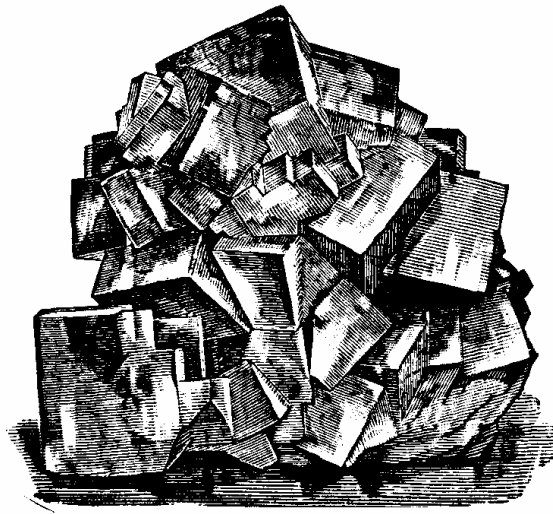


Physical Geology

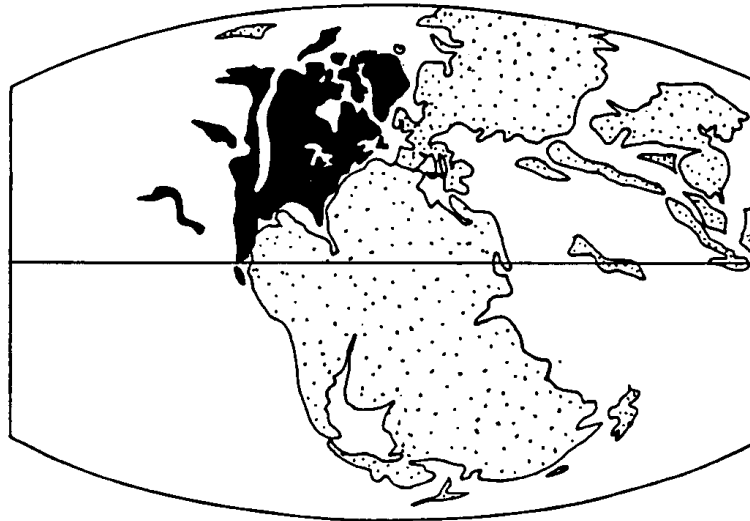
An introductory laboratory manual for
students in GY 111



Dr. Doug Haywick
with contributions from
Murlene Clark and David Allison

Department of Earth Sciences,
University of South Alabama

Third Edition: Revised October 2007©



Preface

This is a newly updated version of the laboratory manual for Physical Geology. It contains material pertaining to minerals, rocks, structural geology and geological map interpretation, all of which are covered in GY 111 and GY 111L.

The original lab manual was written in 1994 to address a concern that geology faculty had for many years: the cost of higher education. Traditional geology laboratory manuals (the ones with glossy photographs and spiral bindings) are expensive. They have to be as they are expected to make a profit for the author(s) and/or the publisher. To make as much money as possible, the lab manuals must also be generalized for use at any institution in the country. Consequently, most of the glossy geology lab manuals contain material that we simply do not teach at the University of South Alabama. Case studies and examples frequently deal with areas that are remote to those of us that live in the "Deep South". While it is important that undergraduate students recognize that geology is everywhere on and in our planet (other planets too!), some concepts are best illustrated by using local examples. For example, Mobile is underlain by sedimentary rocks, so isn't it better to talk about the geological materials on which our houses are built than a similar environment in California? Perhaps the worst problem with the lab manuals that we have used in the past is that they commonly employ rock names and terms that differ from the ones used in your textbook or taught in lectures. This is confusing for everyone, including your humble instructors.

Figure shows the Paleozoic world during the time of the dinosaurs. The components of the future North American continent are highlighted. The figure is modified from Scotese, C.R. 1995. Phanerozoic Plate Tectonic Reconstructions, PALEOMAP Progress Report #36, University of Texas, Arlington

Thus was born this economical version of a GY 111 lab manual. Throughout the text, you will find important terms highlighted in **bold text**. They are well worth knowing for the lab component of GY 111. Most are defined in the glossary section of your lecture textbook or on faculty web pages, or they will be discussed in lab sessions. You will also find a series of questions and exercises at the end of most of the chapters. The questions are designed to test your understanding of the concepts addressed in each section of the course. Your instructor will inform you which if any of these that you are responsible for in each laboratory session. You are advised to do as many of the exercises as possible even if not required. They will help you with the tests.

Additional information and material related to GY 111 can be found on the following web page:

<http://www.southalabama.edu/geology/haywick/>

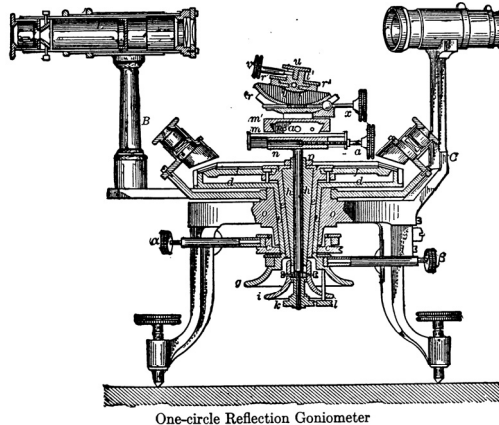
Visit it for manual updates, additional exercises and eventually, for color photographs of rocks and minerals.

Several people deserve credit for this manual. I wish to thank Drs. Murlene Clark and David Allison for their input and contributions to the first editions of the GY 101 (Clark) and GY 102 lab manuals (Allison). Lee Yokel provided valuable early reviews of all chapters of this version of the manual (a painful task!). Rene Smith and Crystal Garner provided many welcome comments by which to improve the 2nd edition. Lastly I thank my Fall 1999 and Spring 2000 GY 111 classes who whether they liked it or not, ended up as Guinea Pigs to the material presented in the later part of the manual. Lauree Stober was largely responsible piecing all of the diagrams and text into a stand alone lab manual and web-based resource.

As this lab manual is frequently revised, expect a few mistakes in the text. The best reviewers and the best critics are the students that use this manual. If you find a mistake, feel that material has been omitted, or otherwise have a problem with the manual, let me know about it. Your input is important.

Dr. Douglas Haywick
(October 2007)

dhaywick@jaguar1.usouthal.edu
<http://www.southalabama.edu/geology/haywick>



Getting Started

A guide to surviving GY 111

Laboratory exercises in GY 111 consists of three major components: 1) mineral identification; 2) rock classification and 3) structural geology/geological map interpretation. The majority of the labs involve the examination of physical specimens (i.e., rocks and minerals). You will learn how to identify minerals and how to characterize rocks by putting them through several "tests". The testing techniques that geologists and eager undergraduate students employ are discussed in detail in upcoming chapters. First you need to obtain a mineral/rock identification kit. These kits consist of the following items (items marked with asterisks are usually available in the labs for students that do not assemble complete kits):

- magnifier
- glass plate*
- streak plate (frosted porcelain plate)*
- pocket knife
- copper penny
- a magnet
- bottle containing dilute acid (optional)*

Mineral identification kits can be purchased for about \$10.00 from the USA Bookstore, but you can assemble your own kit fairly easily. The most critical item in the entire list is the magnifier. In the past, students have used Sherlock-Holmes type magnifying glasses; however, these are not of sufficient power to identify smaller attributes of minerals and rocks. Your best bet is to purchase a geological hand lens.

Figure shows a reflection goniometer used to measure the crystal faces of minerals. Luckily you do not have to know how to use this device in GY 111. But you still need a hand lens! From. Dana, E.S., 1898. A Textbook of Mineralogy 4th edition. Chapman and Hall, London

These vary in price from about \$5.00 to \$50.00. The different cost reflects different quality. Unless you are planning on majoring in geology or if you are an avid rock hound, it would probably be best to purchase a cheaper hand lens (you actually get one with the Bookstore's kits). If you wish a higher quality hand lens, see your instructor or a representative of the Earth Sciences Club. The Club regularly purchases items from science-orientated companies and you may be able to purchase a hand lens (or other geological equipment) through them.

The majority of the items comprising the geology test kit will be used to determine mineral hardness. If you make your own kit, make sure that you obtain a quality pocket knife (e.g. Swiss Army-type). Cheaper knives (e.g., Walmart Specials) may be manufactured from lower quality softer steel and this may affect your results.

You will only require one additional item to characterize rock specimens. In some cases, it will be necessary to measure the size of component crystals and grains, so a ruler is invaluable. Make sure that you purchase a ruler (6-inch size is perfect) that has both metric (e.g., cm) and US standard divisions (inches).

The structural geology component of the lab requires the following items:

- ruler (you should already have this for rock characterization)
- protractor (for measuring angles)
- compass (for drawing circles)
- colored pencils (red, green, brown, yellow, blue etc)
- regular graphite-type pencils (soft lead)
- a HUGE eraser (trust me, you will need it)
- tracing paper (optional)

Your task in the structural geology component of the lab will be to interpret geological structures such as folds and faults. Ultimately you will learn how to draw geological maps. Many students find this to be a challenging exercise (translation: it's hard!), but like learning to ride a bicycle, it is a skill that once learned is not soon forgotten.

Final Words

Do yourself a favor and make up your complete lab kit before you show up for the first lab. Put all of the items together into a pencil case or similar zippered compartment and attach it to the same three-ringed binder that contains this lab manual. Always bring your lab manual and geology kit with you to the lab. It is also a good idea to bring your lecture textbook to the labs. It contains nice color photos of rocks and minerals and useful information that should alleviate some of the difficulties you may have with the lab material in this course. Many students also elect to purchase a field guide to rocks and minerals. One of the best is the Audubon Society's *Field Guide to North American Rocks and Minerals* published by Knopf Inc., New York (ISBN 0-394-50269-8). It retails for under \$20.00 and contains more information about minerals than you ever knew existed. Just remember that the

photographs in these books are generally museum-quality specimens (i.e., the best examples found in nature). Seeing a picture of the Hope Diamond does not really prepare you for the appearance of a "typical" diamond, and the same can be said of the pictures in these books. Your instructor(s) will also show you excellent specimens as part of their lab lectures. The minerals that you eventually find yourself responsible for identifying may be less impressive (some might even say that they are disappointing), but this is the typical quality of most mineral specimens. They are the ones that you must learn to identify by the means discussed in this manual.

Here is one more good piece of advice. Why not read the relevant chapter(s) before you show up for the lab? It always impresses instructors if you are prepared for labs and it will save you a lot of time that could otherwise be used looking at minerals. Time is the critical issue for every course that you will take at this university. If you leave things until the last minute, you will not learn how to properly identify rocks and minerals. You might be able to recognize the specimens in the mineral trays, but this alone is unwise because you will be tested with different specimens (and they are safely locked in faculty offices). Not all mineral specimens look the same. The quartz that you get on a test may not look like the quartz you saw in the mineral tray, so if you fail to learn how to use properties to identify minerals, you may just fail altogether. Mineral identification takes time and cramming or leaving things until the last minute usually results in poor grades. The moral is use the time you have in the assigned lab periods to do the assigned work and ask questions when you need to. We geologists are a friendly lot and we usually enjoy talking about rocks, minerals and geological maps. Just ask us!

Here's the list of stuff you will need to survive GY 111 (in checklist form).

Geology Kit Checklist	√
this lab manual a three ring binder to hold this lab manual your lecture textbook and/or a field guide to the minerals (both optional) zippered pencil case to hold most of the following items: magnifier glass plate streak plate pocket knife copper penny magnet ruler compass protractor colored pencils pencils eraser (big one) tracing paper (optional) bottle containing dilute acid (optional)	√

Notes

