

1 **The Eyes of iPads:**
2 **Videography in Geologic Field Technology**

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8 **1. Abstract**

9 Geologic field observations, field behavior, and field observation preferences
10 were analyzed in a qualitative preliminary study at Halswell Quarry (Fig. 1). This
11 ethics approved study was created, implemented, and analyzed to test how geology
12 students take field observations with the use of video. The test was conducted with
13 three geology student volunteers and the results were analyzed from post-test
14 interviews, students' individual videos, and videos taken of the students. The
15 following questions were addressed with this study: 1) How do geology students
16 take notes with video? 2) Can the use of video replace traditional pencil and paper
17 notes? 3) What is the best way to take geologic field observations? The three
18 student volunteers were each given an iPad to make their field observations. After
19 reviewing the data, the initial figures that were to be created were found to be too
20 subjective, but important conclusions of video observation processes were
21 discovered. For this study, the end goal would be to send the report to Lafayette
22 College where the GeoFieldBook application was developed for the iPad. This study
23 shows the advantages and disadvantages of solely using video for field observations.



24 **Fig. 1.** Halswell Quarry

25 **2. Introduction**

26 With much of the world of education embracing new technology for learning
27 purposes, the use of video is becoming more widely used. Especially for students
28 that have little to no field geology experience, the pen and paper method poses great
29 difficulties in terms of collecting useful data, and many times results in a loss of
30 information prior to digital transfer (Guertin 2006). Additionally, many students
31 claim that traditional methods of fieldwork note taking is a waste of time due to the
32 amount of error that can occur. Technology, specifically the use of video, will ideally
33 reduce the multitude of materials that are normally required for the field (Guertin
34 2006).

35 Technology has been improving rapidly over the past few years and is
36 becoming readily available to a wider audience because of its affordability. The
37 amount of quality video has become more accessible and is greatly aiding science
38 research and education (Derry 2010). Technology is getting cheaper, it is
39 increasingly being used for educational purposes, and it has the potential to greatly
40 enhance students' learning capabilities. Additionally, "video offers a means of close
41 documentation and observation and presents unprecedented analytical,
42 collaborative, and archival possibilities, as well as new problems" (Derry 2010).
43 Technology for learning purposes has not yet been perfected, but it has the potential
44 to enhance the detail and quality of notes taken in the field. With current
45 technology, notes can be more easily obtained, shared to wider audiences, and
46 permanently stored without the worry of losing data (Derry 2010).

47 For students that are learning how to make field observations for the first
48 time, efficient and effective practices are necessary for proper learning. It is
49 important that young field geologists learn how much time is necessary to spend at
50 an outcrop in order to gather the information needed without wasting too much
51 time (Balliet 2012). In order to achieve this advanced efficiency, videography may
52 prove to be a useful tool. The use of technology can efficiently collect, analyze, and
53 improve the overall quality of geoscience fieldwork, and video may enable students
54 to properly develop their field observation skills (Balliet 2012, McCaffrey 2005).
55 Furthermore, appropriate use of technology in the field may yield a great deal of

56 practical implications such as enabling users to more naturally form their stream of
57 consciousness and may save recording time (Yi-Hua Weng 2012). The use of video
58 enables users to utilize a larger scale picture than just a single photo, and more
59 accurately depicts the context with a full 360-degree view. Additionally, video can
60 capture live processes that cameras and hand sketches cannot (Yi-Hua Weng 2012).
61 Video can improve the pace of observations in the field and automatically saves the
62 audio recordings while working. This allows users to easily analyze the content
63 after listening/watching the recordings. This could potentially streamline the
64 manual process of transferring field notes digitally and will ensure that all of the
65 data is saved. If this can translate to a higher understanding of information in the
66 field in a more efficient manner, then video will have great potential for geologists
67 and field scientists at large.

68

69 **3. Experiment Methods**

70 For the test that was implemented at Halswell Quarry, the process and
71 observation methods that students performed was analyzed in order to obtain
72 qualitative data. The use of video was used because video can more accurately
73 reveal the difficulties and benefits that students have when taking field observations
74 (Maltese 85). The test was very similar to the mobile eye-tracking test that was
75 conducted by Maltese, however, instead of using traditional note taking methods,
76 the students at Halswell Quarry solely used video. The data was collected from 3
77 student volunteers and each student used video via an iPad to take his field
78 observations. The following table outlines the experiment protocol at Halswell
79 Quarry:

What the participants were instructed:	What was recorded and analyzed:
1) Take quality field observations so that someone watching the video will have a good understanding of the field area.	1) A video camera recorded participants taking field observations.
2) Take observations with varying scale sizes.	2) A second cameraman recorded the participants to ensure that all of the students were filmed at different locations to analyze behavior with the iPad.
3) Take as much time as necessary in order to make successful field observations.	3) Participants were asked questions about what they observed during the field study and were guided when off task.
4) Keep the video recording the whole time without pausing.	4) After the study, post-test interviews were conducted to gather information of students' background of past fieldwork and preferences about field observations.
5) Do not interact with one another.	5) Interviews and videos were analyzed and transcribed to examine the processes and observation methods of each participant in order to get qualitative data.

80 Table 1. Experimental protocol

81 **4. Results**

82 The following results were gathered from the post-test interviews:

Pros of using the video	Cons of using the video
<ul style="list-style-type: none">• Constant images while working• Reduces number of items in the field• Video images help replace some description• Talking is easier than writing• More efficient use of time• Provides a virtual revisit of the outcrop• No physical writing or sketching• Documenting the experience helps to remember it later• Discussing field observations is more natural than writing them• Less stressful• Does not block individual thought process• Convenient to record thoughts as they come to mind• Relate what is said to what is seen	<ul style="list-style-type: none">• Glare/difficulty of seeing video• Challenging to annotate a question• Challenging to sift through for analysis• Not all of the information spoken was essential and necessary• No process of physically drawing/writing something• Video does not always focus and expose properly• Language used in the video is more colloquial compared to traditional methods• Not as much time was considered about what was recorded• The notes were not condensed• The iPad is fragile

83 Table 2. Post-test interview results

84

85 **5. Discussion**

86 Originally the raw data was intended to form a timeline of events for each
87 participant, separating the data into when each participant was taking observations,
88 hypotheses, and interpretations. The data from the videos was qualitative and the

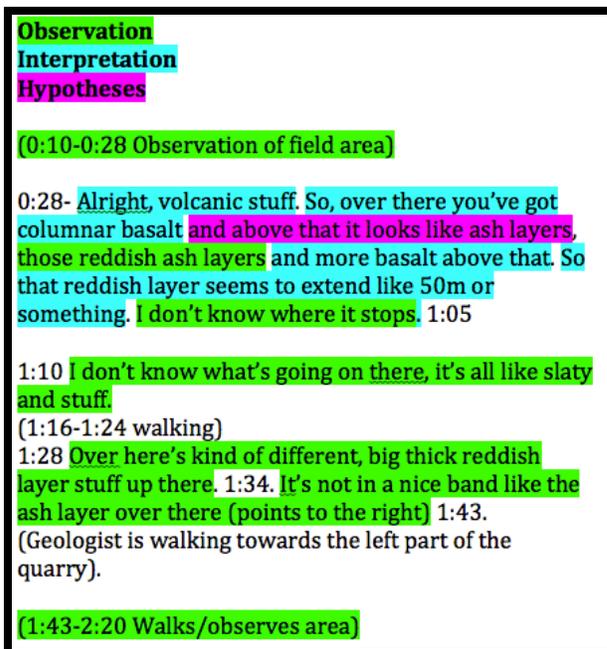
89 timeline of said behavioral proportions would have been too subjective for accurate
90 analysis (transcript example seen in Fig. 2). The transcript example shown was split
91 based off of my interpretation only, and the result would not have been an objective
92 analysis. The use of video enabled the students to elucidate their stream of
93 consciousness and as a result, the students made observations, interpretations, and
94 hypotheses simultaneously for virtually the entire study. The original goal of this
95 process was to show how students take field observations with video and how they
96 spent their time in the field with video. Although this evaluation was too subjective,
97 additional analyses lead to some interesting conclusions.

98 While analyzing the behavior of the students making field observations, it
99 was discovered that the students used the iPad as an extension of their body, using
100 the iPad to observe the field area rather than observing without it (Fig. 3). This
101 behavioral phenomenon likely occurred due to the given instructions and from the
102 following data altering factors: 1) students were unable to pause the video 2) no
103 field tools were provided 3) students influenced one another unintentionally. These
104 factors are unrealistic in an actual field setting, but were originally planned so that it
105 would simplify the data, however, it may have detracted from some interesting
106 results. Therefore the previous results were taken solely from preferences from the
107 post-test interviews.

108 The actual test that was conducted posed some difficulties because this was
109 overall an exploratory qualitative case study, in which there were some inherent
110 problems. Since the participants were restricted from pausing the video,
111 unforeseen outcomes may have occurred. It may have pressured the students to
112 talk for the entire study and not sort their observations, as they would have
113 otherwise. Furthermore, with no field tools provided, the students were unable to
114 make accurate strike and dip calculations and were unable to obtain as precise data
115 of small-scale observations since they were not provided with a hand lens or rock
116 hammer. Additionally, having all of the students make observations at the same
117 time and at the same place may have influenced how much they talked based on
118 what other students were doing. This may have affected the students' independent
119 nature and may have altered the data (Maltese 86). Moreover, it was intended to

120 analyze the behavioral aspects of the students while they were not using the iPad,
121 but the videos proved that the students utilized the iPad for virtually the entire
122 study. This also may have occurred due to the given instructions.

123 In Maltese's mobile eye-tracking study, a more accurate depiction of time
124 spent in the field was illustrated. The data was separated in a more objective
125 manner because there were distinct behavioral features that were analyzed.
126 Although the study at Halswell Quarry did not portray the time spent in the field
127 with the video, the field observation preferences lead to some useful findings. Even
128 though the process of using video in the field is fairly simple, it does not necessarily
129 mean that video is the best option for field observations. Whereas students may
130 separate their physical field notebooks into specific structure, texture, and
131 composition sections, the students used the video to interpret, hypothesize, and
132 make observations simultaneously, without categorizing each. Many of the pros of
133 using the video were also cons. There are pros and cons to using just one individual
134 field observation method, but if multiple methods could be integrated together, it
135 may prove to create a better field observation option.



Observation
Interpretation
Hypotheses

(0:10-0:28 Observation of field area)

0:28- Alright, volcanic stuff. So, over there you've got columnar basalt and above that it looks like ash layers, those reddish ash layers and more basalt above that. So that reddish layer seems to extend like 50m or something. I don't know where it stops. 1:05

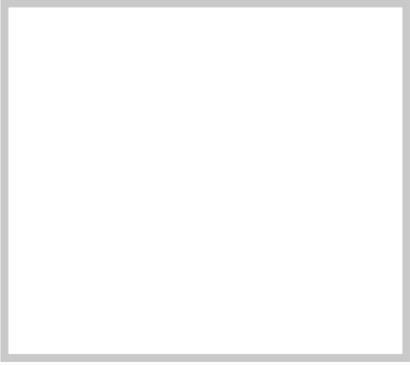
1:10 I don't know what's going on there, it's all like slaty and stuff.

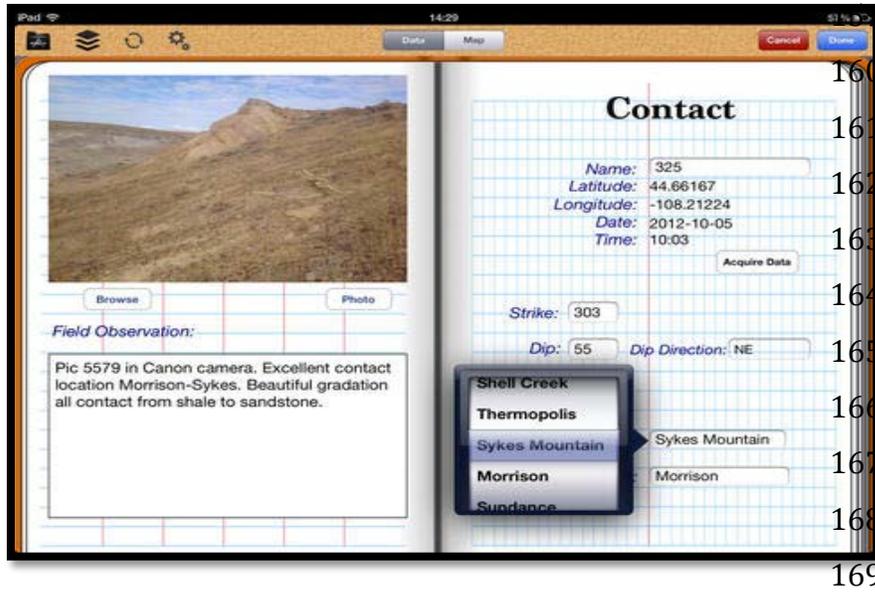
(1:16-1:24 walking)

1:28 Over here's kind of different, big thick reddish layer stuff up there. 1:34. It's not in a nice band like the ash layer over there (points to the right) 1:43. (Geologist is walking towards the left part of the quarry).

(1:43-2:20 Walks/observes area)

136 **Fig. 2.** Video transcript example





170 **Fig. 4.** GeoFieldBook iPad application developed by Lafayette College

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172 **7. Future Research**

- 173 • Integrate video with current GeoFieldBook iPad application
- 174 • Use an even ratio of male to female volunteers
- 175 • Quantify data in timeline form similar to Maltese's eye tracking study
- 176 • Video transcription directly into a document (ex. Dragon Dictation software
- 177 integrated with video)
- 178 • Physically drawing in a field notebook vs. using a stylus on an iPad.
- 179 • Geoeducation and videography for virtual field experience
- 180 • GeoPark iPad Application
- 181 • Comparative study between iPad GeoFieldBook application vs. field
- 182 notebook vs. video
- 183 • Test what field observation method yields the highest quality and most
- 184 efficient observations at each scale size.
- 185 • Analyze what time it is best to incorporate video to accompany field notes
- 186 • Test how students analyze video as opposed to traditional pencil and paper
- 187 methods

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