ESCI-1610: GEOLOGY OF THE NATIONAL PARKS

Cuyahoga Community College

Viewing: ESCI-1610 : Geology of the National Parks

Board of Trustees:
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Academic Term:
Fall 2024

Subject Code
ESCI - Earth Science

Course Number:
1610

Title:
Geology of the National Parks

Catalog Description:
This course is a thorough review of National Parks in the United states, their geologic history, present lithology and topography, and influences of geology and topography on climatic and biotic factors (and vice versa). Ecological and geologic problems that have arisen because of presence of humans in parks are highlighted. Through the framework of plate tectonics, students will become familiar with the geological and cultural processes that are responsible for the creation of National Parks, lakeshores, seashores and monuments.

Credit Hour(s):
3

Lecture Hour(s):
3

Lab Hour(s):
0

Other Hour(s):
0

Requisites

Prerequisite and Corequisite
ENG-0985 Introduction to College Literacies or appropriate score on English Placement Test.

Note: ENG-0980 Language Fundamentals I taken prior to Fall 2021 will also meet prerequisite requirements.

Outcomes

Course Outcome(s):
Apply the principles of geology to gain a better understanding of our national parks.

Essential Learning Outcome Mapping:
Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):
1. Describe the geologic processes that have operated and that continue to operate in the national parks.
2. Interpret topographic maps, aerial photos, and remote sensing images to understand the earth's landforms.
3. Describe the immensity of geologic time and relate to different geologic events that have occurred.
4. Locate plate boundaries and identify the plates and the types of boundaries that separate them.
5. Relate topography to erosional and depositional processes that occur in the park.
6. Describe the relationships that exist between topography, rock and soil types, plants, and animals.

7. Use minerals, rocks, rock structures, and fossils to decipher the geologic history of the park.
8. Recognize the type of and activity of volcanoes by their geomorphology and eruption types.
9. Explain development of major landforms and recognize and discuss the actions and interaction of water, ice, and wind on the earth's surface.
10. Outline the major pieces of evidence of the plate tectonic theory, comparing and contrasting park features across the nation
11. Identify and relate the scientific method to previous and current research relating to the National Parks and Monuments.

Course Outcome(s):

Apply the concepts of geology to current issues facing our national parks.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.
Civic Responsibility: Analyze the results of actions and inactions with the likely effects on the larger local and/or global communities.

Written Communication: Demonstrate effective written communication for an intended audience that follows genre/disciplinary conventions that reflect clarity, organization, and editing skills.

Objective(s):

1. Discuss the value of preservation of natural areas.
2. Relate the effect of environmental abuse on the environment and the importance of preservation.
3. Describe the effect of preservation on animal and plant life.
4. Identify and outline historic moments in various park systems.
5. Interpret and summarize current interdisciplinary research from National Park Scientists and bulletins.
6. Confront and Identify anthropogenic changes on the landscape.
7. Recognize the Native American history and heritage within the parks, as well as grass roots efforts to preserve and protect lands.

Methods of Evaluation:

1. Weekly quizzes on each Chapter
2. Article and Video Summaries/Syntheses weekly
3. Lecture exams (3)
4. Discussion boards (weekly)
5. Participation via video and audio responses
6. Final Project (in lieu of a final exam)
7. Field Trip to Cuyahoga Valley National Park

Course Content Outline:

1. Geologic time
    a. Unconformities
    b. Relative vs. absolute dating techniques
    c. Fossils and the importance to the geological record
    d. Methods of determining geological age
2. Plate tectonic theory
    a. Three main types of rock classifications, and the origins of each
        i. Sedimentary
        ii. Igneous
        iii. Metamorphic
    b. The rock cycle
    c. Magma generation
        i. Hydration melting
        ii. Decompression melting
    d. Isostasy and equilibrium
    e. Results of crustal deformation, folding, faulting
    f. Differences between a plate boundary and a fault
    g. Explain the concept of uniformitarianism to our geological concepts

   h. Three main types of Plate boundaries
      i. Convergent
      ii. Divergent
      iii. Transform
   i. Laramide Uplift
   j. Grenville Orogeny
3. Volcanism
   a. The defining characteristics of four types of volcanoes (all found at our Park of the Week)
   b. Types pf volcanic mountain chain
      i. Volcanic arcs (ancient and current)
      ii. Hotspot chains
      iii. Volcanic arc and forearc basin
   c. The properties of magma
      i. High and low silica lavas, composition and
      ii. Volcanic forms and associated magma contents
   d. Eruptive products of volcanoes, what does this mean and what are some examples
   e. Volcanic Hazards
   f. Magma contents and variability
      i. Components of magma
      ii. How the magmatic components control explosivity
      iii. Variations across space and time
   g. Methods of monitoring volcanic activity (lava dome changes on Mt St Helens)
   h. Volcanic features, composite, lava dome, calderas, craters
   i. Intrusive and extrusive igneous features
      i. Batholiths
      ii. Laccoliths
      iii. Dikes
      iv. Sills
   j. Basaltic floods
      i. Craters of the Moon
      ii. Devils Postpile NM
      iii. Bandalier
4. Earthquakes
   a. Epicenter vs. Focus
   b. Location and earthquake magnitude, correlations to plate boundaries
   c. Mercalli and Magnitude scales
   d. Instrumentation used to measure earthquakes
   e. Earthquake outputs, energy
      i. Compressional waves,
      ii. Shear waves and
      iii. Surface waves
   f. Describe geologic evidence of past earthquakes
5. Tectonic Settings
   a. Describe the tectonic settings of each National Park
   b. Physiographic Provinces
   c. Define accretionary wedge, and surface features
   d. Types of Convergence
      i. Continent/continent
      ii. Ocean/ocean
      iii. Continent/ocean
   e. Crustal buoyancy/isostatic equilibrium
   f. Ancient vs. active collisional zone
   g. Uplift, and resulting parks
   h. Methods of measuring elevation
      i. Remote sensing
      ii. Geodesy
6. Rifting
   a. The structure of and extensional, rifted landscape
   b. Horst and grabens

   c. Fault block mountains
   d. Escarpments
   e. Basin and range province
   f. Resulting landforms after rifting (deep lakes, and current dry beds)
   g. Columnar jointing
   h. Keweenawan rift zone
   i. Wilson Cycles, at all stages
   j. Mid ocean ridge
      i. Activity
      ii. Volcanism
      iii. Magma characteristics
7. Hot Spot/Mantle Plume Theory
   a. Oceanic hot spots
   b. Continental Hotspots
   c. Features associate with Hot spots, and landforms associate with each
      i. Volcanic Islands
      ii. Coral Reef/Atoll Development
      iii. Ecosystem Health/Ocean Acidification
      iv. Mudpots, fumaroles, hot springs, geyser
      v. Geothermal Gradients
      vi. Thermophilic bacteria
   d. The stages of island development
      i. Hawaii Volcanoes
      ii. Canary Islands (as an example)
   e. Features along hot spot tracks
8. The Continental Craton
   a. Terms associated
      i. Platform
      ii. Shield
      iii. Cordillera
   b. History of major Cratons
   c. Identification of earths major cratons/shields
   d. Identify and describe the western interior Seaway
   e. Direction of continental growth
9. Orogenic Events
   a. Appalachian mountain range/creation of Iapetus Ocean basin
   b. Explain a soft vs. hard collision (tectonics)
   c. Explain and identify the valley and ridge, blue ridge, piedmont and coastal plain
   d. Describe the geological setting of the Appalachian mountains
   e. Faults vs folds
      i. Reverse faults
      ii. Thrust faults
      iii. Hanging wall/foot wall
      iv. Valley and ridge system (fold and thrust)
      v. Joints/jointing
   f. Foreland basement uplifting
10. Transform boundaries
   a. Locations of these boundaries (California and Caribbean)
   b. Surface features associated with transform boundaries, sheared landscapes,
   c. Strike skip faults, rock structures, narrow bays
   d. Relative motion of right lateral and left lateral strike skip
   e. Transverse ranges, their formation and definition (Channel Islands)
   f. Jointing (in rock)
11. Glaciation
   a. Glacial Periods (glacial and interglacial periods)
   b. Sea level
      i. Rise and Fall
      ii. How sea level is measured

iii. Active vs passive margins
iv. Eustasy
c. Current glacial extent
d. Features resulting from Glaciation
i. Erosional
1. Striations
2. Outwash
3. Aretes
ii. Depositional
1. Erratic's,
2. Drumlins
3. Eskers
4. Moraines
5. Kettle lakes
6. Glacial till
iii. V vs U shaped valleys
e. Features of glaciers
f. Identify glaciated areas of the US, and parks
i. Gates of the Arctic
ii. Isle Royale
iii. Glacier NP
iv. Olympic NP
v. Cuyahoga Valley and the Great Lake system
vi. Katmai NP

12. Karst Landscapes and Geomorphology
a. Describe the geologic history of cave systems (they were covered by a shallow sea at one point in time)
b. Define Karst
i. Topography
ii. Rock types associated with karst
iii. Depostional features
1. Speleothems
2. Helictites
3. Sinkholes
c. Formation of cave systems and what karst means
d. Identify Karst Landscapes
i. Mammoth Cave NP
ii. Everglades NP
iii. Cumberland Gap

13. Erosional and Depositional Features, Aeolian landscapes
a. Surficial geology, features and definitions
b. Aeolian Landscapes
i. Cross bedding
ii. Arches
iii. Badlands
iv. Loess
v. Ventifacts
vi. Yardangs and hoodoos
c. Topography of Badlands
d. National parks including features
i. Pinnacles NP
ii. Badlands NP
iii. White Sands NP
iv. Death Valley NP

14. Human, cultural and anthropogenic influences
a. Human history in the park
b. Early inhabitants and their use of park resources
c. Birth of the National Park System
d. People influential in having the area preserved as a park
e. Cultural and Archaeological Evidence in the Parks

15. Ethics and Human Responsibility
    a. Present threats to the parks because of the presence of humans
    b. Responsible visits to National Parks
        i. Adhering to leave no trace
        ii. Honoring closures and other regulations

Resources

Lillie, Robert J. *Parks and Plates: The Geology of Our National Parks, Monuments, and Seashores*. New York : W.W. Norton, 2005.

David A. Foster, David Hacker, Ann G Harris . *Geology of National Parks*. 8th ed. Dubuque, IA: Kendall/Hunt Publishing, 2022.

Harris, David V., and Eugene P. Kliver. *The Geology of US Parklands*. 5th ed. New York: John Wiley and Sons, 1999.

Ann G. Harris; David Hacker, and David Foster. *Geology of the National Parks*. 7th. Kendall Hunt , 2019.

Johnson, Chris, Matthew D. Affolter, Paul Inkenbrandt, and Cam Mosher. *An Introduction to Geology (free opensource textbook)*. Salt Lake Community College, 2017. https://opengeology.org/textbook/

Osleger, David. *Geology and Landscapes of America's National Parks*. Oxford University Press, 2021.

Resources Other

1. Google Earth Application

Instructional Services

OAN Number:

Ohio Transfer 36 TMNS

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