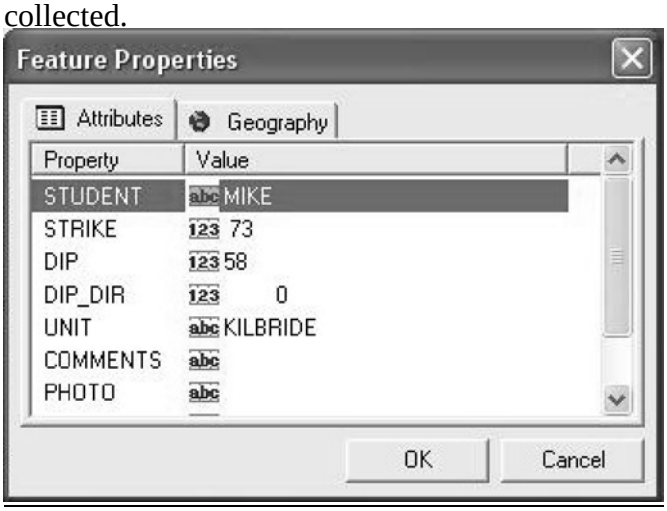
GSA Supplemental Data item 2010102
Appendices A through C

APPENDIX A

1. Generic attribute table in ArcPAD for collection of point data

Below is an image of a typical ArcGIS attribute table to collect point data (lithology, orientation) in the field. The data fields consist of STUDENT name (15 characters), STRIKE (3 numbers), DIP (2 numbers), DIP_DIRection (recently we have removed this field, since ArcGIS requires orientation information to be entered using right hand rule), UNIT name (20 characters), COMMENTS (50 characters, not necessarily filled in), PHOTO (20 characters, not necessarily filled in). Note that ArcPAD automatically adds fields for latitude and longitude coordinates for the spatial position where the data was collected.



2. Converting ArcGIS attribute tables to KML code

Below is MATLAB code that converts orientation data from ArcGIS attribute tables to KML code. This automated the process of generating several hundred 3-D strike and dip symbols as individual objects in Google Earth. Though this code is particular to the format of our ArcGIS attribute tables, an experienced programmer might find it useful as a template for transferring a large quantity of data from ArcGIS to KML.

MATLAB code:

```
%GE filescanner; creates KML from a formatted text document of data
%code written by J. Nicoletti, 2008-9
fid = fopen('TLfin.txt');
A = fscanf(fid,'%c');
dimensions = size(A);
entrysize = dimensions/3
datasets = 3;
x=0;
fclose(fid);
fid = fopen('TLexportFINN.doc','a');
for x = 0 : datasets-1;
```

```
%for x = 0 : 1;
strstart = x*77 +30;
strstop = strstart + 2;
dipstart = strstop + 2;
dipstop = dipstart+1;
lonstart = x*77 +1;
lonstop = lonstart + 13;
latstart = lonstop + 2;
latstop = latstart + 13;
stringstart = x*77 + 36;
stringstop = stringstart + 37;
strike = A(1,strstart:strstop)
dip = A(1,dipstart:dipstop)
lat = A(1,latstart:latstop)
lon = A(1,lonstart:lonstop)
descr = A(1,stringstart:stringstop);
fprintf(fid,'\t<Placemark> \n\t\t<name>Tonalee %g',x);
fprintf(fid,'</name> \n\t\t<Style id="default"> </Style> \n\t\t<description>
%s',descr)
fprintf(fid,'</description>\n\t\t<Model id="model_1"> \n\t\t<altitudeMode>
        relativeToGround </altitudeMode> \n\t\t<Location>
\n\t\t\t<longitude>%s',lon);
fprintf(fid,' </longitude> \n\t\t\t<latitude>%s',lat);
fprintf(fid,' </latitude> \n\t\t\t<altitude>12</altitude> \n\t\t</Location>
        \n\t\t\t<Orientation> \n\t\t\t<heading>%s',strike);
fprintf(fid,' </heading> \n\t\t\t<tilt>0</tilt> \n\t\t\t<roll>-%s',dip);
fprintf(fid,' </roll> \n\t\t\t</Orientation> \n\t\t<Scale> \n\t\t\t<x>5</x>
\n\t\t\t<y>5</y>
        \n\t\t\t<z>5</z> \n\t\t</Scale> \n\t\t<Link>
\n\t\t<href>SUPreview2.dae</href>
        \n\t\t</Link> \n\t\t</Model> \n\t</Placemark> \n');
x = x+1
end
fclose(fid);
```

Typical format of our ArcGIS attribute tables, with the fields: longitude, latitude, strike, dip, lithology (only showing three points of data) that the MATLAB code above translates to a Google Earth KML file:

-9.45660954000	53.57258496340	90	50	GREY SHALE
-9.45708916495	53.57210912780	90	65	GREY SHALE
-9.46144661742	53.57162311150	59	57	SHALE, transitional finer grained

KML code for the three data points from the above attribute table, generated by the MATLAB code above. Note that each data point has its own sequence of KML code bounded by the <Placemark> and </Placemark> tags:

```
<Placemark>
        <name>Tonalee 1</name>
        <Style id="default"> </Style>
        <description>     GREY SHALE </description>
        <Model id="model_1">
        <altitudeMode> relativeToGround </altitudeMode>
        <Location>
            <longitude>-9.45660954000 </longitude>
            <latitude>53.57258496340 </latitude>
            <altitude>12</altitude>
        </Location>
            <Orientation>
            <heading>   90 </heading>
            <tilt>0</tilt>
            <roll>-50 </roll>
            </Orientation>
        <Scale>
            <x>5</x>
            <y>5</y>
            <z>5</z>
        </Scale>
        <Link>
        <href>SUPreview2.dae</href>
        </Link>
        </Model>
    </Placemark>
<Placemark>
        <name>Tonalee 2</name>
        <Style id="default"> </Style>
        <description>     GREY SHALE </description>
        <Model id="model_1">
        <altitudeMode> relativeToGround </altitudeMode>
        <Location>
            <longitude>-9.45708916495 </longitude>
            <latitude>53.57210912780 </latitude>
            <altitude>12</altitude>
        </Location>
            <Orientation>
            <heading>   90 </heading>
            <tilt>0</tilt>
            <roll>-65 </roll>
            </Orientation>
```

```
            <Scale>
                <x>5</x>
                <y>5</y>
                <z>5</z>
            </Scale>
            <Link>
            <href>SUPreview2.dae</href>
            </Link>
            </Model>
        </Placemark>
    <Placemark>
            <name>Tonalee 3</name>
            <Style id="default"> </Style>
            <description>     SHALE, transitional finer grained </description>
            <Model id="model_1">
            <altitudeMode> relativeToGround </altitudeMode>
            <Location>
                <longitude>-9.46144661742 </longitude>
                <latitude>53.57162311150 </latitude>
                <altitude>12</altitude>
            </Location>
                <Orientation>
                <heading>   59 </heading>
                <tilt>0</tilt>
                <roll>-57 </roll>
                </Orientation>
            <Scale>
                <x>5</x>
                <y>5</y>
                <z>5</z>
            </Scale>
            <Link>
            <href>SUPreview2.dae</href>
            </Link>
            </Model>
        </Placemark>
```

3. Creating GE Screen Overlays for map legends

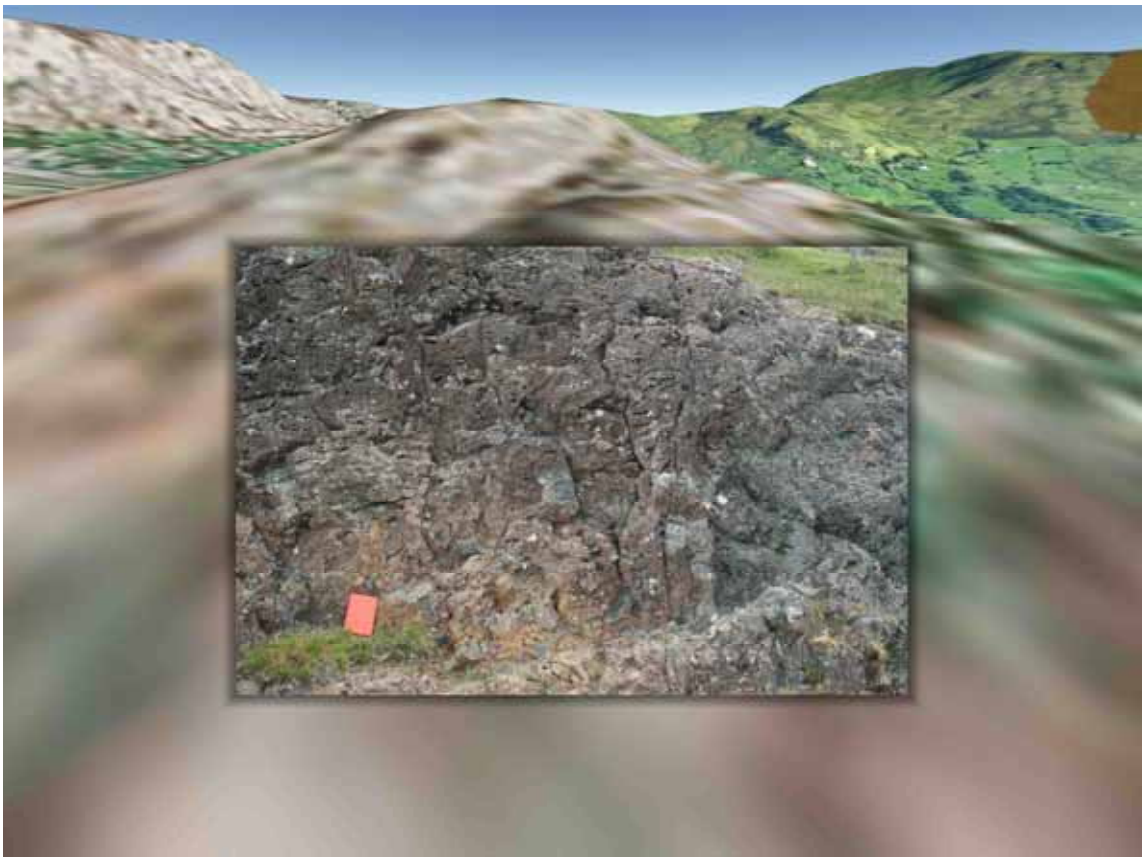
The method for making a geologic map legend as a Screen Overlay in Google Earth is fairly straightforward: after creating an image of the legend using any graphics program like Adobe Illustrator, it is positioned in the Google Earth window using code like the sample below:

```
<ScreenOverlay>
        <name>Map Legend</name>
        <Icon>
                <href>files/key.png</href>
        </Icon>
        <overlayXY x="0" y="1" xunits="fraction" yunits="fraction"/>
        <screenXY x="0" y="1" xunits="fraction" yunits="fraction"/>
        <size x="0" y="0" xunits="fraction" yunits="fraction"/>
</ScreenOverlay>
```

In this sample code, the map legend image is “key.png”, located in the folder “files”, and the three lines of code below the </Icon> tag tell Google Earth to position the legend in the upper left corner of the window. For more information on using Screen Overlays and window positioning, see the Google Earth online KML tutorial (http://code.google.com/apis/kml/documentation/kml_tut.html) or Wernecke (2009).

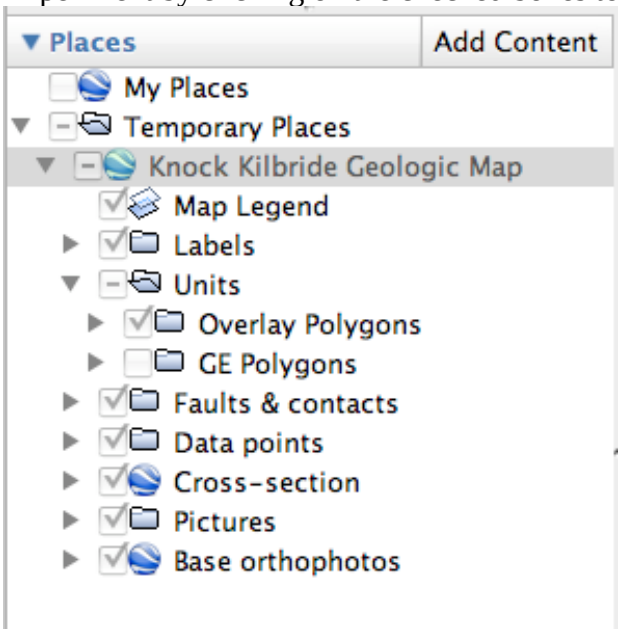
APPENDIX B, ftp://rock.geosociety.org/pub/reposit/2010/2010102DRB.pdf

The electronic file AppendixB.zip, when unzipped, generates the folder PhotoOverlaySample. This folder is platform independent and will work on Macintosh, Windows, and Linux systems. Within the folder is a doc.kml file and associated images in the tiles folder. Together these files constitute the “FinnyPillows” photo overlay. Load the photo overlay in Google Earth by opening the doc.kml file. Double-clicking on the icon or the “FinnyPillows” name will zoom in to the oriented outcrop photo (see Google Earth screen capture image below.)



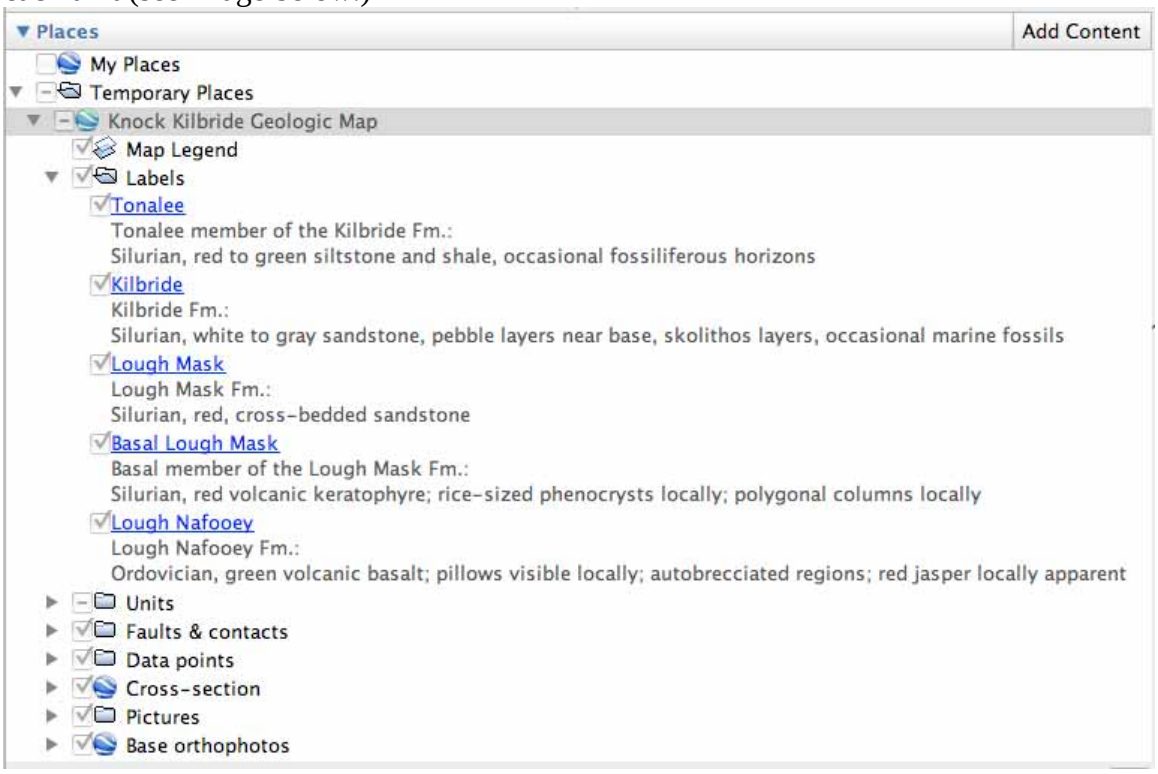
APPENDIX C, ftp://rock.geosociety.org/pub/reposit/2010/2010102DRC.kmz

The electronic file AppendixC.kmz consists of the Google-Earth-based digital geologic map of the mountain of Knock Kilbride, near the Connemara region of western Ireland. The KMZ file is platform independent and will work on Macintosh, Windows, and Linux systems. When opened in Google Earth, the Knock Kilbride Geologic Map will be listed under the "Temporary Places" menu in the "Places" window at the left of the main Google Earth window. Sub-headers and folders within the Knock Kilbride Geologic Map include Map Legend, Labels, Units, Faults & contacts, Data points, Cross-Section, Pictures, and Base orthophotos (see screen capture image below.) Each of these folders can be expanded to show the various KML files and associated images that make up the interactive Google Earth geologic map of the field area. As an example, the Units folder has been expanded to show two sub-folders: Overlay Polygons (which is checked and therefore visible) and GE Polygons (which is not checked and therefore invisible.) Experiment by clicking on the checked boxes to turn individual layers on or off.



The unchecked GE Polygons folder, when made visible, displays the lithologic units as colored areas drawn using the GE polygon tool  (instead of using image overlays of PNG files.) This is a nice way to display colored areas, but at present, you can't use the Draw Order function to make polygons appear directly above ground overlays. Thus, in order to see these GE polygons on our maps, you need to turn off Overlay Polygons and Base orthophotos.

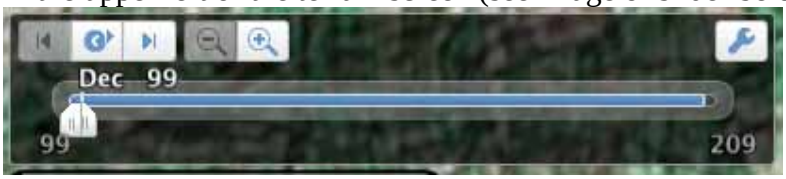
Detailed information about the lithologic units can be displayed by clicking on the triangle icon left of the Labels folder. This will list the units along with details underneath each unit (see image below.)



Clicking on individual data point on the Google Earth map will also pull up a local window that lists specific field data collected at that point.

Field photos can be viewed by clicking on one of the pink camera icons  on the Google Earth Map.

The cross-section can be extracted out of the ground by pulling the right tab of the slider in the upper left of the terrain screen (see image of slider below.)



Make sure you tilt your view to see the vertical cross-section image; this can be accomplished by double-clicking on the “Cross-section” title in the Places box. The numbers or dates listed above the slider are irrelevant, as we are not using the “time slider” as a time-dependent feature.

Note that individual KML scripts can be viewed by saving a Place or folder as a KML file and then opening the .kml file in a standard text editor like TextEdit or WordPad, or a code editor like BBEdit.

APPENDIX D, ftp://rock.geosociety.org/pub/reposit/2010/2010102DRD.kmz

The electronic file AppendixD.kmz consists of the Google-Earth-based digital geologic map of the mountain of Ben Levy, at the boundary of the Connemara region of western Ireland. The KMZ file is platform independent and will work on Macintosh, Windows, and Linux systems. Similar to the description of Appendix C, when the KMZ file is opened in Google Earth, the Ben Levy Geologic Map will be listed under the "Temporary Places" menu in the "Places" window at the left of the main Google Earth window. Sub-headers and folders within the Ben Levy Geologic Map include Map Legend, Labels, Units, Faults & contacts, Data points, Cross-Section, Pictures, and Base orthophotos. Each of these folders can be expanded to show the various KML files and associated images that make up the interactive Google Earth geologic map of the field area on the mountain of Ben Levy in western Ireland. The cross-section can be extracted out of the ground by pulling the right tab of the slider in the upper left of the terrain screen.