APPLICATION

Please complete the following application, providing attachments as requested.

1. **Program:** **GEOLOGY**

2. **Course:** **GEOL 1301 – Earth Sciences I for non-science majors**

3. **Petition Type**

X New Course

____ Re-submitted THECB Rejected Course (New statement of Justification Attached)

____ CAO Course moved to Component Area

4. **Foundational Component Area**

___	Communication	___	Creative Arts
___	American History	___	Mathematics
___	Governmental/Political Science	_X__	Life and Physical Sciences
___	Social/Behavioral Science	___	Language, Philosophy, and Culture

☐ Component Area Option Only

5. **Core Objectives**

Core Objectives	Required	Optional
Critical Thinking	X	____
Communication Skills	X	____
Empirical & Quantitative	_X___	____
Teamwork	_X___	____
Social Responsibility	____	____
Personal Responsibility	____	____

6. **Statement of Justification** (See Attached.)

7. **Attach the Assessment Plan,** (See Attached.)

8. **Attach the course syllabus.** (Appears as a separate link on the Submissions webpage.)

Submitted by Karen Yip Feb 22, 2018

Program Coordinator Date

STATEMENT OF JUSTIFICATION

1. **Why does this course belong in the Foundational Component Area (FCA)?**

GEOL 1301 is 3-unit lecture-based science class that explores the broad spectrum of Earth Science topics from physical geology to oceanography to planetary science to meteorology. The course is offered at a number of 2-year colleges across Texas both as GEOL 1301 and as a lab-class GEOL 1401. This course belongs in the Life and Physical Science FCA because it presents different theories and models of understanding the history of the solar system, the development of planets, and Earth processes like Plate Tectonics. General science concepts like the scientific method, understanding facts versus beliefs, building scientific concepts with evidence, and exploring interrelatedness of these natural systems with human society and hazards are emphasized.

The Geology Program has offered and scheduled many sections of GEOL 1403 as the introductory geology class for general students. But when the Core Curriculum changed to not require lab classes of non-science majors the enrollment in GEOL 1305 began declining. The Geology Program wishes to offer GEOL 1301 to better serve the needs of HCC students following the new Core Curriculum requirements. Enrollment in GEOL 1305 Environmental Science has been very consistent with high make rates and fill rates. The demand exists for students looking for 3-unit non lab science classes.

2. ***Applies to all Core courses:*** **How does the course target critical thinking?**

(You must show that the course requires creative thinking, innovation, inquiry, and analysis, evaluation and synthesis of information.)

Earth Sciences is a course that synthesizes many sciences into the framework of planet Earth and our Solar System. Students will be presented with the opportunity to distinguish evidence for the theories and models explaining Earth's history and evolution both as a planet and a member of the solar system. Geosciences are nearly entirely forensic in nature. We see Earth as it is now, we can measure and observe processes and changes in our own time scale but our understanding of Earth comes from piecing together changes that occurred through time from Earth's beginnings. Students will need to explore deep time, decipher observation versus interpretation of data to explain evidence of Earth's processes. Concepts from sister sciences of chemistry, biology, physics and astronomy will be applied to exploring Earth's dynamic systems.

3. ***Applies to all Core Courses:*** **How does the course target communication skills?**

(You must show that the course targets effective development, interpretation, and expression of ideas through written, oral, and visual communication.)

The Earth Sciences are nothing if not visual. Through the semester students will learn to use and interpret topographic maps, geologic maps, structural diagrams, block diagrams, satellite images, and aerial photographs. Emphasis is placed on students developing skills of sketching geologic concepts in addition to writing about them. Our program has started adoption of these concept sketches as an assessment tool. Grades aren't based on artistic prowess, instead on indicating accurate size relationships, distribution of features and arrows aiding in description. Oral communication will be exercised during frequent in-class discussions, small group discussion (like think-pair-share) and in at least one oral presentation during the semester. Instructors may design written assignments as necessary but these may include current event reports, research papers, local hazard reports, and essay-format assessment questions.

4. ***If applicable*:** **How does the course target empirical and quantitative skills?**

(You must show that the course targets the manipulation and analysis of numerical data or observable facts resulting in informed conclusions.)

Quantitative skills development is one of the common threads through all science courses and Earth Science is not excepted. In GEOL 1301 students will not only learn to communicate with maps but also observe and collect quantitative data from them. This includes finding distances on maps, calculating slopes or gradient of streams, calculating distance of celestial bodies and describing the geometry of orbits. Plate tectonics is understood in direction and rate of plate motion over millions of years; seismic, flood, and volcanic hazards are calculated in terms of recurrence intervals. Manipulating and discussing Earth's history in terms of millions and billions of years is the true unique property of Geosciences. Understanding order-of-events is the main focus of geologic history which is one of the course SLOs. General chart reading and graph reading are included throughout the semester. In-class or homework assignments will help students develop these quantitative skills.

5. ***If applicable*: How does the course target teamwork skills?**

(You must show that the course targets the ability to consider different points of view and to work effectively with others to support a shared purpose or goal.)
Frequently science courses rely on laboratory exercises and experiences to emphasize teamwork. But teamwork skills will be developed formally and informally in GEOL 1301. Classes will emphasize active-learning and frequent small group and whole class discussions will be essential. Each GEOL 1301 instructor will design an assignment which will include oral presentation and be assigned to teams of students. Team dynamics and cooperation should be assessed as part of the assignment score in addition to geologic content or quality of presentation. Instructors should take time to make suggestions or best-practices tips for their students related to teamwork expectations.

6. ***If applicable*: How does the course target social responsibility?**

NA

7. ***If applicable*: How does the course target personal responsibility?**

NA

ASSESSMENT PLAN

1. How will you measure each of the four core objectives targeted in the course? Describe the methods (participants, procedures, & measures) you will employ to gather evidence that students are achieving these core objectives in this course. Attach copies of representative assignments and rubrics or sample exam items you will use to measure each core competency.

   An example of an exam question that requires visual and written communication is:

   > "**Sketch** a cross section of an oceanic divergent plate boundary. Thoroughly and carefully label the diagram and include expanded "captions" of what processes or events are occurring at different places. Consider plate tectonic features, sedimentation, magmatism, and bathymetric features."

   This kind of exam question would be worth 5-8 points out of ~100. Or possibly a more major portion of the assessment score. Students would be expected to make a legible sketch with all relevant layers of the Earth sketched and labeled, faults, relative depth of ocean floor, relative thickness and type of sediments deposits, hydrothermal activity, elevation difference of the rift-valley compared to abyssal plain. Instructors would look for description of spreading plates, tension forces, description of cooling crust away from the plate boundary and correct sediment types. Instructors will be asked to collect a selection of student answers to questions like this to show as satisfactory, excellent, and less than satisfactory for the program to discuss methods that may improve success.

   Attached are scanned pages of assignments that may be used in class involving quantitative/empirical skills and critical thinking. These would be short (2-3 page) assignments providing thinking opportunities to highlight concepts from the chapter(s). The GEOL 1301 instructors for each semester would select assignments for their course and have at least 3 or 4 common assignments.

   Attached is an example of a presentation assignment that could be used in GEOL 1301. Instructors may choose different topics to highlight.

2. Which of the following formats, settings, and populations apply:

☒Face-to-Face, on-campus section(s)

Which campuses?

The Geology Program believes this class could be successful in person at West Loop, Central, Spring Branch, Southeast and Stafford campuses. But, this is up to the availability of classroom space and success. The course would be in demand by non-science majors looking for a general introductory science to fill core-curriculum requirements.

☐Face-to-Face, dedicated dual credit section(s)

Which high schools?

☒Hybrid section(s)

This course could be taught in hybrid format incorporating online assignments or web-based research to compliment textbook chapters.

☒Distance education section(s)

Yes, this course could be taught successfully Online, but initially our Program believes it would be more successful in-person. The course would be in demand by any student needing to fill 3-units (half) of the Life and Physical Science requirement. The Geology Program has had high demand for Online offers of GEOL 1305, GEOL 1345, and GEOL 1347.

☐Section(s) taught in other off-campus settings

Where?

☒Section(s) taught by adjunct faculty?

The course could be taught by Geology Program adjunct faculty as it is a general introductory level. Initially, the Geology Program hopes to have full-time faculty teach the course until we establish its success and demand.

3. Can you attest to the fact that core objectives are targeted and assessed in all course sections, regardless of instructional format, population, or setting?

Instructors of the course will be provided with the list of necessary topics as approved by the Program Committee. This is already the process for GEOL 1305 – Environmental Science. In the pilot semester or two the few GEOL 1301 instructors will choose a couple in-class exercises to do with all students in all sections that include components of quantitative skill-building and critical thinking. All instructors will design an oral presentation assignment to assign to teams. Our program is small enough that any additional instructor assigned to the course would be mentored in what is required and where they can be creative as instructors. The syllabus template is edited and distributed each semester for each Geology course by the Geology Program Coordinator. If the Committee determines changes should be made to all sections of the course the syllabus template can be updated for the following semester.

4. How will you evaluate the results of your course-wide assessment(s)?

The instructors of GEOL 1301 will assemble examples of student work for the common assignments and evaluations of oral presentations. These will be presented to the Geology Committee at a meeting in December (wrapping up the fall semester) and May (wrapping up spring semester). Continued discussion may occur at the Instructional Day meetings prior to the start of each semester. Additional small meetings of the GEOL 1301 instructors may be called during the course of the semester to check-in about course progress and design of the oral presentation projects. The Geology Committee will compile comments and results to determine if adjustments should be made to the structure or content of GEOL 1301.

5. How will you know when your students have been successful in achieving each core competency?

When at least 80% of students attempting each assessment (mapped to core competencies) achieve scores of 80% correct or higher.

6. How will your assessment results be documented and archived?

Assessment results will be documented as part of our May Geology Program Committee meeting minutes. We will have discussion about the core components of each GEOL course. Should changes be agreed on by the Program Committee, new language may be added to or edited in syllabus templates as distributed by the Program Coordinator. If required, the results will be included in a summary document or report and posted to a specific database as determined by HCC administration.

7. How will you use the results of your assessments to improve student learning?

The Program Coordinator presents findings at one of two program committee meetings each year. Faculty discuss relative strengths and weaknesses and propose changes in course design, instructional strategies, and assessment tools and methodologies. When targets are not met, the program coordinator and the program committee make plans to intervene and reassess student learning within the four-year cycle.

Geology Program, Department of Natural Sciences

Course Syllabus – PROPOSED

Earth Sciences I for non-science majors

GEOL 1301

Semester with Course Reference Number (CRN) Instructor, please indicate semester and CRN

Instructor contact information: (instructor, please include name, a phone number and HCC email address)

Office Location and Hours (instructors, indicate office location and hours)

Course Location/Times (instructors, indicate class location and hours)

Course Semester Credit Hours (SCH) (lecture, lab) If applicable
Credit Hours: 3
Lecture Hours: 3

Total Course Contact Hours
48.00

Course Length (Instructor should indicate if course is 16-week, 12-week, 8-week, summer 5-week, or Mini term)

Type of Instruction
Lecture
Online (>85% online)
Hybrid (~50% in-person)
Face to Face (can include Online components)

Course Description:
From the ACGM: Survey of geology, meteorology, oceanography, and astronomy.
This course does not count toward a Geology Major.

Course Prerequisite(s)

- Qualify to take INRW 0420 or ESOL 0360

Geology Program Learning Outcomes
1. Students will recognize scientific and quantitative methods.
2. Students will evaluate the differences of scientific approaches and communicate these findings, analyses, and interpretations in oral and written communication.
3. Students will demonstrate knowledge of the major issues and problems facing modern

science, including issues that touch upon ethics, values, religion, and public policies.
4. Students will demonstrate knowledge of the interdependence of science and technology and their influence on, and contribution to, modern culture.
5. Students will identify and recognize the differences in competing scientific theories.

Course Student Learning Outcomes (SLO) as defined by ACGM. Upon successful completion of this course students will:

1. Explain the current theories concerning the origin of the Universe and of the Solar System.
2. Explain the place of Earth in the Solar System and its relationships with other objects in the Solar System.
3. Relate the origin and evolution of Earth's internal structures to its resulting geologic systems, including Earth materials and plate tectonic activities.
4. Explain the operation of Earth's geologic systems and the interactions among the atmosphere, the geosphere, and the hydrosphere, including meteorology and oceanography.
5. Explain the history of the Earth including the evolution of earth systems and life forms.

Learning Objectives (instructors, you may edit and/or add objectives connected to each of the course's learning outcomes. They are numbered to relate to the SLOs)**:**

1.1 Explore evidence of the Big Bang theory
1.2 Describe the Nubular Hypothesis and development of our Solar System

2.1 Relate Earth's history to the Nebular Hypothesis
2.2 Describe the theories for the origin of the moon
2.3 Relate climate change to changes in astronomical relationships
2.4 Contrast Earth to the other planets of the Solar System

3.1 Compare the processes on early Earth to the processes of modern Plate Tectonics
3.2 Sketch a model of Earth's internal structure showing thickness and explaining the characteristics that define each layer
3.3 Make a concept sketch of the rock cycle and explain the processes that create Earth's diverse rocks.

4.1 Recognize the influence of the atmosphere on the biosphere and vice versa
4.2 Describe Earth surface processes as the result of interaction of moving water, air, gravity, and rock matter.
4.3 Explain distribution of geologic hazards that are result of geologic, atmospheric, and oceanographic processes
4.4 Explain geologic resources as products of geologic processes.
4.5 Use online resources to find maps of local hazards
4.6 Articulate the interrelated nature of the geosphere, atmosphere, biosphere and hydrosphere in the context of Climate Change.

5.1 Summarize the models of the origin of Earth's surface water and atmospheric gases
5.2 Recognize that scientific models represent Earth's complex systems
5.3 Distinguish pieces of evidence and data that lead to development of theory of Plate Tectonics
5.4 Describe the process of fossilization in relation to geologic processes and illustrate how fossil evidence is used to understand Earth's history

Core Curriculum Objectives:
This course is in the Life and Physical Science Core Curriculum “functional component area” and meets the objectives of:

- **Critical Thinking Skills** - to include creative thinking, innovation, inquiry, and analysis, evaluation and synthesis of information
- **Communication Skills** - to include effective development, interpretation and expression of ideas through written, oral and visual communication
- **Empirical and Quantitative Skills** - to include the manipulation and analysis of numerical data or observable facts resulting in informed conclusions
- **Teamwork** - to include the ability to consider different points of view and to work effectively with others to support a shared purpose or goal

Course Calendar (instructor indicates what types of materials/assignments students will work with or be assessed with.)

The following is a suggested semester calendar, but instructors may present material any order.

WEEK 1 – Unit 1 Earth Materials – Ch 1 matter and minerals
WEEK 2 – Unit 1 cont – Ch 2 Rocks
WEEK 3 – Unit 2 Sculpting Earth’s Surface – Ch 3 Landscapes fashioned by water
WEEK 4 – Unit 2 cont – Ch 4 Glacial and Arid Landscapes
WEEK 5 – Unit 3 Forces Within – Ch 5 Plate Tectonics
WEEK 6 – Unit 3 cont – Ch 6 Restless Earth: earthquakes
WEEK 7 – Unit 3 cont – Ch 7 Volcanoes and Igneous Activity
WEEK 8 – Unit 4 Earth’s History – Ch 8 Geologic Time
WEEK 9 – Unit 5 The Global Ocean – Ch 9 Oceans: The Last Frontier
WEEK 10 – Unit 5 cont – Ch 10 The Restless Ocean
WEEK 11 – Unit 6 Earth’s Dynamic Atmosphere – Ch 11 Heating the Atmosphere & 12 Moisture, clouds, and precipitation
WEEK 12 – Unit 6 cont – Ch 13 Atmosphere in Motion & 14 Weather Patterns
WEEK 13 – Unit 7 Earth’s Place in the Universe – Ch 15 Nature of the Solar System
WEEK 14 – Unit 7 cont – Ch 16 Beyond our Solar System
WEEK 15 – Semester wrap-up
WEEK 16 = FINALS WEEK

Instructional Methods (instructor indicates what types of materials/assignments students will work with or be assessed with)
Students will work with maps, diagrams, websites, and local case studies. Students will give presentation at least once during the semester, will take exams, and a cumulative final exam.

Student Assignments

(instructor, briefly describe the assignments for the semester. Comment on which assignments are mandatory, general timeline or due dates. Please connect/relate the assignments to core curriculum requirements and course SLOs)

In all sections students will give a presentation in pairs/groups during the semester. The topic and details will be provided by the instructor.

Student Assessment(s)

(instructor, describe the assessments (quizzes, tests, exams, etc) that will be given during the semester. Include chapters/topics covered for each. Also describe instructor’s make-up policy or other expectations for students related to assessments)

Instructor's Requirements

(instructor, here is where you should describe your general expectations of students in class, preparedness for class, personal attendance policies/expectations, computer/technology access requirements, cell phone class policy and anything else that is not covered elsewhere. Also include some tips like “to be successful in this course students should…” Can also be where you describe your teaching philosophy or general personal introduction.)

Program/Discipline Requirements: If applicable

All HCC policies regarding attendance, withdrawal, academic honesty, students with disabilities, grading, and student rights will be followed in this course. Refer to syllabus section titled "Instructor's Requirements", "HCC Policy Statements", and "Grading" for more details as well as the Student Handbook http://www.hccs.edu/district/students/student-handbook/

Where can you get help? Visit your instructor during office hours. Contact your instructor to meet at a time outside of office hours. Get help online via: https://hccs.upswing.io/ Search for tutoring at HCC at: http://ctle3.hccs.edu/alltutoring/

HCC Grading Scale:

A = 100- 90:	4 points per semester hour
B = 89 - 80:	3 points per semester hour
C = 79 - 70:	2 points per semester hour
D = 69 - 60:	1 point per semester hour
59 and below = F	0 points per semester hour
FX (Failure due to non-attendance)	0 points per semester hour
IP (In Progress)	0 points per semester hour
W (Withdrawn)	0 points per semester hour
I (Incomplete)	0 points per semester hour
AUD (Audit)	0 points per semester hour

IP (In Progress) is given only in certain developmental courses. The student must re-enroll to receive credit. COM (Completed) is given in non-credit and continuing education courses.

FINAL GRADE OF FX: Students who stop attending class and do not withdraw themselves prior to the withdrawal deadline may either be dropped by their professor for excessive absences or be assigned the final grade of "FX" at the end of the semester. Students who stop attending classes will receive a grade of "FX", compared to an earned grade of "F" which is due to poor performance. Logging into an Online course without active participation is seen as non-attending. Please note that HCC will not disperse financial aid funding for students who have never attended class.

Students who receive financial aid but fail to attend class will be reported to the Department of Education and may have to pay back their aid. A grade of "FX" is treated exactly the same as a grade of "F" in terms of GPA, probation, suspension, and satisfactory academic progress.

Instructor Grading Criteria

(instructor, specify the semester grade calculation here including assessments and assignments. Be as detailed and specific as possible)

Instructional Materials

Required Textbook: Foundations of Earth Science, 8th ed., 2017, Lutgens and Tarbuck,

Pearson. ISBN 978-0134184814 (subject to Program approval)

HCC Policy Statement:
Please familiarize yourself with campus policies in the HCC Student Handbook for topics including: ADA (students with disabilities), Scholastic Dishonesty, General Student Attendance, Repeating courses, Electronic Devices in class, Threatening Behavior, Religious Holidays, withdrawal deadline and mores: http://www.hccs.edu/district/students/student-handbook/

Any student who faces challenges securing their food or housing and believes this may affect their performance in the course is urged to contact the Dean of Students for support. Furthermore, please notify the professor if you are comfortable in doing so.

Student with Disabilities (ADA):
HCC strives to make all learning experiences as accessible as possible. If you anticipate or experience academic barriers based on your disability (including mental health, chronic or temporary medical conditions), please meet with a campus Abilities Counselor as soon as possible in order to establish reasonable accommodations. Reasonable accommodations are established through an interactive process between you, your instructor(s) and Ability Services. It is the policy and practice of HCC to create inclusive and accessible learning environments consistent with federal and state law. For more information, please go to http://www.hccs.edu/district/students/disability-services/

Withdrawal Policy: The withdrawal deadline is **instructor fill-in date for this semester.** Instructors, you can specify your policy of whether you will assign Ws without consultation or whether you require student consultation. Be clear.

HCC Sexual Harassment Policy and Title IX: Houston Community College is committed to cultivating an environment free from inappropriate conduct of a sexual or gender-based nature including sex discrimination, sexual assault, sexual harassment, and sexual violence. Sex discrimination includes all forms of sexual and gender-based misconduct and violates an individual's fundamental rights and personal dignity. Title IX prohibits discrimination on the basis of sex-including pregnancy and parental status-in educational programs and activities. If you require an accommodation due to pregnancy please contact an Abilities Services Counselor. The Director of EEO/Compliance is designated as the Title IX Coordinator and Section 504 Coordinator. All inquiries concerning HCC policies, compliance with applicable laws, statutes, and regulations (such as Title VI, Title IX, and Section 504), and complaints may be directed to:
David Cross
Director EEO/Compliance
Office of Institutional Equity & Diversity
3100 Main
(713) 718-8271
Houston, TX 77266-7517 or Institutional.Equity@hccs.edu

HCC Campus Carry statement: At HCC the safety of our students, staff, and faculty is our first priority. As of August 1, 2017, Houston Community College is subject to the Campus Carry Law (SB11 2015). For more information, visit the HCC Campus Carry web page at http://www.hccs.edu/district/departments/police/campus-carry/.

EGLS$_3$ -- Evaluation for Greater Learning Student Survey System
At Houston Community College, professors believe that thoughtful student feedback is necessary to improve teaching and learning. During a designated time near the end of the term, you will be asked to answer a short online survey of research-based questions related to instruction. The anonymous results

of the survey will be made available to your professors and department chairs for continual improvement of instruction. Look for the survey as part of the Houston Community College Student System online near the end of the term.

Geology of National Parks Presentation

Groups of three students will give a ~15 minute presentation to the class on (date), about the geology of a National Park or National Monument that the group chooses. This assignment will be worth **5%** of the final course score. This is your chance to use the geologic knowledge you have gained this semester to think about a specific place outside of Houston and share that place with the rest of your classmates. The presentation should make the audience feel like we have a virtual brief field trip to that location.

Content:

The *majority* of the presentation will be about the **geologic topics** you have chosen. Here are some suggested categories: *stratigraphy* (rock layers present), *ancient climate/environment*, *fossil* history, important *structures* (folds, faults, mountains etc), *plate tectonic setting* (present & past), modern *landscape* features and *processes* that are creating them (glaciers, canyons, sand dunes etc), any volcanic processes, and evidence for dramatically different environments today than in the past.

Try to tell us something of a timeline of geologic events in the region. Give us an idea of the age of the processes or rocks or structures you talk about. Maybe you will come across some sort of geology controversy regarding your park. Tell us about it! Really, you will want to tell as much of the **geologic history** of the area as you can. If at all possible attempt to present geologic information in chronologic order. Avoid the modern flora and fauna. But, *ancient* plants and animals are fossils and are thus very appropriate.

The presentation should be about the major **geologic** aspects of the national park.
An **introduction** should include a clear explanation and map of where the park is. Include a US map with the location and also a closer-in map (maybe state map, maybe regional map). Also include a brief (1-2 slides) overview of other cool tid-bits and facts about the park to give the audience an idea of why it's an interesting place before you even get into the geology discussion. Remember, most of your classmates have not been there.

Research:

You may research the parks on the internet or in your textbook or in other books from the HCC or local libraries. Consider travel books, roadside geology books, books about the **state** the park is in. Refer to your textbook for diagrams or definitions to help you.

Meet with your partners and assign responsibilities. Will you work on separate sub-topics? Plan a time to gather and join your information. Is one person in charge of the slideshow/media? You may find it useful to have a thumb-drive/jump drive to transport your digital notes and figures, or set up a shared folder in the Office365 OneDrive (super convenient).

ANNOTATED REFERENCES - Please keep a list of the references and what type of information you extracted from them. These will be assembled into an annotated reference list that you will submit the day of the presentation. The reference list should be typed and printed (a hard copy, not digital). The reference list should include the basic reference information AND a short paragraph annotating how the reference was useful. Examples: Did you use many figures from the reference? Did you use the FAQ website? Did you find a map in it? Was there a timeline that was helpful?*

**** Progress report due by (date) ***.** Please submit in a typed 1-page report outlining the info you have already collected and point out areas that you hope to find more information for. You will also lay out the division of responsibility for the team members that you have set out already. This may be submitted electronically via an assignment tool on EagleOnline. The progress report will not specifically be scored but will be a component of the overall project grade.

Grade will be based on clearness of introduction, organization/flow (logical order?), presentation quality, content (quality of your information), annotated reference list, and completion of the progress report. After the presentations you will also write an evaluation of your teammate. Indicate what behind-the-scenes tasks each was responsible for and whether they contributed positively to the success of the group. This will help me assess your teamwork skills.

Expectations:

- Consider this a virtual field trip. If you could take the class to this park what would you be able to point at and show us to display the geologic history or environment?
- Show that something you have learned this semester allows you to better understand one of our country's National Parks. And that you can communicate geologic thoughts to others.
- Don't be afraid of using textbook topics that we haven't yet covered – the textbook is a really good reference for many geologic processes and definitions.
- You can pre-record it, you can video it, show as a slideshow, make it a skit – be creative
- If there is a projected/digital image portion of your presentation it should be legible (consider color combinations, clear font/font size, too much text)
    - **Limit** the number of non-useful slide animations/transitions (flying text, fizzling slides) if you use PowerPoint
- Remember to give a well-planned introduction including at least 2 or 3 location maps to orient the rest of the class as to WHERE your park is. Don't lose your audience.
- Limit discussion of the plants & animals in the park unless they affect or compliment the geology. This is not a biology or ecology class. Unless you tell us "this plant only grows here because the soil has a high concentration of a mineral because of the local volcano"
- * * * Hand in a complete reference list. The list should have at **least** 4 ANNOTATED references. Remember to describe how useful the reference is and what you used it for.
- Take notes during your classmates' presentations – *there WILL be questions on the final about these parks and the processes*. Be ready to ask and answer questions.
- There are scanners in the computer labs and library where you can scan images to make them in digital format (encouraging hard-copy resource use).

Map Locations, Distances, Directions, and Symbols

Activity 9.2

Name : ________________ Course/Section : __________ Date:__________

a Whal are the latitude-longitude coordinates of point Bin Fig. 9.2?

Latitude:------------------ Longitude:------------------

m Refer to Fig. 9.8, which de.o;cribcs t.he Pt1blic Land Sun·cy Syslem (PLSS).

1. Rc\ ew Fig.9.8 lo understand how the location of point X in Fig. 9.8C was delermined Using Pl.SS shot1hand. What L◇ the location of point Z in Fig. 9.8C in Pl.SS shor1hand?

2. How many ao·c.s are pre.o;ent in the 10wn.ship in Fig. 9.88? (*Hint:* There arc 640 acrc.o; in I mi.^{2}.) Show rour work.

3. Imagine that. you wallled to purchase t.he :-IE 1/4 of theSE 1/4 of scc:tiun I I in Fig. 9.8C. If t.he property cost'> $500 per acre, then how much mu.J>t you pay for the entire pmpct1y?

B uses 30 X 60-minute quadrangle maps have a sale or 1:100,000.

1. One inch on such maps equals abom how many miles? Show your work.

2. One an on .such maps equals about how many meters? Show rour work.

m The smndard base map ror man)' region a) geologic ShHlies L◇ the 7.5-minute top()graphic quadrangle:. Imagine that a field gcologisttL<>e.<> a handheld 12-channel CPS rc.-cd..er with a location uncert.linty of ±5 m. W'hat would be: the *dumll'/t'Y()f* the uncertainty area as..<>od;ued with that CPS unit if y()u plotted it *as* a circle on the I:24,000 scale map (in mm)?

IJ Refer t() Fig. 9.5.

1. What is the bearing (azimuth) fmm point *cto* point *tl?* ______

2. What *is* the bearing (azimuth) from point *d* to poinl *c?* — — — — —

a Refer to the Riucr Ridge, C::alifomia. i.5-minutc topographic quadrangle map in Figs. 9.3A and 9.38.

1. What arc the lat..itudc-longiludc: coordinate..; or the NW comer of the map?

255

2. 11u:: USC!.S used a polrconic projection 10 map points on the curved surf..ic or Earth onto the plane of this map. What j_... the tltrl llm usc:d for this map pr jcction? (*fl mt:* Read the information at the lower left corner of the map in Fig. 9.38.) ________________ (The most rcccnl rrsion or thil< map uses the Nort.h American Dalum of 1983, so lhe coordinates of a given point. on t..hc older map arc slight..ly different (rom Ihose on the currcnl map.)
3. In what. UTM zone is this map localcd? (*1-/mJ:* Read the information <at t.he low·er lefl corner of the map in Fig. 9.38.) UTM zone ______
4. In wh;n year w:.t: this map originally made? ______
   In wh;n year w:.t: i1 photorc,i<>cd? ______
5. (a) What. was I he magnetic declination at t..hc center of t.he map when the map v.d.:i prepared? *Hint:* Find the north arrow at the bottom of Fig. 9.38 and read the angle lx:tween tt"Uc north (indkat.ed with the black star) and magnct.ic north (M) in degrec-s and minutell of arc. What was the magnct.ic dedinat.ion angle?______

   (b) What is the current magnetic dedination for the center of the map-34.5625° . I I8.I Si5"W-as indicated br the N"OAA-NC£1 Magnetic Declination Est.inmted VaJue CalculalOr? (http://\'oww.ngdc.no.aa.gov /geomag wcb/)

   ______
6. What is t.he PLSS locat.ion of section 21 in the sout.hwellt comer of the map?

Refer to Fig.A9.2.1 to liCe the SW comer of the Ritter Ridge. California. 7.5-minute topo&•raphic quadrangle map, published by the USGS (1975).

1. What general kind of vegetation ill indk:ned on the wc..;t (left) side of Fig. A9.2.1? (Refer to spnbuls in Fig. 9.4.)

2. Lba the dilfercnt. kinds of roads depicted on t.he map balled on the symbol.; explained in Fig. 9.4.

3. Gold. copper, and titanium were mined here until the early 1900s. otice that. there are three different .<i)'tnbols used to indicate the kind of mining acthity t.J1al occurred here. Draw the mine srmbols below and identify what. they mean using Fig.9.4.

4. What. are the UTM (NAD27) coordinatell of Purit:tn (\;fine ncar the southwc-st corner of the map? {*Hi11t* Cut out and u..;c t.J1e l:24.000 UTM Crid from CA:otoolsSheet 4 at. the back of the manual, or use the orange linell to help you compute t.J1e coordinate..; using pmport.iom. The orange line..; arc exactly 1000 m apar1.)

5. Usc a protractor to measure t.he bearing (azimuth) from Red Ro\'cr line lo Puritan Mine. The hlack line au he left edge of the map Lo; oricnlcd north-south.

6. The black line aLihe left edge of t..he map is along a meridian t..hat exlends to t..he north and .south poles. Not..ice that the orange line..; of the UTM grid are not quite parallel and perpendicu lar with t..he black line. Grid north is the me as true nonh for point'> along t.he centr.d meridian of a zone. along which the ca..;ting.s arc all defined *as* 500,000 m E. The f.trthcr away from the central meridian a point i.s, t.he larger the angle of difference betWC."Cn UT);f grid north and tnlc north.

(a) What is your estimate of the angle between grid north and true north in Fig. A9.2.1? ——————

(b) Look at t.hc north arrow in Fig. 9.38 and read the angle between grid north (G) and true north {indicated wit.h the black star) in degrce.s and minutes of an:. What is th;u angle?------

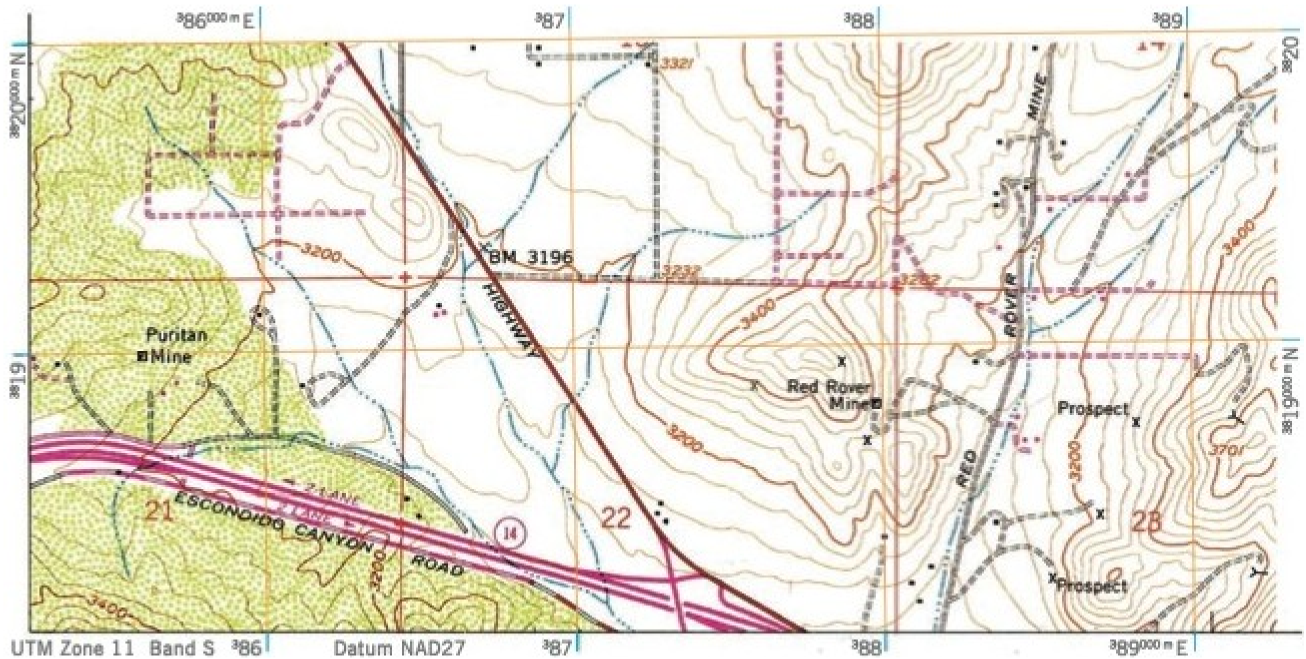
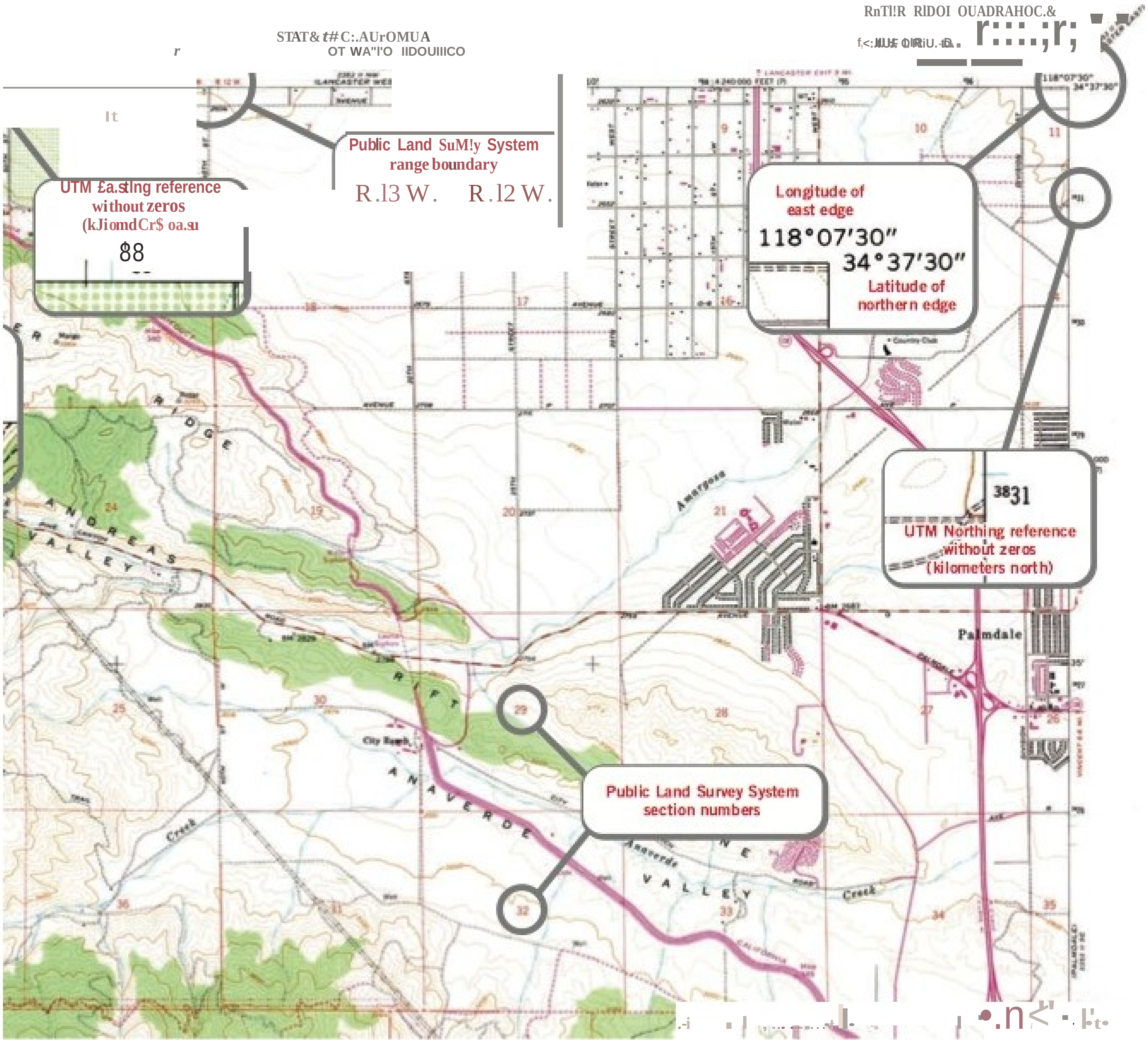


Figure A9.2.1

m **REFLECT & DISCUSS** Below Fig. A9.2.1, add bar scales to show how long I mi. and 1 km arc on the map, and t.hen explain how you detenninccd t.he length.s of the bars in your bar .scale..;.



alifornia, USGS 7.5-minute topographic quadrangle map (19751. This map was reduced to about 55% of its actualsize.

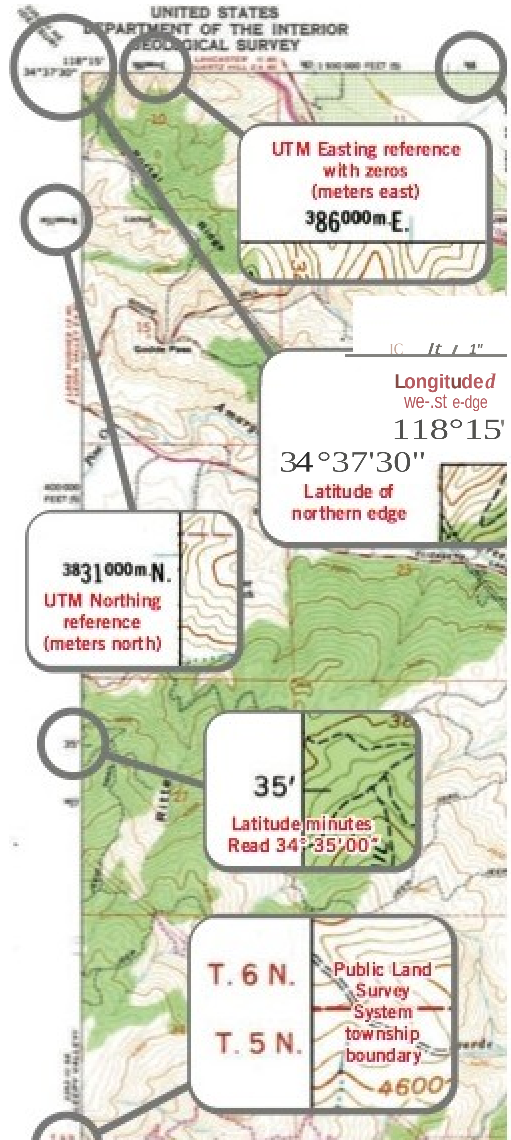
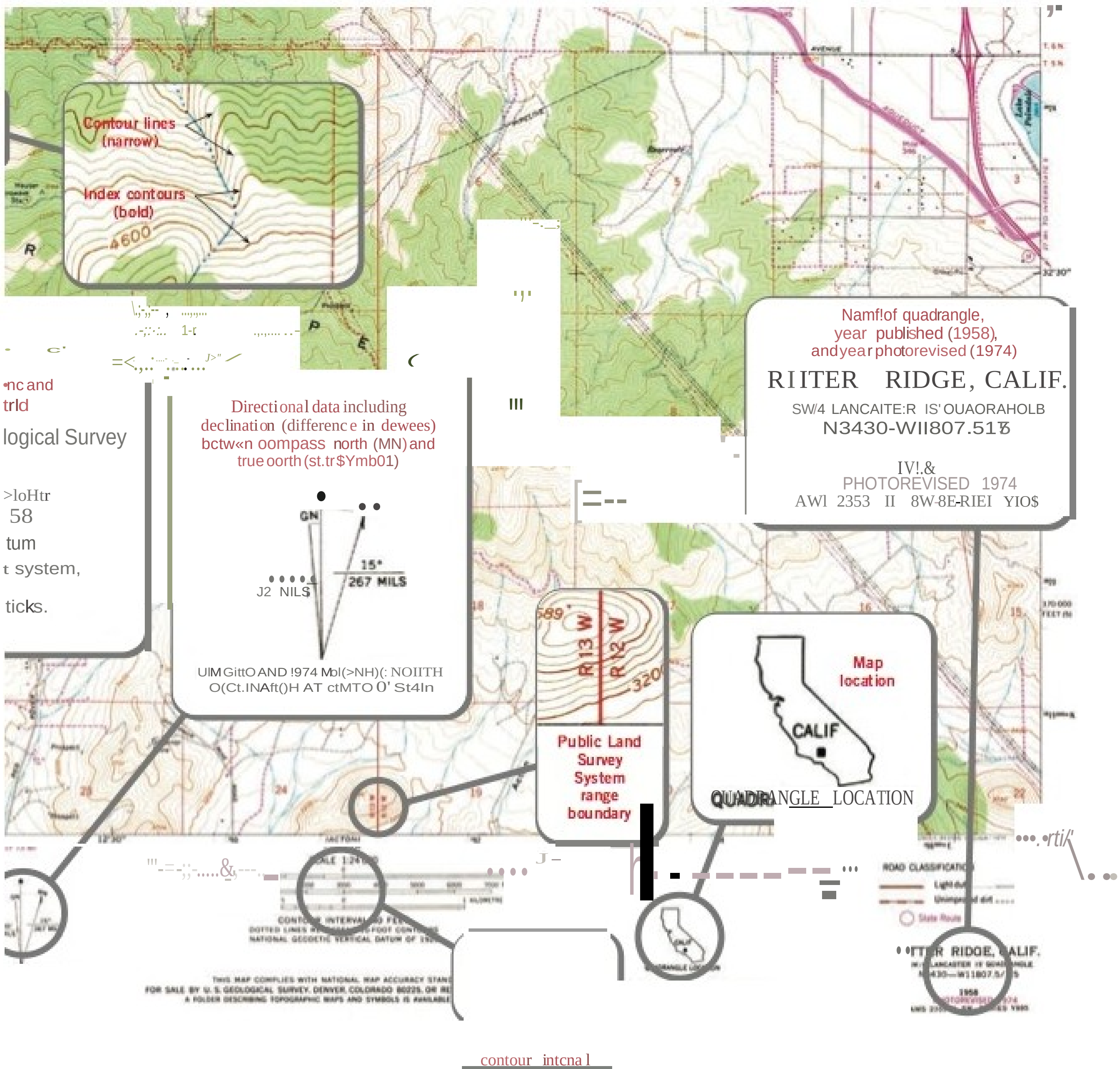


Figure 9.3A Northern part of the Ritter Ridge, C


Contour lines (narrow)
Index contours (bold)
4600
Directional data including declination (difference in degrees) between compass north (MN) and true north
GN
15°
267 MILS
Name of quadrangle, year published (1958), and year photorevised (1974)
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PHOTOREVISED 1974
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Public Land Survey System range boundary
Map location
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ROAD CLASSIFICATION
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Map fraetional $tale,
bar scales, and

California, USGS 7.5-minute topographic quadrangle map (1975). This map was reduced to about 55% of s a::tual size.

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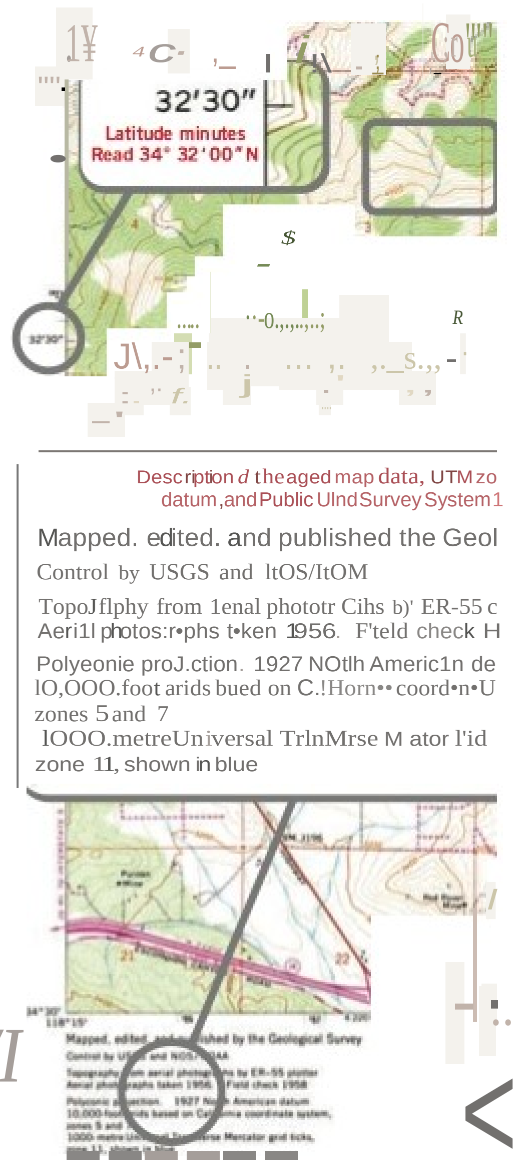
32'30"
Latitude minutes
Read 34° 32'00" N

Figure 9.38 Southern part of the Ritter Ridge,

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15. The period of normal polarity, c, began (1, 2, 3) million years ago.

16. During the past 4 million years, each interval of reverse polarity has lasted (more, less) than 1 million years. Circle your answer.

17. Based upon the pattern of magnetic changes exhibited in Figure 10.4, does it appear as though Earth is due for another magnetic polarity reversal in the near future?

____

Paleomagnetism and the Ocean Floor

The records of the magnetic polarity reversals that have been determined from the oceanic crust across sections of the mid-ocean ridges in the Pacific, South Atlantic, and North Atlantic oceans are illustrated in Figure 10.5. As new ocean crust forms along the mid-ocean ridge, it spreads out equally on both sides of the ridge. Therefore, a record of the reversals is repeated (mirrored). Notice that the general pattern of polarity reversals presented in Figure 10.4 can be matched with the polarity of the rocks on either side of the ridge for each ocean basin in Figure 10.5.

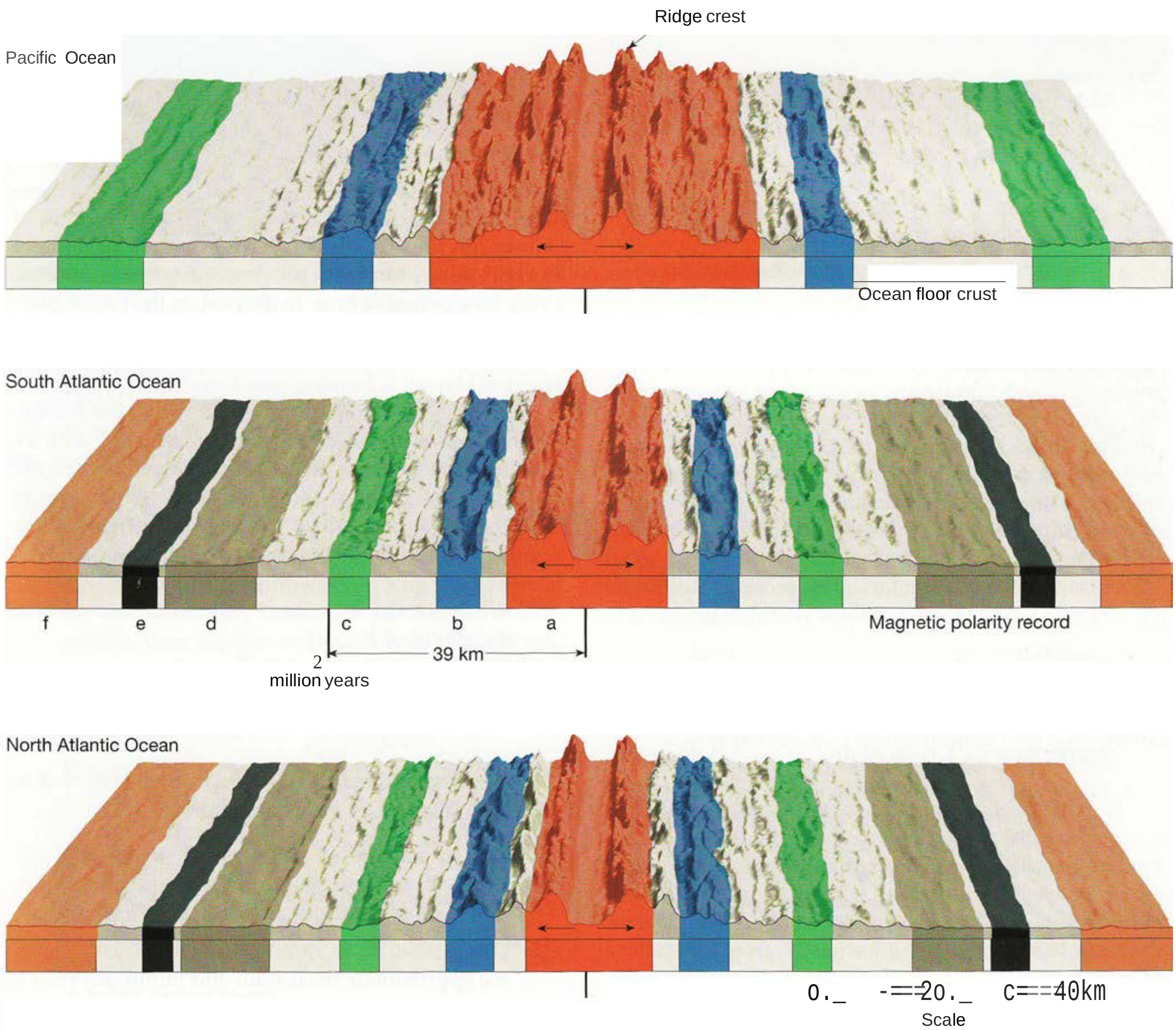

Figure 10.5 Generalized record of the magnetic polarity reversals near the mid-ocean ridge in the Pacific, South Atlantic, and North Atlantic oceans. Periods of normal polarity are shown in color and correspond to those illustrated in Figure 10.4.

Use Figures 10.4 and 10.5 to answer questions 18--23.

18. On Figure 10.5, identify and mark the periods of normal polarity with the letters a-f (as in Figure 10.4) along each ocean floor. Begin at the ridge crest and label along both sides of each ridge. (*Note:* The left side of the South Atlantic has already been done and can act as a guide. Also, only the periods of normal polarity through c are illustrated in the Pacific basin.)
19. Using the South Atlantic as an example, label the beginning of the normal polarity period c, "2 million years ago," on the left sides of the Pacific and North Atlantic diagrams.
20. Using the distance scale in Figure 10.5, the (Pacific, South Atlantic, North Atlantic) has spread the greatest distance during the last 2 million years. Circle your answer.
21. Refer to the distance scale. Notice that the left side of the South Atlantic basin has spread approximately 39 kilometers from the center of the ridge crest in 2 million years.

    a. How many kilometers has the left side of the Pacific basin spread in 2 million years?

    ___________kilometers

    b. How many kilometers has the left side of the North Atlantic basin spread in 2 million years?

    ___________kilometers

The distances in question 21 are for only one side of the ridge. Assuming that the ridge spreads equally on both sides, the actual distance each ocean basin has opened would be twice this amount.

22. How many kilometers has each ocean basin opened in the past 2 million years?

Pacific Ocean basin:	______kilometers
South Atlantic Ocean basin:	______kilometers
North Atlantic Ocean basin:	______kilometers

If both the *distance* that each ocean basin has opened and the *time* it took to open that distance are known, the rate of seafloor spreading can be calculated. To determine the rate of spreading in centimeters per year for each ocean basin, first convert the distance the basin has opened (see question 22) from kilometers to centimeters and then divide this distance by the time, 2 million years.

23. Determine the *rate of seafloor spreading* for the Pacific and North Atlantic Ocean basins. As an example, the South Atlantic has already been done.

    a. South Atlantic: distance =

    78 krn × 100,000 crn/krn = 7,800,000 ern

    Rate of spreading = $\frac{7{,}800{,}000 \text{ ern}}{2{,}000{,}000 \text{ yr}}$ = 3.9 crn/yr

    b. Pacific: distance = __krn × 100,000 crn/krn

    ________ ern

    Rate of spreading = $\frac{\text{\_\_\_\_\_\_\_\_ ern}}{\text{yr}}$

    __________crn/yr

    c. North Atlantic: distance =________krn

    × 100,000 crn/krn =_______________ern

    Rate of spreading = $\frac{\text{\_\_\_\_\_\_ ern}}{\text{yr}}$

    __________crn/yr

Hot Spots and Plate Velocities

Researchers have proposed that a rising plume of mantle material has formed a *hot spot* below the island of Hawaii (Figure 10.6). It is believed that the position of this hot spot within Earth has remained constant during a very long period of time. In the past, as the Pacific plate has moved over the hot spot, the successive volcanic islands of the Hawaiian chain have been built. Today the island of Hawaii is forming over this mantle plume.

Radiometric dating of the volcanoes in the Hawaiian chain has revealed that they increase in age with increasing distance from the island of Hawaii (see Figure 10.6). Knowing the age of an island and its distance from the hot spot, the velocity of the plate can be calculated.

Use Figure 10.6 to answer questions 24-26.

24. What are the minimum and maximum ages of the island of Kauai?

    Minimum age:______million years

    Maximum age:______million years

25. What is the distance of Kauai from the hot spot in both kilometers and centimeters?

    ___________kilometers

    ___________centimeters

26. Using the data in questions 24 and 25, calculate the approximate maximum and minimum velocities, in centimeters per year (crn/yr), of the Pacific plate as it moved over the Hawaiian hot spot.

    Maximum velocity:_________crn/yr

    Minimum velocity: crn/yr

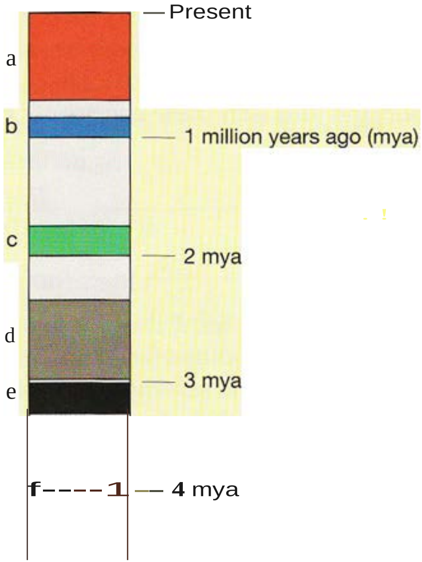

Figure 10.4 Chronology of magnetic polarity reversals on Earth during the last 4 million years. Periods of normal polarity, when a compass would have pointed North as **it** does today, are shown **in** color. Periods of reverse polarity are shown in white. (Data from Allan Cox and G. Dalrymple)

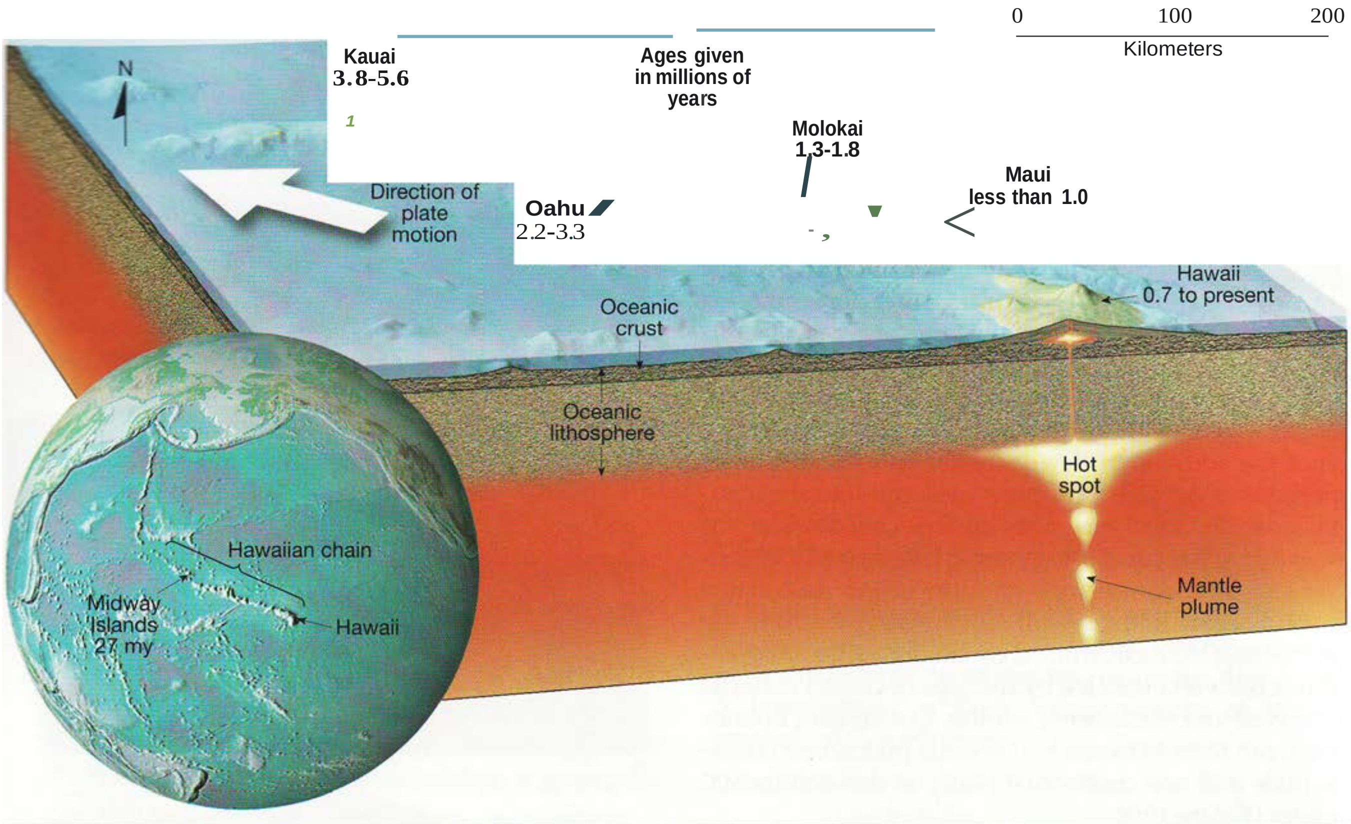

Figure 10.6 Movement of the Pacific plate over a stationary hot spot and the corresponding radiometric ages of the Hawaiian Islands in millions of years.