View, Bookmarks, Insert, Selection, Geoprocessing, Customize, Windows, Help), a toolbar, and a status bar at the bottom.



Next, Choose The Storage And
Display Method For Your Photos



Next, Choose The Storage And Display Method For Your Photos

- Hyperlinks to image files or URL



Next, Choose The Storage And Display Method For Your Photos

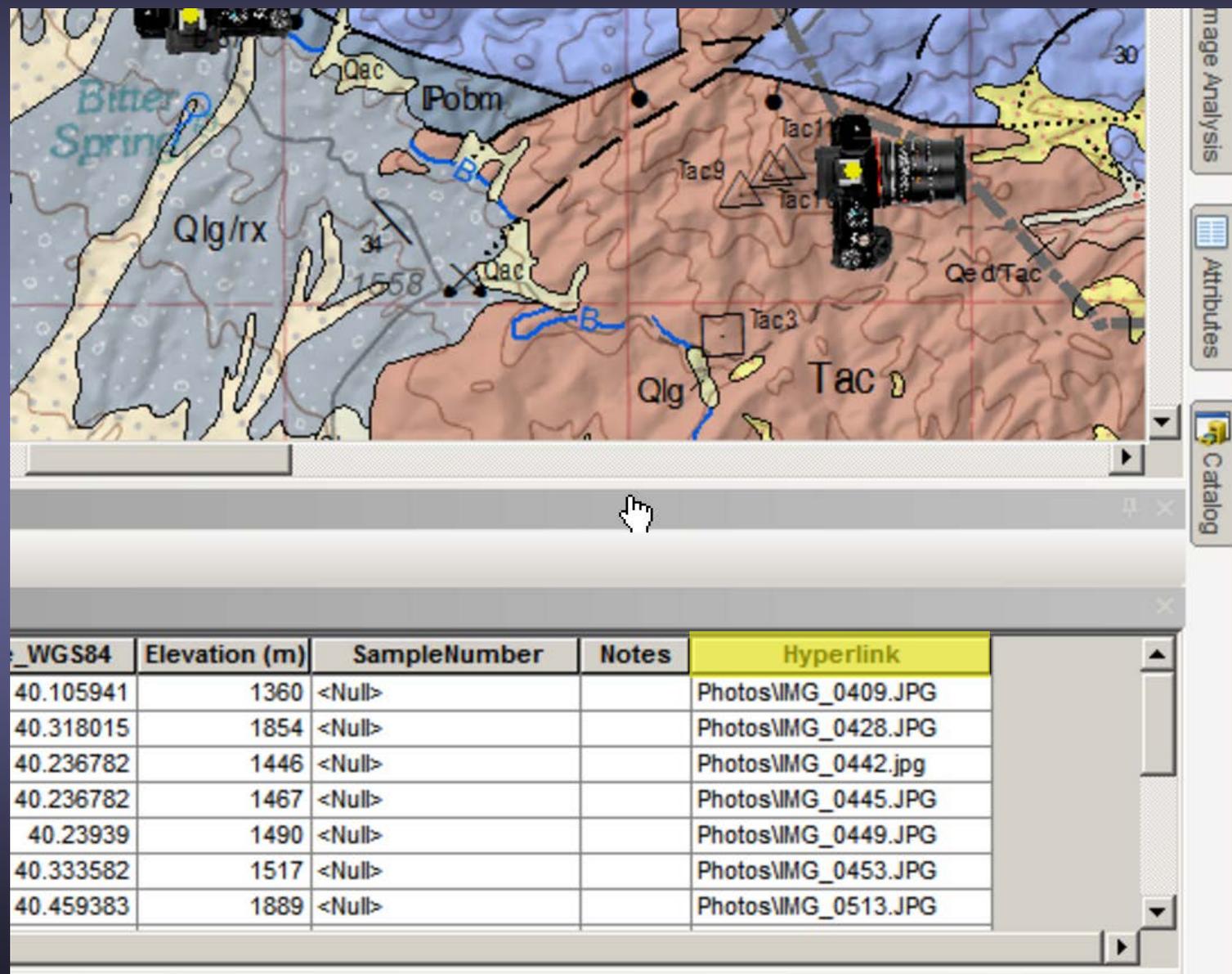
- Hyperlinks to image files or URL
- Images embedded in raster data field



Next, Choose The Storage And Display Method For Your Photos

- Hyperlinks to image files or URL
- Images embedded in raster data field
- Images embedded as feature class attachments (BLOB)

Hyperlinks



The screenshot displays a GIS interface. The top portion shows a topographic map with various features labeled: "Bitter Springs", "Qlg/rx", "Pobm", "Qac", "Tac9", "Tac1", "Tac3", "Qe d/Tac", and "Tac". A camera icon is positioned on the map. On the right side, there are three vertical buttons: "Image Analysis", "Attributes", and "Catalog". Below the map is a data table with the following columns: "X_WGS84", "Elevation (m)", "SampleNumber", "Notes", and "Hyperlink". The "Hyperlink" column contains file paths to image files.

X_WGS84	Elevation (m)	SampleNumber	Notes	Hyperlink
40.105941	1360	<Null>		Photos\IMG_0409.JPG
40.318015	1854	<Null>		Photos\IMG_0428.JPG
40.236782	1446	<Null>		Photos\IMG_0442.jpg
40.236782	1467	<Null>		Photos\IMG_0445.JPG
40.23939	1490	<Null>		Photos\IMG_0449.JPG
40.333582	1517	<Null>		Photos\IMG_0453.JPG
40.459383	1889	<Null>		Photos\IMG_0513.JPG

Hyperlinks

The screenshot shows the 'Layer Properties' dialog box with the 'Display' tab selected. The 'Hyperlinks' section is highlighted in yellow and contains the following settings:

- Support Hyperlinks using field:
- Field:
- Document
- URL
- Script
-

Below the Hyperlinks section, the 'Feature Exclusion' section is visible, showing a table of excluded features:

Feature ID	Caption

Buttons for 'Restore Drawing' and 'Restore All' are located to the right of the table.

Hyperlinks

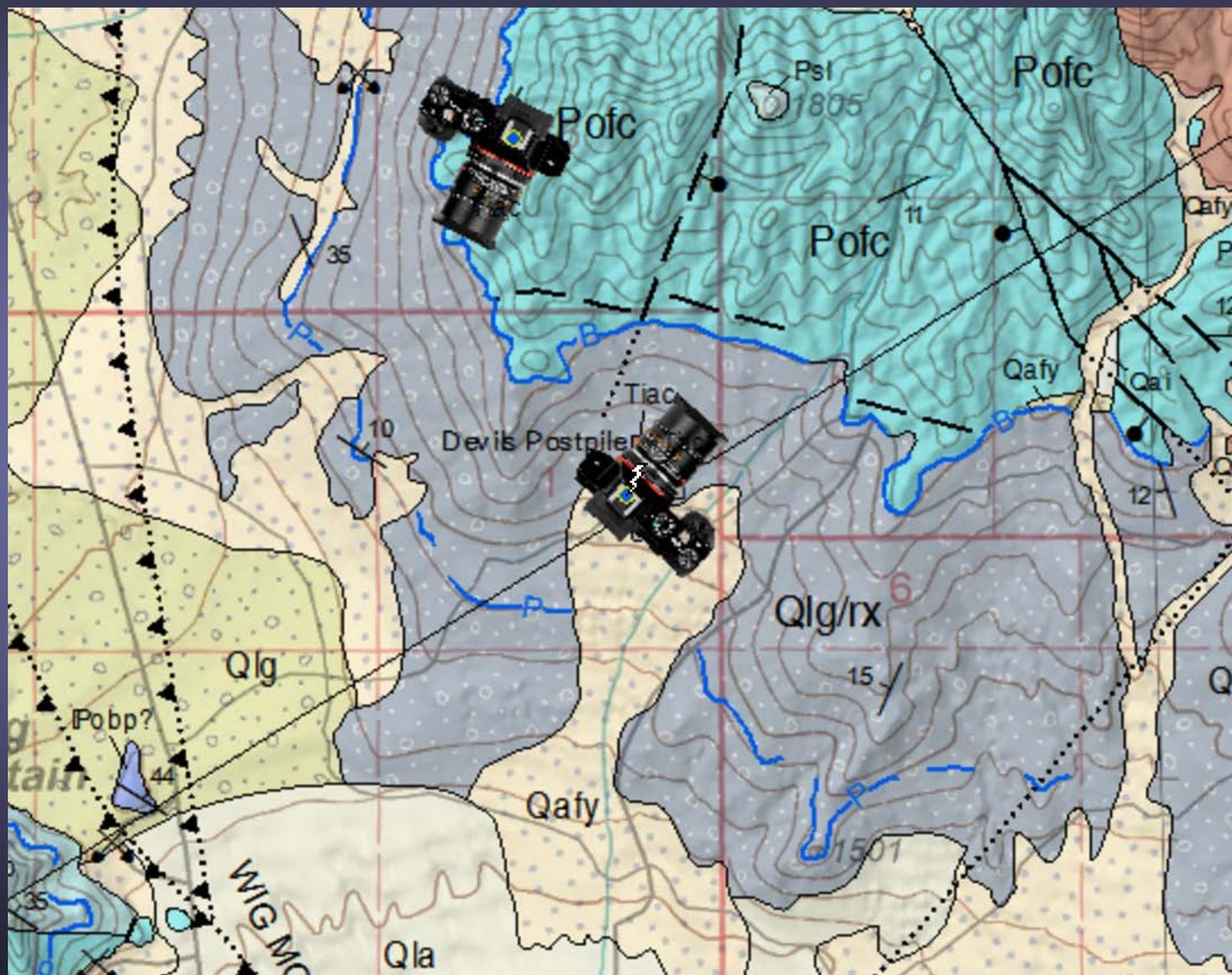
The screenshot displays the ArcMap interface with a map titled "DugwayProvingGround_20151119.mxd". The map shows a topographic view with various geological features and labels such as "Pofc", "Qafy", "Qlg/rx", and "Qla". A tooltip for the "Hyperlink" tool is visible, explaining its function and providing a hint to press F1 for more help.

Hyperlink
Launch a hyperlink to a website, document or script by clicking on a feature.
Press F1 for more help.

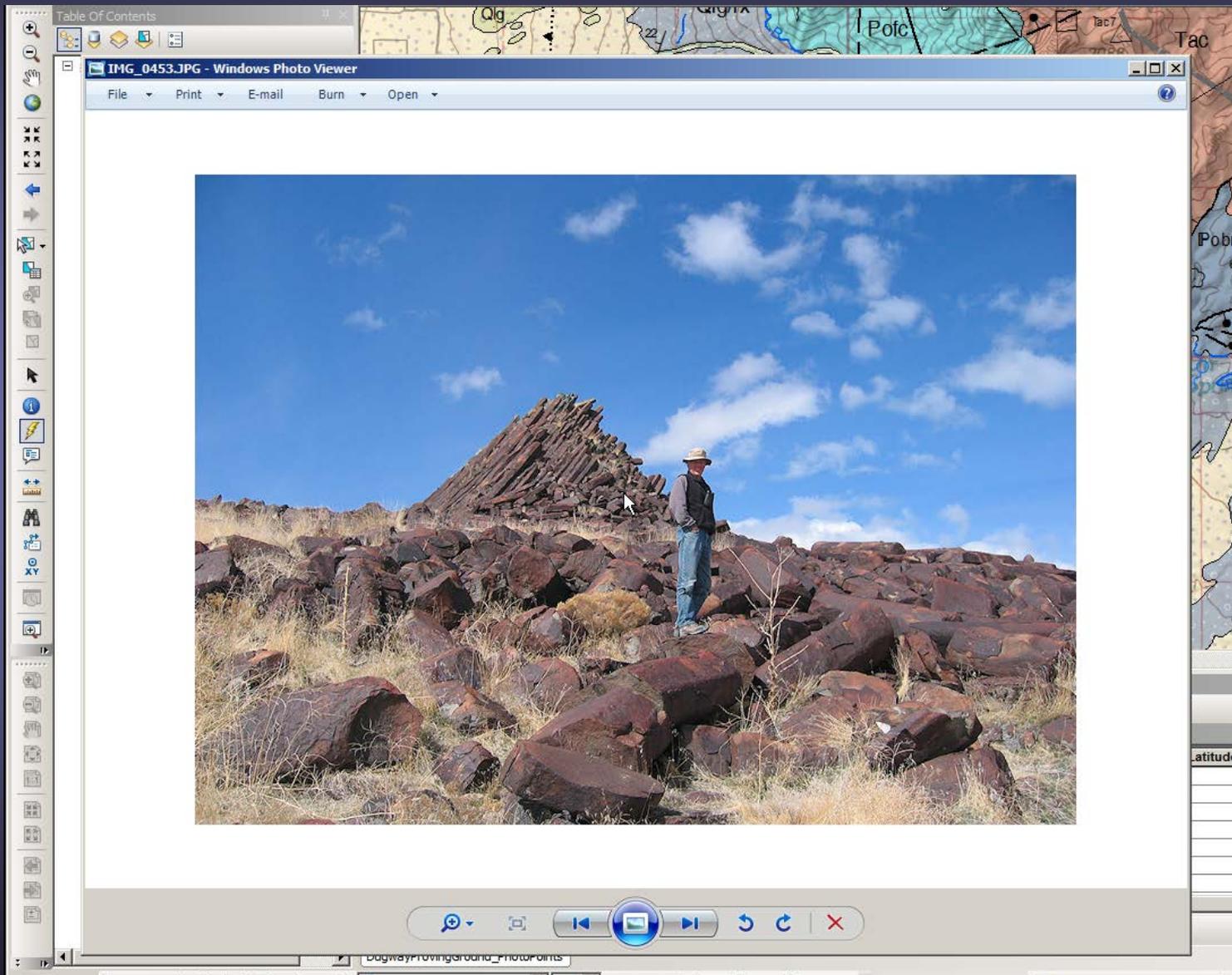
Table of Contents:

- DugwayProvingGround_PhotoPoints
- Dugway Sample Tables
- DugwayProvingGround_WellLogTable
- DugwayProvingGround_GeologicSymbols
- Dugway Gravity Contours
- DugwayProvingGround_CrossSectionLine
- DugwayProvingGround_ShorelineMask
- DugwayProvingGround_MapBoundary
- DugwayProvingGround_GeologicUnits_lea
- DugwayProvingGround_GeologicLines
- DugwayProvingGround_GeologicStructure
- DugwayProvingGround_PaleoChannels
- DugwayProvingGround_PaleoChannelBoundary
- DugwayProvingGround_PaleoChannelBoundary
- DugwayProvingGround_PaleoChannelBoundary
- DugwayProvingGround_GeologicUnits
- DugwayProvingGround_mashup_2015090
- DugwayProvingGround_mashup_2015110
- DugwayProvingGround_mashup_2015110
- DugwayProvingGround_mashup_2015110
- DugwayMappingProject_DRG.tif

Hyperlinks



Hyperlinks



Hyperlinks

Image Hyperlinks

Pros

- Accessing the images using the ArcMap Hyperlink Tool is intuitive
- Image opens in default external image viewer that includes zoom and pan tools

Cons

- Hyperlinks only work in ArcMap Data View
- Images open in default external image viewer instead of an ArcMap window, and don't display photo caption or other attributes; not the best user experience
- Images are not embedded. A folder of image files must accompany the geodatabase

Images Embedded In Raster Field

The screenshot displays a GIS application interface. On the left is the 'Table of Contents' panel, which lists various layers. The 'Dugway Field Photos' layer is selected, and its contents are visible in the 'DugwayProvingGround_PhotoPoints' table at the bottom. The main map area shows a geological map with various units (e.g., Qlg, Pofo, Qafy, Qla, Qag, Qed) and features like 'WIG MOUNTAIN THRUST FAULT'. Several photo points are marked on the map, each with a camera icon. The bottom panel shows a table with the following data:

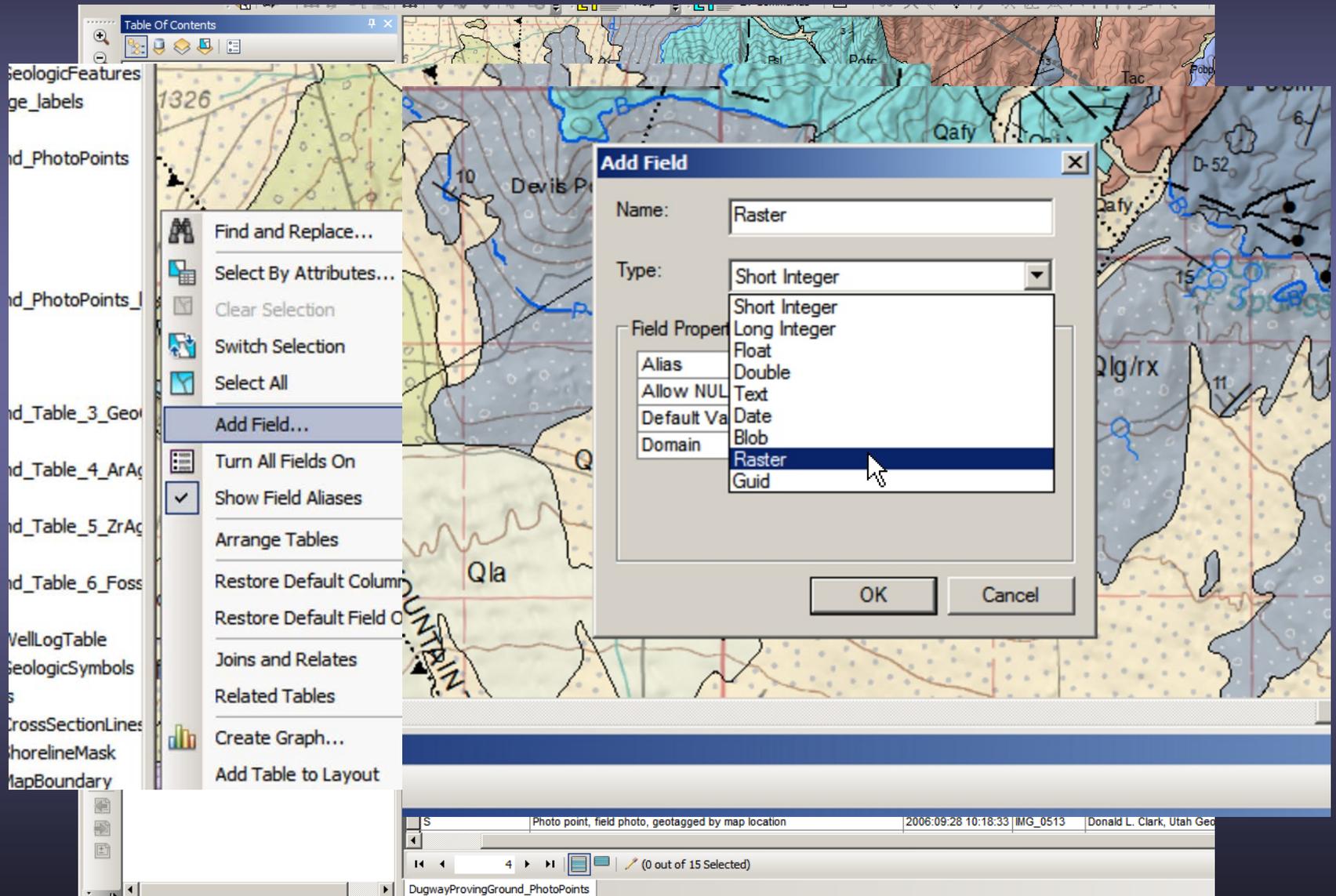
ViewDirection	Feature	PhotoDateTime	Filename	Photo
WNW	Photo point, field photo, geotagged by map location	2006:03:29 16:00:04	IMG_0409	Donald L. Clark, Utah Geo
E	Photo point, field photo, geotagged by map location	2006:03:29 13:45:06	IMG_0428	Donald L. Clark, Utah Geo
SSE	Photo point, field photo, geotagged by map location	2006:03:29 18:37:42	IMG_0442	Donald L. Clark, Utah Geo
SSW	Photo point, field photo, geotagged by map location	2006:03:29 18:39:10	IMG_0445	Donald L. Clark, Utah Geo
SSW	Photo point, field photo, geotagged by map location	2006:03:29 18:53:12	IMG_0449	Donald L. Clark, Utah Geo
NE	Photo point, field photo, geotagged by map location	2006:03:30 16:16:23	IMG_0453	Donald L. Clark, Utah Geo
S	Photo point, field photo, geotagged by map location	2006:09:28 10:18:33	IMG_0513	Donald L. Clark, Utah Geo

Images Embedded In Raster Field

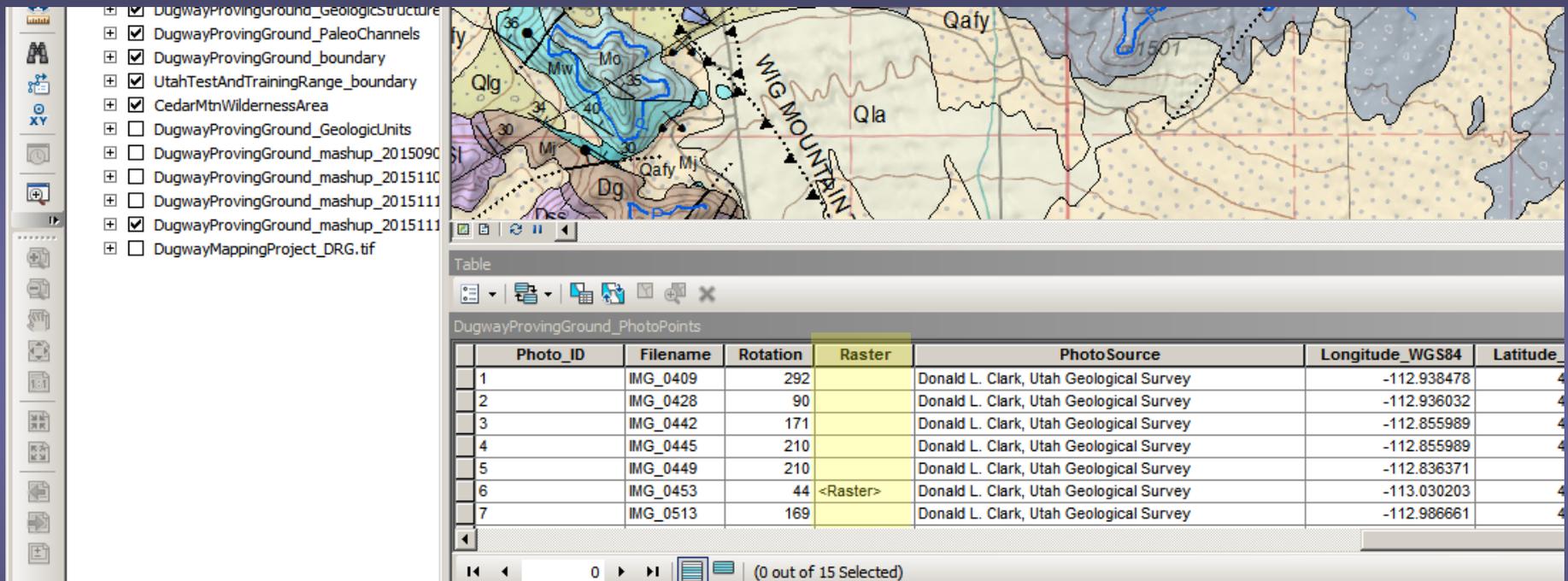
The screenshot shows a GIS application interface. A map displays a topographic area with several photo points (represented by camera icons) and a grid overlay. A context menu is open over the map, with the 'Add Field...' option highlighted. A tooltip for 'Add Field' is visible, stating 'Adds a new field to the table.' The Table of Contents on the left lists various layers, including 'PhotoPoints'. At the bottom, a table displays the data for the selected photo points.

PhotoDateTime	Filename	Photo
2006:03:22 16:00:04	IMG_0409	Donald L. Clark, Utah Geo
2006:03:29 13:45:06	IMG_0428	Donald L. Clark, Utah Geo
2006:03:29 18:37:42	IMG_0442	Donald L. Clark, Utah Geo
2006:03:29 18:39:10	IMG_0445	Donald L. Clark, Utah Geo
2006:03:29 18:53:12	IMG_0449	Donald L. Clark, Utah Geo
2006:03:30 16:16:23	IMG_0453	Donald L. Clark, Utah Geo
2006:09:28 10:18:33	IMG_0513	Donald L. Clark, Utah Geo

Images Embedded In Raster Field



Images Embedded In Raster Field



The screenshot displays a GIS application interface. On the left is a layer list with several checked items, including 'DugwayProvingGround_Geologicstructure', 'DugwayProvingGround_PaleoChannels', 'DugwayProvingGround_boundary', 'UtahTestAndTrainingRange_boundary', 'CedarMtnWildernessArea', 'DugwayProvingGround_GeologicUnits', 'DugwayProvingGround_mashup_2015090', 'DugwayProvingGround_mashup_2015110', 'DugwayProvingGround_mashup_2015111', 'DugwayProvingGround_mashup_2015111', and 'DugwayMappingProject_DRG.tif'. The main map area shows a topographic map with contour lines, a grid, and various geological features. A 'WIG MOUNTAIN' label is visible. Below the map is a 'Table' window titled 'DugwayProvingGround_PhotoPoints' with the following data:

Photo_ID	Filename	Rotation	Raster	PhotoSource	Longitude_WGS84	Latitude
1	IMG_0409	292		Donald L. Clark, Utah Geological Survey	-112.938478	4
2	IMG_0428	90		Donald L. Clark, Utah Geological Survey	-112.936032	4
3	IMG_0442	171		Donald L. Clark, Utah Geological Survey	-112.855989	4
4	IMG_0445	210		Donald L. Clark, Utah Geological Survey	-112.855989	4
5	IMG_0449	210		Donald L. Clark, Utah Geological Survey	-112.836371	4
6	IMG_0453	44	<Raster>	Donald L. Clark, Utah Geological Survey	-113.030203	4
7	IMG_0513	169		Donald L. Clark, Utah Geological Survey	-112.986661	4

At the bottom of the table window, there are navigation icons and the text '(0 out of 15 Selected)'.

Images Embedded In Raster Field

Right-click
to load a raster dataset

- Load...
- Clear
- Save As...
- Properties...

Photation	Raster	PhotoSource	Longitude_WGS84	Latitude
292		Donald L. Clark, Utah Geological Survey	-112.938478	
90		Donald L. Clark, Utah Geological Survey	-112.936032	
171		Donald L. Clark, Utah Geological Survey	-112.855989	
210			-112.855989	
210			-112.836371	
44	<Raster>		-113.030203	
169			-112.986661	

(0 out of 15 Selected)

B I U A

Show/Hide ArcPhoto Window

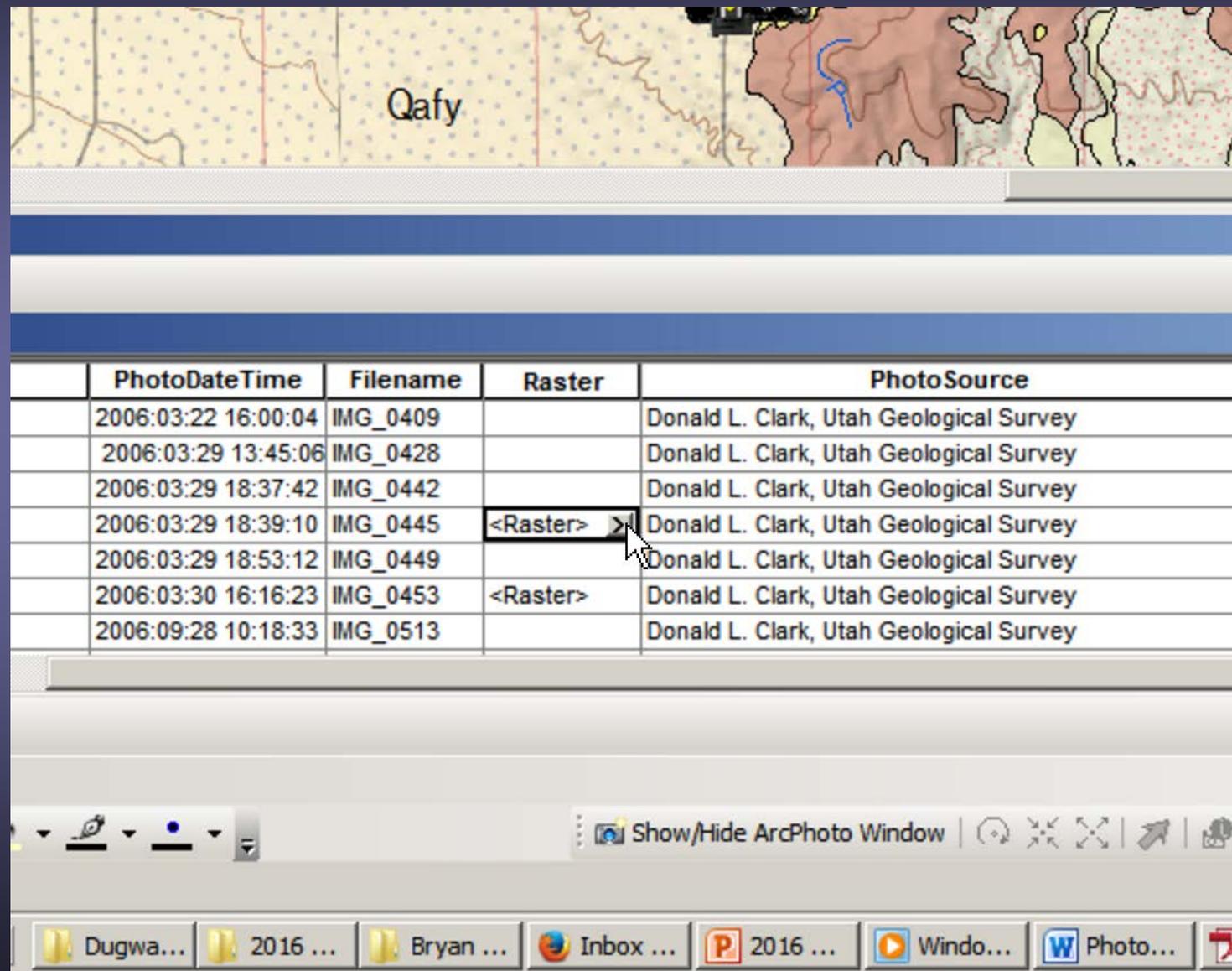
Dugwa... 2016 ... Bryan ... Inbox ... 2016 ... Win

Images Embedded In Raster Field

The screenshot shows a GIS application interface. A dialog box titled "Select Raster Dataset" is open, displaying a list of image files in the "Photos" folder. The file "IMG_0445.jpg" is selected. The dialog has "Name:" and "Show of type:" fields, and "Add" and "Cancel" buttons. The background shows a map with a raster grid and a table of data.

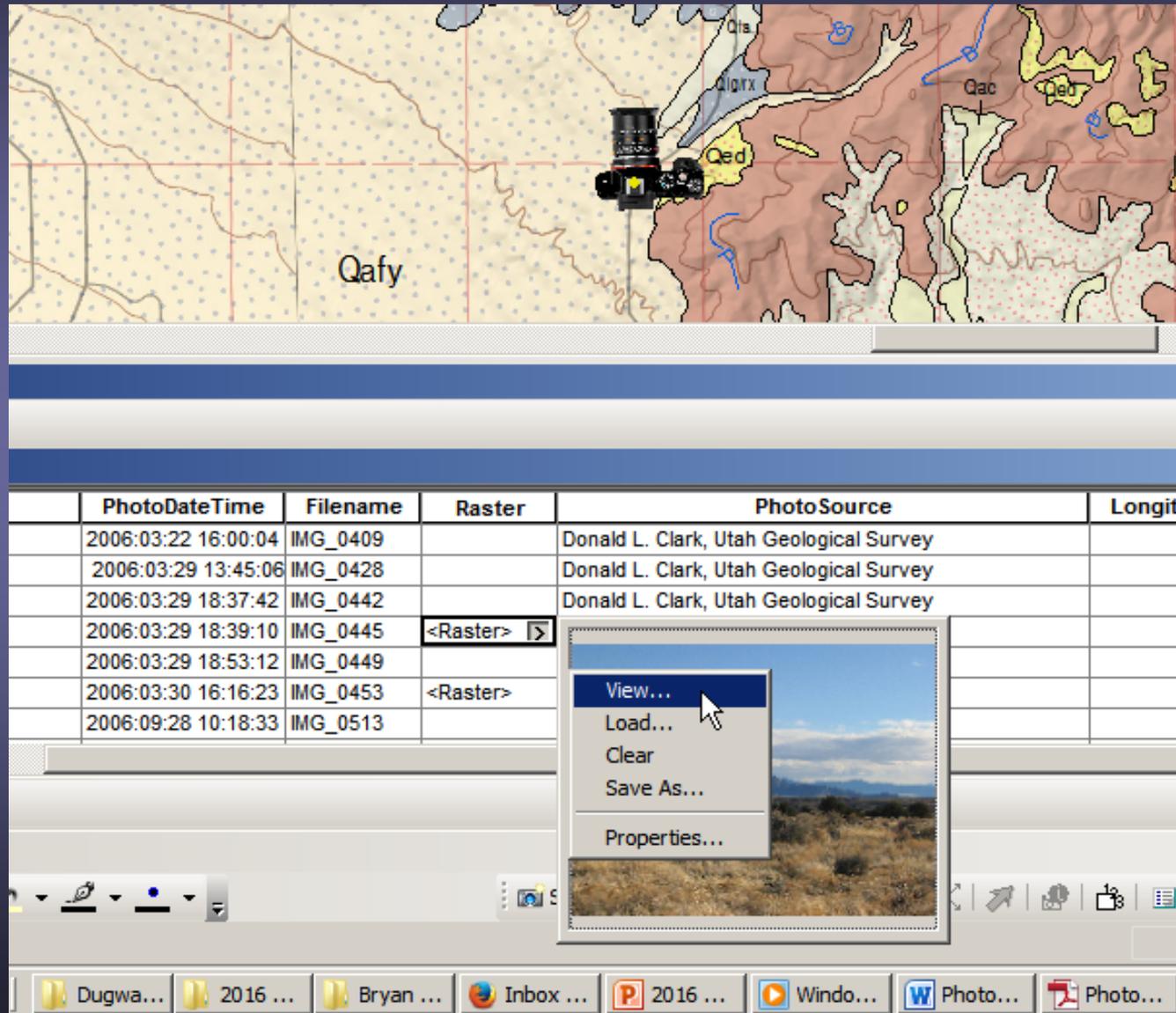
Photation	Raster	PhotoSource	Longitude_WGS84	Latitude_WGS84
292		Donald L. Clark, Utah Geological Survey	-112.938478	40.105941
90		Donald L. Clark, Utah Geological Survey	-112.936032	40.318015

Images Embedded In Raster Field



PhotoDateTime	Filename	Raster	PhotoSource
2006:03:22 16:00:04	IMG_0409		Donald L. Clark, Utah Geological Survey
2006:03:29 13:45:06	IMG_0428		Donald L. Clark, Utah Geological Survey
2006:03:29 18:37:42	IMG_0442		Donald L. Clark, Utah Geological Survey
2006:03:29 18:39:10	IMG_0445	<Raster>	Donald L. Clark, Utah Geological Survey
2006:03:29 18:53:12	IMG_0449		Donald L. Clark, Utah Geological Survey
2006:03:30 16:16:23	IMG_0453	<Raster>	Donald L. Clark, Utah Geological Survey
2006:09:28 10:18:33	IMG_0513		Donald L. Clark, Utah Geological Survey

Images Embedded In Raster Field



The screenshot displays a GIS application interface. At the top, a map shows a terrain with various geological units labeled 'Qafy', 'Qac', and 'Qed'. A camera icon is positioned on the map, indicating a photo location. Below the map is a data table with the following columns: PhotoDateTime, Filename, Raster, PhotoSource, and Longitude. The table contains several rows of data, with the 'Raster' column for some entries containing the text '<Raster>'. A context menu is open over the '<Raster>' entry for 'IMG_0445', showing options: View..., Load..., Clear, Save As..., and Properties... The 'View...' option is highlighted, and a small thumbnail image of a landscape is visible in the background of the menu. The Windows taskbar at the bottom shows several open applications, including 'Dugwa...', '2016 ...', 'Bryan ...', 'Inbox ...', '2016 ...', 'Windo...', 'Photo...', and 'Photo...'.

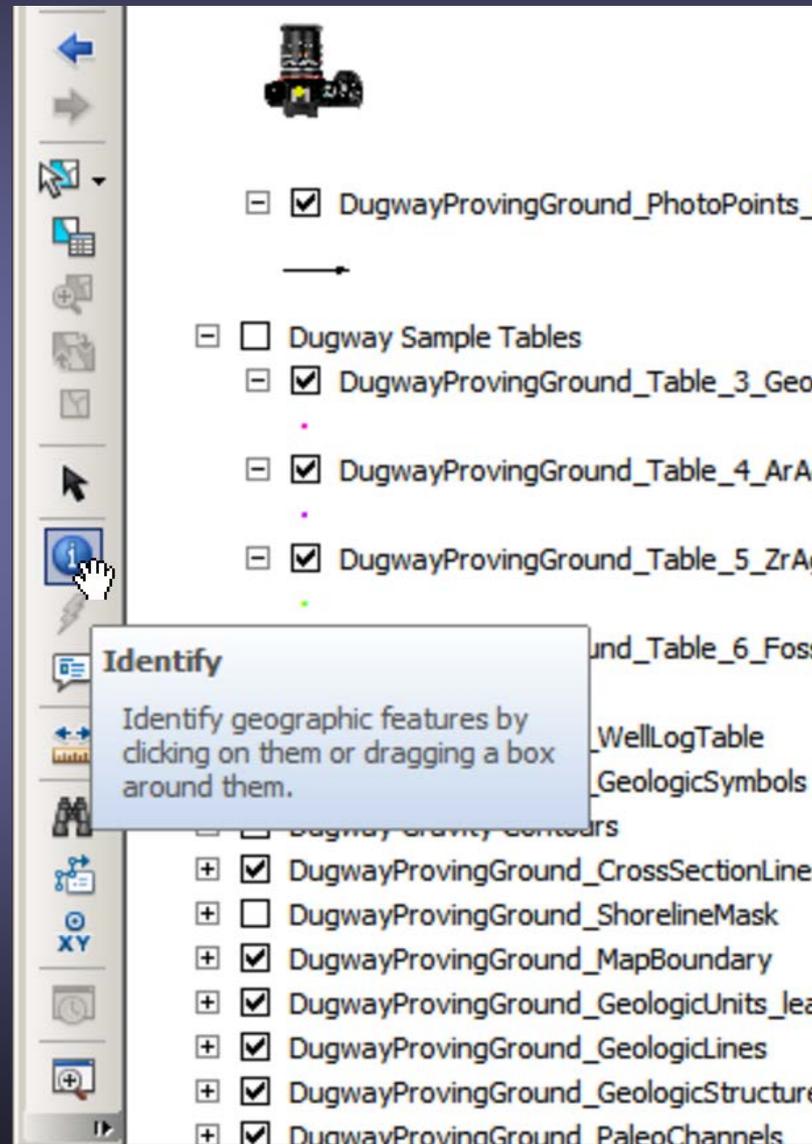
PhotoDateTime	Filename	Raster	PhotoSource	Longitude
2006:03:22 16:00:04	IMG_0409		Donald L. Clark, Utah Geological Survey	
2006:03:29 13:45:06	IMG_0428		Donald L. Clark, Utah Geological Survey	
2006:03:29 18:37:42	IMG_0442		Donald L. Clark, Utah Geological Survey	
2006:03:29 18:39:10	IMG_0445	<Raster>		
2006:03:29 18:53:12	IMG_0449			
2006:03:30 16:16:23	IMG_0453	<Raster>		
2006:09:28 10:18:33	IMG_0513			

Images Embedded In Raster Field

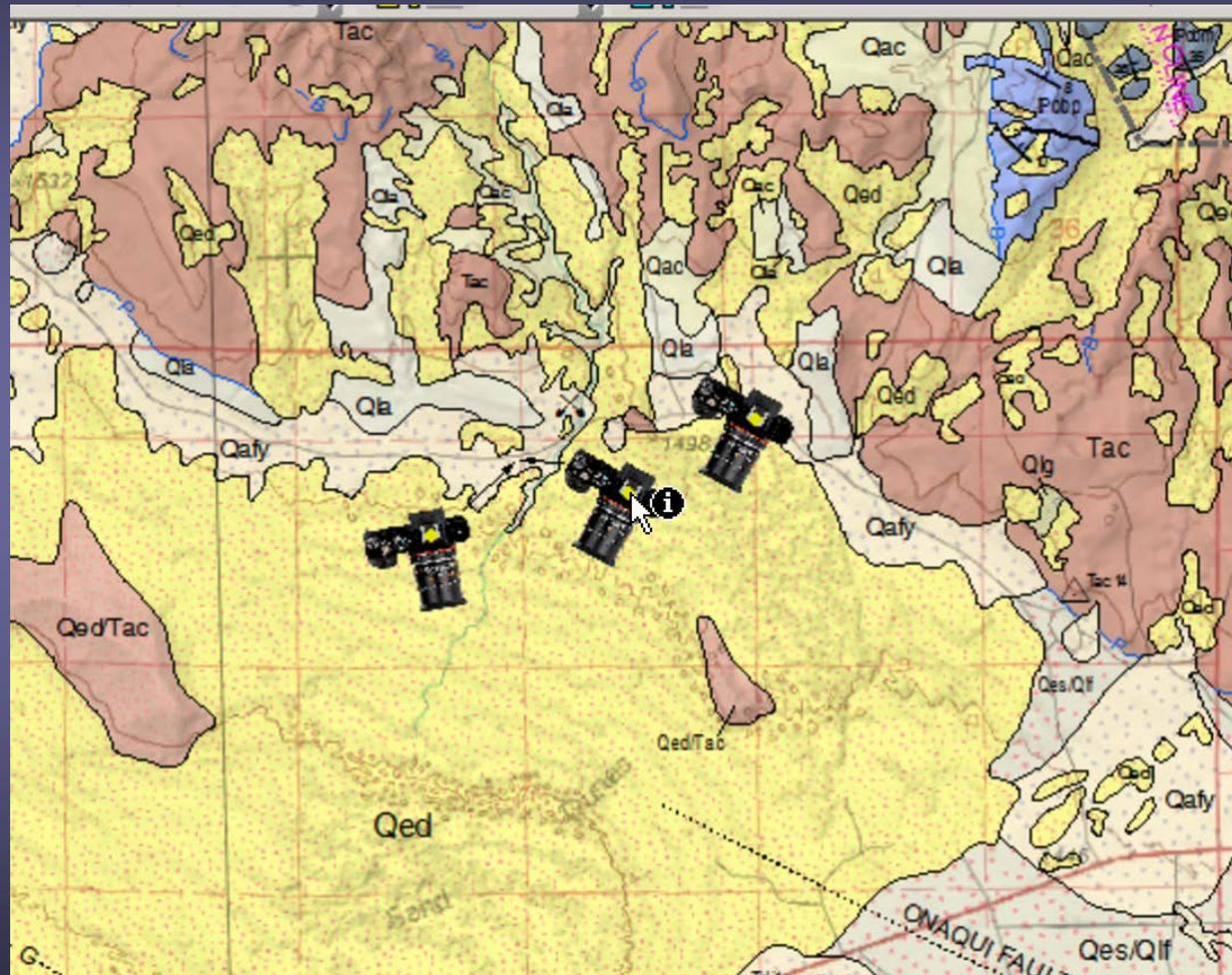
The screenshot displays the ET GeoWizards interface. The main window, titled '4 - Raster', shows a landscape image of a grassy field with mountains in the background, which is embedded within a raster field. The software's toolbar and menu are visible at the top. On the left, a list of layers includes 'PhotoPoints' and 'PhotoPoints_I'. On the right, a map shows the geographic context of the raster field. At the bottom, a table provides metadata for the raster cells.

							Elevation (m)	SampleNumber
1	IMG_0409	292		Donald L. Clark, Utah Geological Survey	-112.938478	40.105941	1360	<Null>
2	IMG_0428	90		Donald L. Clark, Utah Geological Survey	-112.936032	40.318015	1854	<Null>
3	IMG_0442	171		Donald L. Clark, Utah Geological Survey	-112.855989	40.236782	1446	<Null>
4	IMG_0445	210	<Raster>	Donald L. Clark, Utah Geological Survey	-112.855989	40.236782	1467	<Null>
5	IMG_0449	210		Donald L. Clark, Utah Geological Survey	-112.836371	40.23939	1490	<Null>
6	IMG_0453	44	<Raster>	Donald L. Clark, Utah Geological Survey	-113.030203	40.333582	1517	<Null>
7	IMG_0513	169		Donald L. Clark, Utah Geological Survey	-112.986661	40.459383	1889	<Null>

Images Embedded In Raster Field



Images Embedded In Raster Field



Images Embedded In Raster Field

The screenshot shows the ArcGIS interface with a map of a desert region. Several black camera icons represent photo points. A 'Raster Viewer' window is open, showing a landscape photo of a desert valley with mountains in the distance. An 'Identify' window is also open, displaying metadata for a selected photo point. The metadata includes fields like Caption, OBJECTID, SHAPE, LayerInt, Layer, ViewDirection, Feature, PhotoDateTime, Type, Subtype, Modifier, Photo_ID, Filename, Rotation, Raster, PhotoSource, Longitude_WGS84, Latitude_WGS84, Elevation (m), and SampleNumber. A table at the bottom right shows a list of photo points with columns for SampleNumber, Notes, and Hyperlink.

SampleNumber	Notes	Hyperlink
9		Photos\IMG_0409.JPG
8		Photos\IMG_0428.JPG
2		Photos\IMG_0442.jpg
5		Photos\IMG_0445.JPG
9		Photos\IMG_0449.JPG
3		Photos\IMG_0453.JPG
3		Photos\IMG_0513.JPG

Images Embedded In Raster Field

The screenshot shows the ET GeoWizards interface. The main map displays a topographic map with several photo points marked as black camera icons. An 'Attributes' window is open, showing details for a selected photo point: 'View southwest of Camels Back Ridge'. The 'Attachments' section lists one attachment: a 'Photo point' subtype 'field photo' with a 'Raster' field. This raster field contains a small image of a landscape. A context menu is open over the raster field, showing options: 'View...', 'Load...', 'Clear', 'Save As...', and 'Properties...'. At the bottom, a table lists the photo points and their attributes.

Photo_ID	Filename	Rotation	Raster	PhotoSource
1	IMG_0409	292		Donald L. Clark, Utah Geological Survey
2	IMG_0428	90		Donald L. Clark, Utah Geological Survey
3	IMG_0442	171		Donald L. Clark, Utah Geological Survey
4	IMG_0445	210	<Raster>	Donald L. Clark, Utah Geological Survey
5	IMG_0449	210		Donald L. Clark, Utah Geological Survey
6	IMG_0453	44	<Raster>	Donald L. Clark, Utah Geological Survey
7	IMG_0513	169		Donald L. Clark, Utah Geological Survey

Images Embedded In Raster Field

The screenshot displays a GIS application window titled "DugwayProvingGround_PhotoPoints\Raster.OBJECTID = 4 - Raster". The main map area shows a landscape photograph of a grassy field with mountains in the distance. The interface includes a toolbar at the top, a layer list on the left, and a data table at the bottom.

							Elevation (m)	SampleN
1	IMG_0409	292	Donald L. Clark, Utah Gec	SampleNumber	<Null>		5941	1360 <Null>
2	IMG_0428	90	Donald L. Clark, Utah Gec	Notes			8015	1854 <Null>
3	IMG_0442	171	Donald L. Clark, Utah Gec	Hyperlink	Photos\IMG_0445.JPG		5782	1446 <Null>
4	IMG_0445	210	Donald L. Clark, Utah Gec	Raster			5782	1467 <Null>
5	IMG_0449	210	Donald L. Clark, Utah Gec	Raster			5939	1490 <Null>
6	IMG_0453	44	Donald L. Clark, Utah Gec	Null values allowed			5582	1517 <Null>
7	IMG_0513	169	Donald L. Clark, Utah Gec				5383	1889 <Null>

Images Embedded In Raster Field

Images Embedded in Raster Field

Pros

- Access images using the ArcMap identify tool, or from raster field in attributes table, or from selected feature attributes window in edit mode; this method is the most flexible option
- Images are embedded in geodatabase
- Images open in ArcMap viewing window— not in external viewer— and includes zoom and pan tools

Cons

- Accessing images with the ArcMap identify tool is intuitive, but not the best user experience
- Accessing images from attribute table or from selected feature attributes window in edit mode is less intuitive and still not the best user experience.

Images Embedded In Feature Class Attachments (BLOB)

The screenshot displays a GIS application interface. On the left is the Table of Contents (TOC) pane, listing various layers such as 'Dugway Proving Ground Geologic Units', 'Dugway Field Photos', and 'Dugway Proving Ground Photo Points'. The main map area shows a topographic map of the Dugway Proving Ground, with several camera icons indicating photo locations. A table at the bottom of the map displays the data for the 'Dugway Proving Ground Photo Points' feature class.

ViewDirection	Feature	PhotoDateTime	Filename	Photo
WNW	Photo point, field photo, geotagged by map location	2006:03:22 16:00:04	MG_0409	Donald L. Clark, Utah Geol
E	Photo point, field photo, geotagged by map location	2006:03:29 13:45:06	MG_0428	Donald L. Clark, Utah Geol
SSE	Photo point, field photo, geotagged by map location	2006:03:29 18:37:42	MG_0442	Donald L. Clark, Utah Geol
SSW	Photo point, field photo, geotagged by map location	2006:03:29 18:39:10	MG_0445	Donald L. Clark, Utah Geol
SSW	Photo point, field photo, geotagged by map location	2006:03:29 18:53:12	MG_0449	Donald L. Clark, Utah Geol
NE	Photo point, field photo, geotagged by map location	2006:03:30 16:16:23	MG_0453	Donald L. Clark, Utah Geol
S	Photo point, field photo, geotagged by map location	2006:09:28 10:18:33	MG_0513	Donald L. Clark, Utah Geol

Images Embedded In Feature Class Attachments (BLOB)

The screenshot displays the ArcGIS Desktop interface. On the left, a map shows a geological area with various units and features. Several camera icons are overlaid on the map, indicating photo points. Below the map is a table with the following data:

eTime	Filename	Raster	PhotoSource	Longitude
16:00:04	IMG_0409		Donald L. Clark, Utah Geological Survey	-1
13:45:06	IMG_0428		Donald L. Clark, Utah Geological Survey	-1
18:37:42	IMG_0442		Donald L. Clark, Utah Geological Survey	-1
18:39:10	IMG_0445	<Raster>	Donald L. Clark, Utah Geological Survey	-1
18:53:12	IMG_0449		Donald L. Clark, Utah Geological Survey	-1
16:16:23	IMG_0453	<Raster>	Donald L. Clark, Utah Geological Survey	-1
10:18:33	IMG_0513		Donald L. Clark, Utah Geological Survey	-1

The right side of the screenshot shows the ArcToolbox and a context menu for the 'DugwayProvingGround_PhotoPoints' feature class. The 'Create Attachments' option is highlighted. A tooltip for 'Create Attachments' is displayed, providing the following information:

Create Attachments
Enable this geodatabase feature class or table to contain file attachments linked to its features or records. Attachments can be images, pdfs, text documents, or any other type of file. You can add attachments to the features during an edit session.

Disabled if you are using a Basic license. A Standard or an Advanced license is required to add, edit or delete attachments. Also disabled if the feature class or table already has attachments or is in a geodatabase that has not been upgraded to ArcGIS version 10.

Images Embedded In Feature Class Attachments (BLOB)

The screenshot displays the ArcGIS interface. On the left, a map of the Dugway Proving Ground area is shown, featuring geological units (e.g., Qlg/rx, Qed/Ts, Qafy), the Bitter Springs river, and several photo points marked with camera icons. Below the map is a table with the following data:

eTime	Filename	Raster	PhotoSource
16:00:04	IMG_0409		Donald L. Clark, Utah Geological Survey
13:45:06	IMG_0428		Donald L. Clark, Utah Geological Survey
18:37:42	IMG_0442		Donald L. Clark, Utah Geological Survey
18:39:10	IMG_0445	<Raster>	Donald L. Clark, Utah Geological Survey
18:53:12	IMG_0449		Donald L. Clark, Utah Geological Survey
16:16:23	IMG_0453	<Raster>	Donald L. Clark, Utah Geological Survey
10:18:33	IMG_0513		Donald L. Clark, Utah Geological Survey

On the right, the Catalog pane shows a list of feature classes and attachments for the 'DugwayProvingGround' dataset. The 'DugwayProvingGround_PhotoPoints_ATTACH' feature class is selected, and its attachments are listed below:

- DugwayProvingGround_GeologicUnits_labels
- DugwayProvingGround_GeologicUnits_leaders
- DugwayProvingGround_GravityContours_1mgal
- DugwayProvingGround_GravityContours_labels
- DugwayProvingGround_PaleoChannels
- DugwayProvingGround_PhotoPoints
- DugwayProvingGround_PhotoPoints_leaders
- DugwayProvingGround_Table_3_GeoChem
- DugwayProvingGround_Table_4_ArAges
- DugwayProvingGround_Table_5_ZrAges
- DugwayProvingGround_Table_6_FossilAges
- DugwayProvingGround_WellLogTable
- DugwayProvingGround_PhotoPoints_ATTACH** (selected)
- DugwayProvingGround_PhotoPoints_ATTACHREL
- 9781557919120_DugwayPG.tif
- DugwayProvingGround_20151008.mxd
- DugwayProvingGround_20151110.mxd
- DugwayProvingGround_20151116.mxd
- DugwayProvingGround_20151119.mxd**
- DugwayProvingGround_Mapunits_20160125.xls
- DugwayUnitsTest.shp

At the bottom of the interface, the 'Show/Hide ArcPhoto Window' button is visible.

Images Embedded In Feature Class Attachments (BLOB)

The screenshot displays the ET-GW software interface. The main window shows a topographic map with various geological features and labels. A specific feature, 'DugwayProvingGround_PhotoPoint', is selected, and its attributes are displayed in a pop-up window. The attributes window includes a list of fields and their values, such as 'LayerInt', 'Layer', 'Feature', 'Type', 'Subtype', 'Modifier', 'Photo_ID', 'Filename', 'Rotation', 'Caption', 'Longitude_WGS84', 'Latitude_WGS84', 'Elevation', 'PhotoSource', 'SampleNumber', 'Notes', 'Hyperlink', 'ViewDirection', and 'PhotoDateTime'. Below the attributes window, a table shows the spatial coordinates for the feature.

OBJECTID	Value
LayerInt	61
Layer	Layer61
Feature	Photo point, field photo, geotagged
Type	Photo point
Subtype	field photo
Modifier	geotagged by map location
Photo_ID	6
Filename	IMG_0453
Rotation	44
Caption	Southwest margin of Cedar Mountain
Longitude_WGS84	-113.030203
Latitude_WGS84	40.333582
Elevation	1517.128052
PhotoSource	Donald L. Clark, Utah Geological Survey
SampleNumber	<Null>
Notes	
Hyperlink	Photos\IMG_0453.JPG
ViewDirection	NE
PhotoDateTime	2006:03:30 16:16:23

Longitude_WGS84	Latitude_WGS84	Elevation
-112.938478	40.105941	1360.456

Images Embedded In Feature Class Attachments (BLOB)

The screenshot displays the ArcGIS interface with a map of a mountainous region. Two windows are open: the 'Attachments' dialog box and the 'Attributes' table.

Attachments Dialog Box:

Name	Size
------	------

Buttons: Open, Save As..., Save All..., Add..., Remove, OK, Cancel

Tip: Double-click an item to open.

Attributes Table:

Attachments (0)	
OBJECTID	6
LayerInt	61
Layer	Layer61
Feature	Photo point, field photo, geotagged
Type	Photo point
Subtype	field photo
Modifier	geotagged by map location
Photo_ID	6
Filename	IMG_0453
Rotation	44
Caption	Southwest margin of Cedar Mountain
Longitude_WGS84	-113.030203
Latitude_WGS84	40.333582
Elevation	1517.128052
PhotoSource	Donald L. Clark, Utah Geological Survey
SampleNumber	<Null>
Notes	
Hyperlink	Photos\IMG_0453.JPG
ViewDirection	NE
PhotoDateTime	2006:03:30 16:16:23

Table View:

Longitude_WGS84	Latitude_WGS84	Elevation
-112.938478	40.105941	1360.456

Images Embedded In Feature Class Attachments (BLOB)

The screenshot displays the ET-GT software interface. The main window shows a map with a feature class named 'DugwayProvingGround_PhotoPoint'. A specific feature, 'IMG_0453', is selected. The 'Attributes' window shows the following data:

Field	Value
OBJECTID	6
LayerInt	61
Layer	Layer61
Feature	Photo point, field photo, geotagged
Type	Photo point
Subtype	field photo
Modifier	geotagged by map location
Photo_ID	6
Filename	IMG_0453
Rotation	44
Caption	Southwest margin of Cedar Mountain
Longitude_WGS84	-113.030203
Latitude_WGS84	40.333582
Elevation	1517.128052
PhotoSource	Donald L. Clark, Utah Geological Survey
SampleNumber	<Null>
Notes	
Hyperlink	Photos\IMG_0453.JPG
ViewDirection	NE
PhotoDateTime	2006:03:30 16:16:23

The 'Attachments (0)' window is also visible, showing a list of attachments. Below it, a table displays the coordinates and elevation for the selected feature:

Longitude_WGS84	Latitude_WGS84	Elevation
-112.938478	40.105941	1360.456

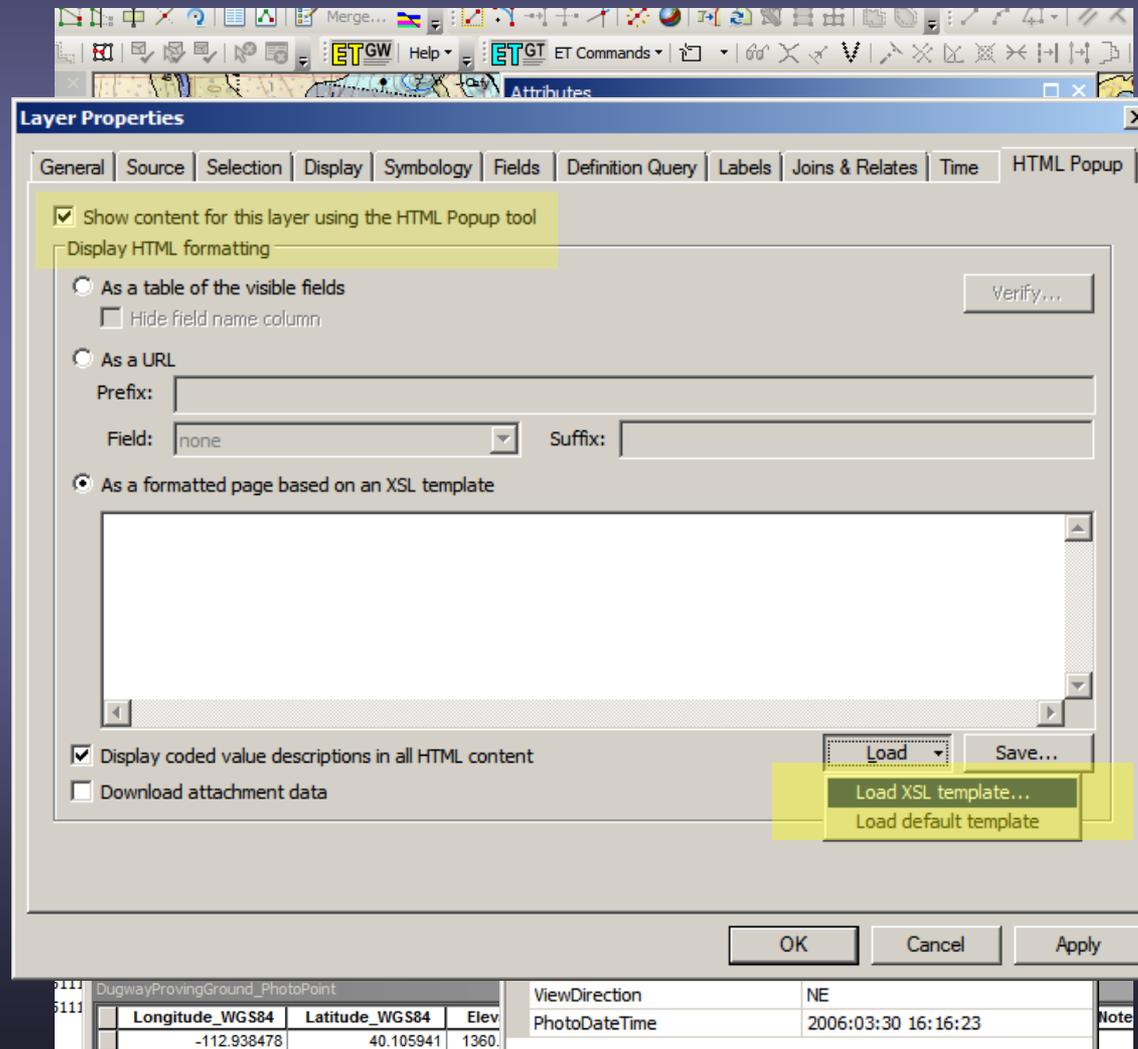
The 'Choose File' dialog box is open, showing a list of files in the 'Photos' folder. The file 'IMG_0453.JPG' is selected. The 'File name' field contains 'IMG_0453.JPG' and the 'Files of type' is set to 'All files (*.*)'.

Images Embedded In Feature Class Attachments (BLOB)

The screenshot displays the ET-GW software interface. The main window shows a geological map with various features and labels. A specific feature, 'DugwayProvingGround_PhotoPoint', is selected. The 'Attributes' window on the right shows the feature's details, including its name and the attached image 'IMG_0453'. Below the attributes, the 'Attachments (1)' section shows the image file 'IMG_0453.JPG (329 KB)'. A table at the bottom of the interface provides additional metadata for the feature.

Feature	Photo point, field photo, geotagged
Type	Photo point
Subtype	field photo
Modifier	geotagged by map location
Photo_ID	6
Filename	IMG_0453
Rotation	44
Caption	Southwest margin of Cedar Mountain
Longitude_WGS84	-113.030203
Latitude_WGS84	40.333582
Elevation	1517.128052
PhotoSource	Donald L. Clark, Utah Geological Sur
SampleNumber	<Null>
Notes	
Hyperlink	Photos\IMG_0453.JPG
ViewDirection	NE
PhotoDateTime	2006:03:30 16:16:23

Images Embedded In Feature Class Attachments (BLOB)



Images Embedded In Feature Class Attachments (BLOB)

The screenshot shows the 'Layer Properties' dialog box in ArcGIS, specifically the 'HTML Popup' tab. The 'Show content for this layer using the HTML Popup tool' checkbox is checked. Under 'Display HTML formatting', the 'As a formatted page based on an XSL template' option is selected. The XSL template code is visible in a text area, and the 'Display coded value descriptions in all HTML content' checkbox is also checked. The 'OK' button is highlighted with a mouse cursor.

Layer Properties

General | Source | Selection | Display | Symbology | Fields | Definition Query | Labels | Joins & Relates | Time | HTML Popup

Show content for this layer using the HTML Popup tool

Display HTML formatting

As a table of the visible fields Verify...

Hide field name column

As a URL

Prefix:

Field: Suffix:

As a formatted page based on an XSL template

```
<?xml version="1.0" encoding="UTF-8"?>
<xsl:stylesheet version="1.0" xmlns:xsl="http://www.w3.org/1999/XSL/Transform" xmlns:fo="http://www.w3.o
<xsl:variable name="ignoreFieldNames" select="|OBJECTID|Shape|Shape_Length|Shape_Area|ATTACHMENTI
<xsl:variable name="headerRowColor" select="#9CBCE2"/>
<xsl:variable name="alternateRowColor" select="#D4E4F3"/>
<xsl:template match="/">
  <html>
    <head>
```

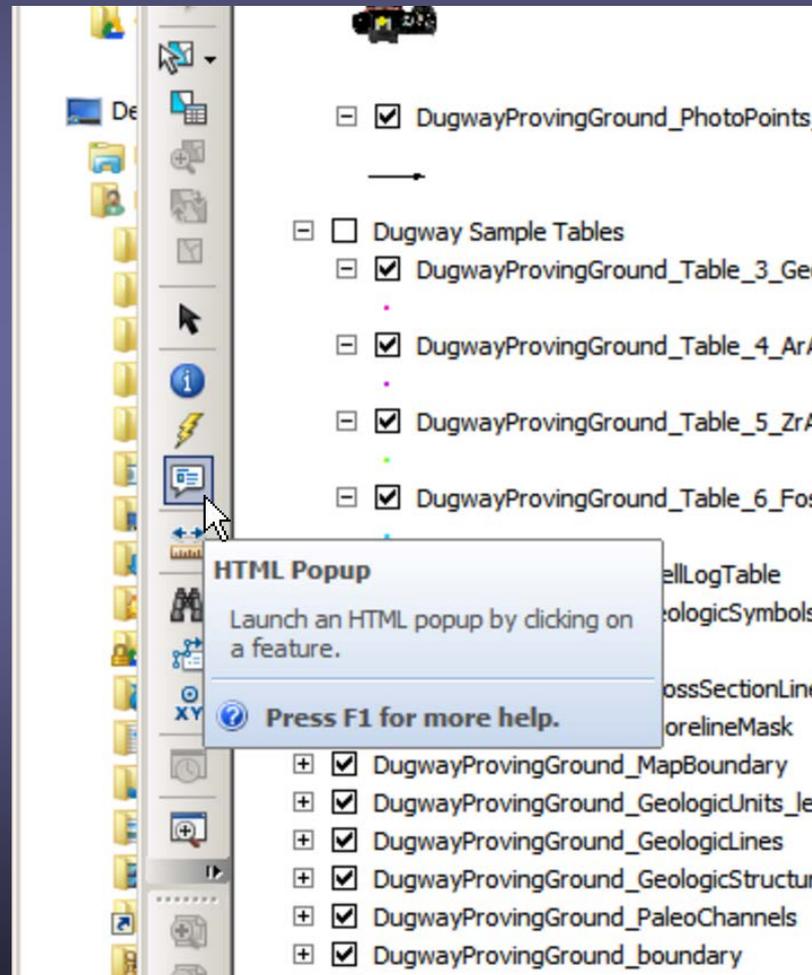
Display coded value descriptions in all HTML content Load Save...

Download attachment data

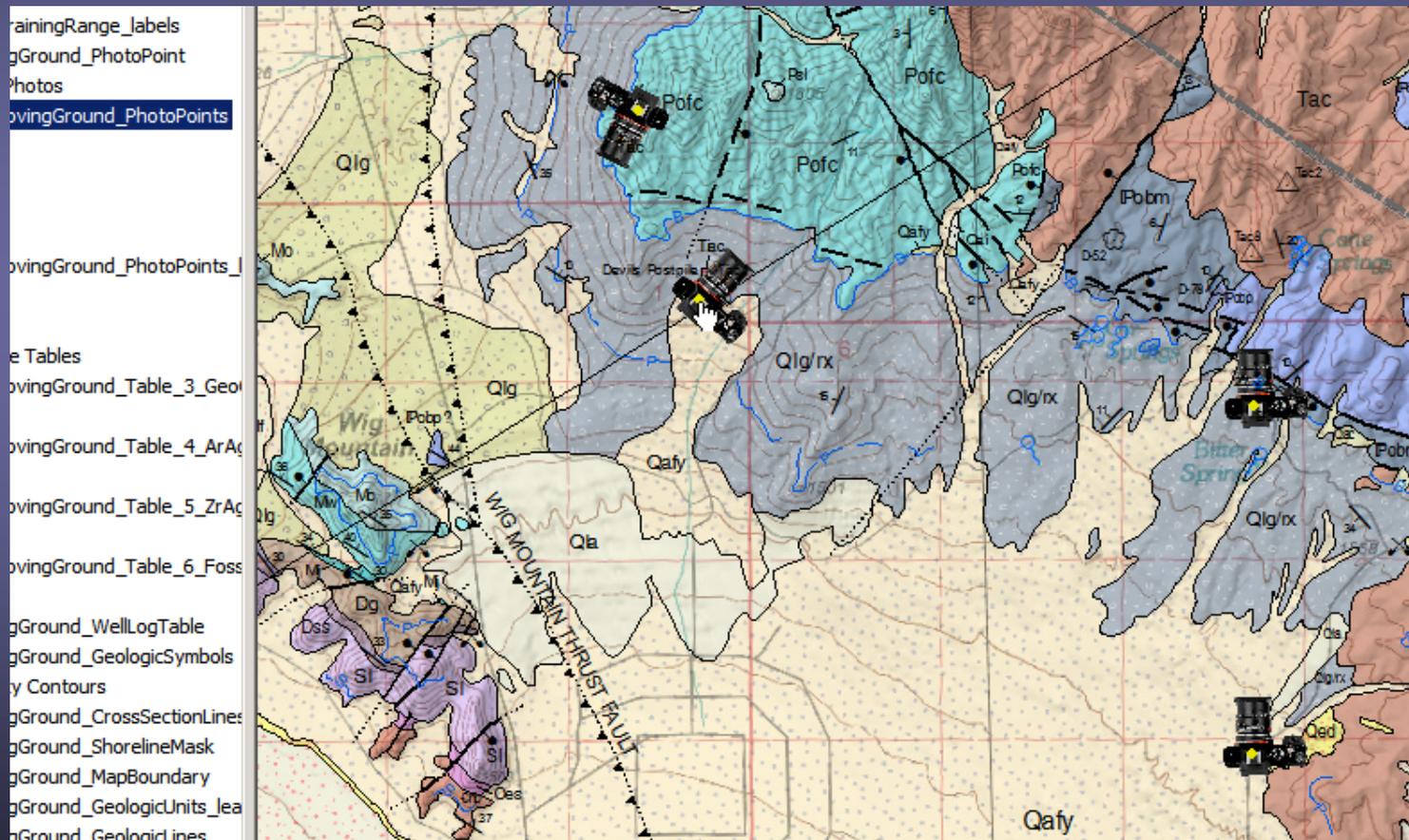
OK Cancel Apply

DugwayProvingGround_PhotoPoint			ViewDirection		NE
Longitude_WGS84	Latitude_WGS84	Elev	PhotoDate		Time
-112.938478	40.105941	1360.	2006:03:30		16:16:23

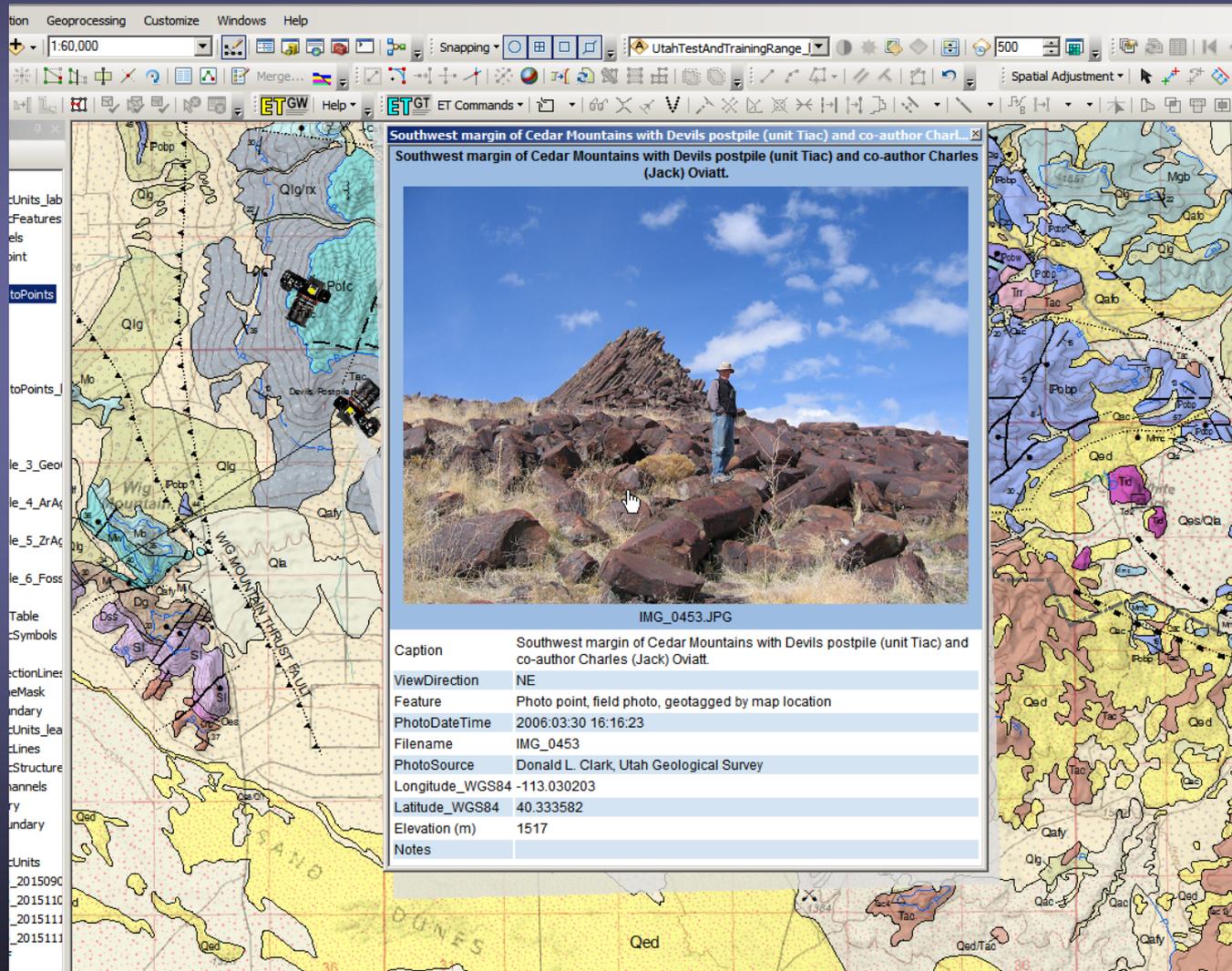
Images Embedded In Feature Class Attachments (BLOB)



Images Embedded In Feature Class Attachments (BLOB)



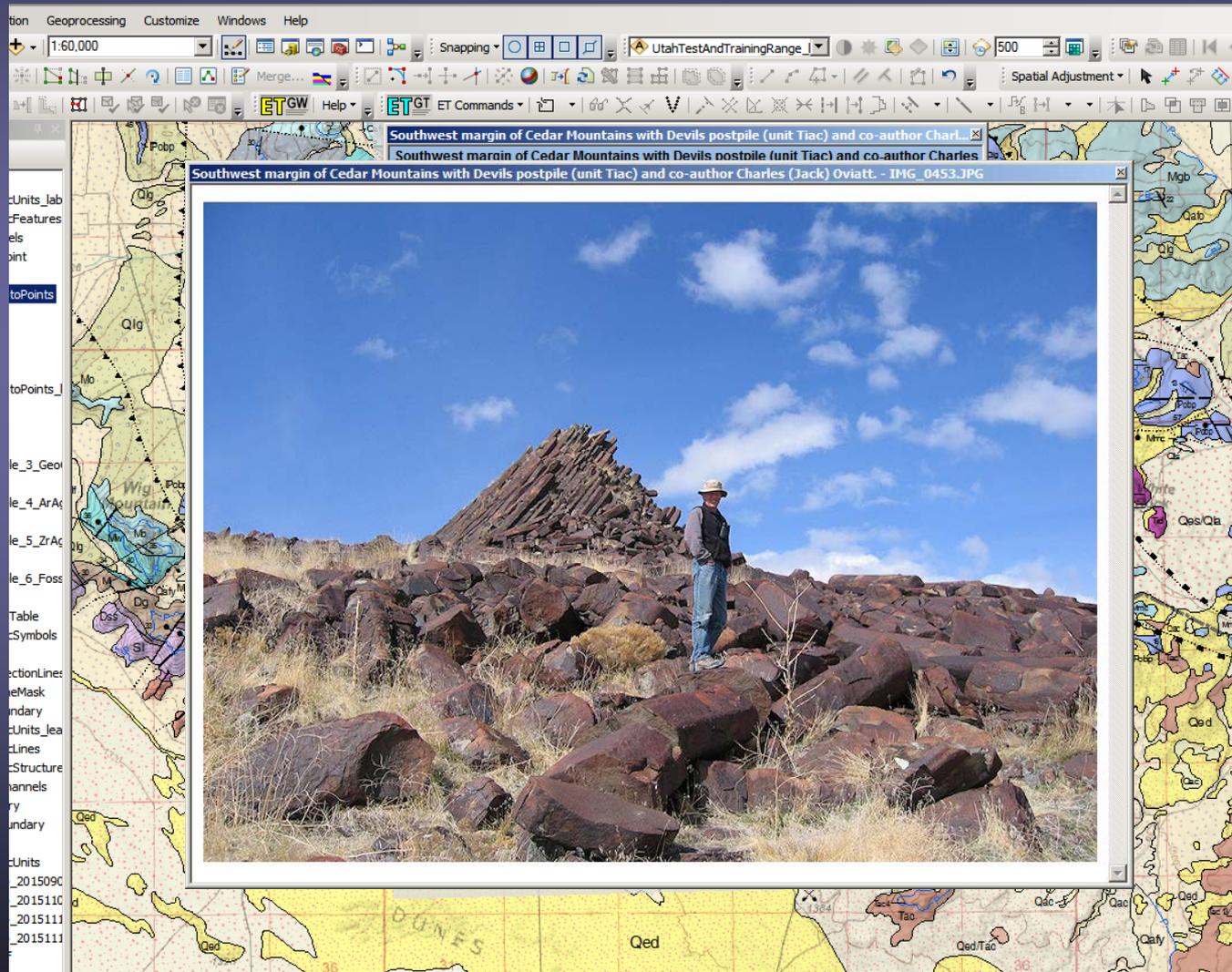
Images Embedded In Feature Class Attachments (BLOB)



The screenshot displays a GIS application window with a map of the Cedar Mountains region. A photo point is marked on the map, and a pop-up window shows the corresponding field photo. The photo shows a person standing on a rocky ridge, with the southwest margin of Cedar Mountains and Devils postpile in the background. The photo is titled 'IMG_0453.JPG' and includes a detailed metadata table.

Property	Value
Filename	IMG_0453
PhotoSource	Donald L. Clark, Utah Geological Survey
Longitude_WGS84	-113.030203
Latitude_WGS84	40.333582
Elevation (m)	1517
Notes	

Images Embedded In Feature Class Attachments (BLOB)



Images Embedded In Feature Class Attachments (BLOB)

Images Embedded as Feature Class Attachments (BLOB)

Pros

- Accessing the images using the ArcMap HTML Popup Tool is intuitive, and gives the best user experience
- Images are embedded in geodatabase
- Images open in custom ArcMap viewing window (XSL template) that includes select feature attributes and photo captions

Cons

- The HTML tool only works in the ArcMap Data View



Pros and Cons

Geotagged Field Photos in ESRI File Geodatabases

Three Methods

Image Hyperlinks

Pros

- Accessing the images using the ArcMap Hyperlink Tool is intuitive
- Image opens in default external image viewer that includes zoom and pan tools

Cons

- Hyperlinks only work in ArcMap Data View
- Images open in default external image viewer instead of an ArcMap window, and don't display photo caption or other attributes; not the best user experience
- Images are not embedded. A folder of image files must accompany the geodatabase

Images Embedded in Raster Field

Pros

- Access images using the ArcMap identify tool, or from raster field in attributes table, or from selected feature attributes window in edit mode; this method is the most flexible option
- Images are embedded in geodatabase
- Images open in ArcMap viewing window—not in external viewer—and includes zoom and pan tools

Cons

- Accessing images with the ArcMap identify tool is intuitive, but not the best user experience
- Accessing images from attribute table or from selected feature attributes window in edit mode is less intuitive and still not the best user experience.

Images Embedded as Feature Class Attachments (BLOB)

Pros

- Accessing the images using the ArcMap HTML Popup Tool is intuitive, and gives the best user experience
- Images are embedded in geodatabase
- Images open in custom ArcMap viewing window (XSL template) that includes select feature attributes and photo captions

Cons

- The HTML tool only works in the ArcMap Data View



Digital Mapping Techniques

2016

Association of American State Geologists

United States Geological Survey



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