Today's Objectives – Giant Stairs Field Trip, Bailey Island, Harpswell

As we explore the spectacular exposures along the coast, we have **three primary objectives** for the afternoon. We will break into small groups that rotate among different stations so that everyone has a chance to actively participate in the activities and discussions that will allow us to meet the objectives.

Objective A – Learn about and experiment with StraboSpot2

Hannah Blatchford and Basil Tikoff will guide interested participants in how to use StraboSpot2. iPads will be available for you to use. You may also download a previous version of the app (StraboSpot) on any iPhone or Android device.

StraboSpot2 is an app that enables the acquisition and digital storage of structural data (it also makes stratigraphic sections). You and students may choose to use it as a field notebook, to plot structural data on the fly, and to keep all your observations tied together in a spatial framework that scales with your observations, from the hand lens to the outcrop to the regional scale. We will also introduce StraboMicro, which links field data and laboratory data (e.g., photomicrographs, compositional maps of minerals, EBSD results, experimental rock deformation data). The app and database provide the following (https://www.StraboSpot.org/overview):

- A method of simultaneously acquiring and storing field data.
- An accessible way to archive structural data digitally so that structural data can be discovered or easily reused.
- Ability to evaluate data quality and digitally store metadata (that otherwise may get lost in file cabinets).
- Ability for the community to improve data collection and quality, and to develop tools (e.g., StraboTools, Stereonet, upcoming statistical packages) for a shared database, to facilitate an improvement in the quality of science.
- Ability to link field data to microstructures and collaborate on microstructural projects.

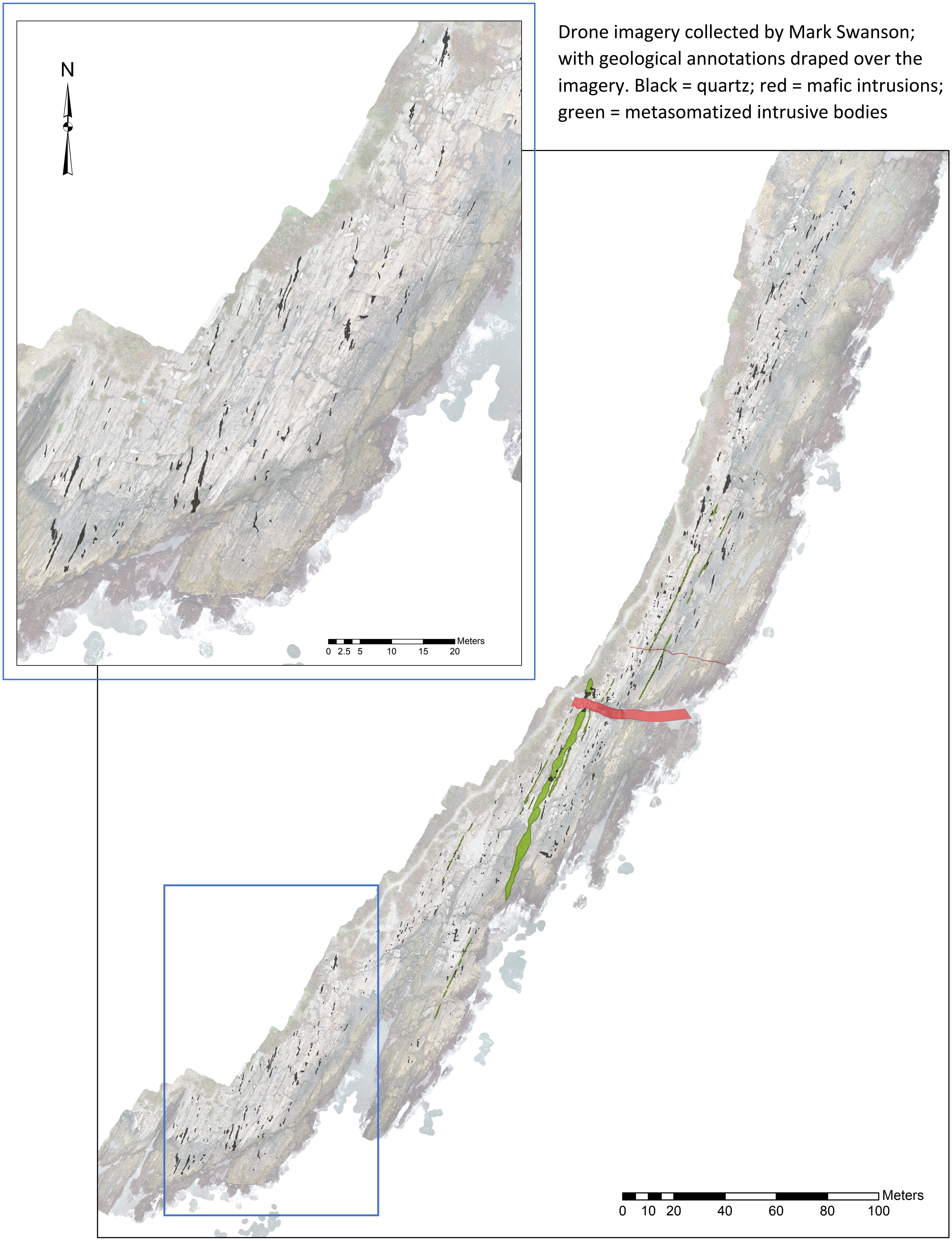
Objective B – Explore the structures & reconstruct the tectonic history

The Giant Stairs exposures provide excellent evidence of nearly 500 million years of tectonic history. As you explore the outcrops, **measure and observe** foliations, lineations, brittle structures, orientations of cross-cutting relationships, quartz veins, mineral assemblages (and how they vary across and along strike), asymmetric boudins and tails on porphyroblasts. While collecting your data, look at the annotated drone photos graciously provided by Mark Swanson detailing key portions of the structural history recorded by these rocks.

Measure, sketch, discuss!

Interpret data to reconstruct the geologic history. How many phases of deformation do you observe? Is there evidence for pure shear vs. simple shear? What is the timing of deformation relative to metamorphic mineral growth? What sense of shear do you interpret for the quartz veins? Are your data consistent with the background geology provided in the overview? What modifications or nuance do your data suggest?

Drone imagery collected by Mark Swanson; with geological annotations draped over the imagery. Black = quartz; red = mafic intrusions; green = metasomatized intrusive bodies



Reflect on your experience with collecting and interpreting data (objective B), and consider how you might design field activities that promote students' developing and practicing fundamental skills or learning essential concepts. Share some strategies, learning goals, and activities that you have found successful.

We often revisit the same outcrops for different learning goals. How might you design activities differently for introductory vs. upper-level courses? For structural geology vs. tectonics courses?

Objective C – Discuss & develop strategies for more inclusive teaching

By addressing the themes in the prompts below, we have the opportunity to make our learning spaces more inclusive and equitable for all students. After you've collected and interpreted data (Objective B) and tried out StraboSpot (Objective A), discuss these themes in a small group—and jot down some notes to share tomorrow with the whole group.

Accessibility: Field trips are often the moments where theoretical concepts "click" and students suddenly "get it." However, physical limitations may prevent some people from accessing the outcrops.

- How does accessibility factor into the activities you choose and/or the sites you visit as you design field activities?
- What strategies have you used to make field sites more accessible for all participants?

Inclusion: There are many aspects of inclusion that we could talk about today. Here we highlight two aspects that we hope will generate a helpful discussion.

Students in our courses are differently prepared—some are in their second year and have taken just the prerequisites to get into the course, whereas other students may be seniors wrapping up their final semester of work.

- How do you design learning activities that actively engage, include, and challenge students from all backgrounds?

Some students may also have all the rain gear, foul weather gear, and "tools of the trade" on hand – and they know what the "tools of the trade" are. Differences in who has this knowledge and access to the "tools" and gear can lead to a lack of a sense of belonging.

- What steps can you take to ensure that your students have what they need to succeed in your course?

Relevance: Those of us gathered here today are members of a group who find structural datasets and tectonic histories interesting. We recognize the intrinsic importance of our field in addressing some of the grand challenges facing society. Our students, however, don't often have the ability to draw connections between their ability to measure and define structural data with some of these grand challenges.

One of our teaching challenges is to help students identify the societal relevance and applications of their learning. For example, how can we make structural studies of these nearly half billion-year-old rocks relevant to today's most pressing societal challenges (e.g., freshwater supplies, impacts of climate change on coastal communities, clean and abundant energy supply? As you think about some of these grand challenges ahead:

- Identify how the scientific skills of structural geology and tectonics relate to these grand challenges. For example, how will measuring the orientations of fracture sets prepare students for tackling one of these grand challenges?
- Knowing that most of our undergraduate students will go on to careers outside of academia (Gonzalez and Keane, 2022), how do we (re)design field activities that connect with students considering non-academic career paths?
- Next, develop a "Big Picture Thinking" question you might use in one of your courses to help students draw these connections.

Space is provided on the next page for you to write down some ideas.

Safety: We know that feeling safe helps students focus on their learning and can promote retention in STEM fields (Marín-Spiotta et al., 2020). Many of us focus on creating a learning environment that fosters inclusion and a sense of belonging, but what happens when we travel into the field? Although outdoor learning spaces may feel comfortable for some, it can be the first time that some students have been asked to learn outside of the classroom, and many students may experience apprehension or feel physically unsafe. There are steps we can take to ensure that our students feel safe and are thus able to better focus on their learning (Anadu et al., 2020; Cooperdock et al., 2021).

- What steps do you take to ensure safety for your students? For example, if your field activities take you near the coast, you probably check the tides and the weather forecast. You probably also pack a small first aid kit and know where the nearest hospital is in the event someone needs treatment.

- How might you share with your students that you're planning ahead and are thinking about their safety when designing field activities?

- What additional steps can you take to make the learning environment safe?