



Geography of Ethiopia and the Horn (GeES 1011)

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Unit 1 Introduction

Unit Contents

- 1.1. Definition, Scope and Themes of Geography
- 1.2 Location, Shape and Size of Ethiopia and the Horn
- 1.3. Basic Skills of Map Reading



Chapter One

Chapter Objectives

At the end of this chapter you are expected to:

1. *Comprehend the meaning and scope of Geography.*
2. *Explain the themes of Geography.*
3. *Explicate the implications of location, shape and size of Ethiopia and the Horn on the physical environment, socioeconomic and political aspects.*
4. *Acquire basic skills of map reading.*



CHAPTER ONE

INTRODUCTION

□ Geography: Definition, Scope and Themes

1.1.1. Meaning of Geography

Activity 1.1

1. Define Geography.
2. Could you mention the major themes of Geography?
3. Do you know where the Horn of Africa is located? What are the member states of the Horn of Africa?
4. Distinguish between astronomical and relative locations?

✓ It is difficult to forward a definition acceptable to all geographers at all times and places because of the dynamic nature of the discipline and the changes in its scope and method of study.



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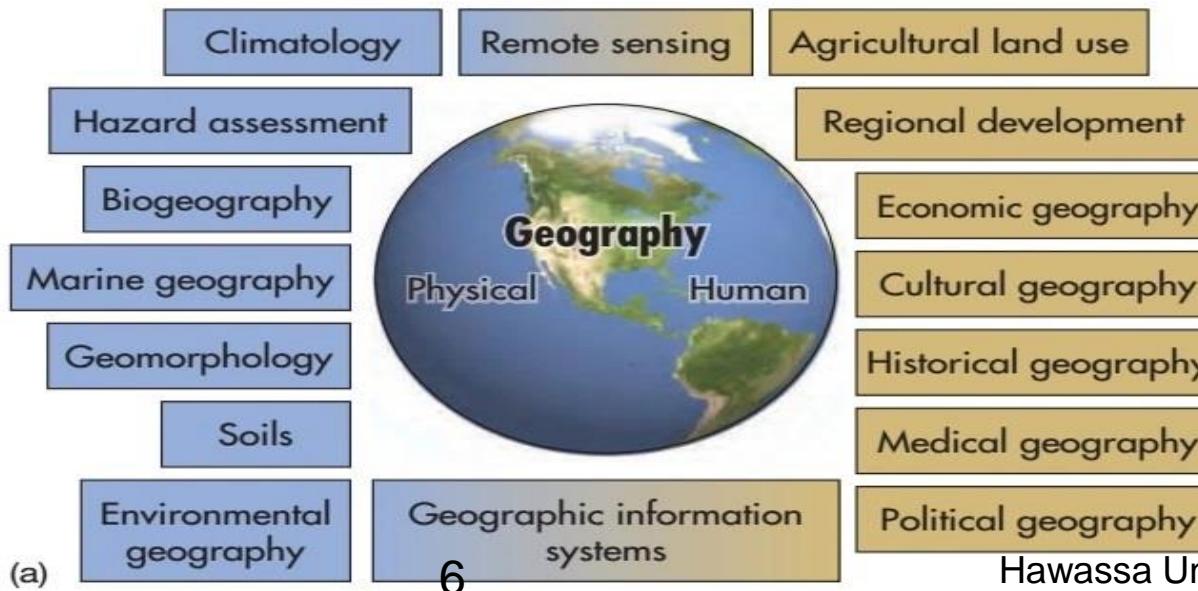
- ✓ However, the following may be accepted as a working definition.
- ✓ Geography is the **scientific study of the Earth**
- ✓ It describes and analyses spatial and temporal variations of **physical**, **biological** and **human phenomena**, and their interrelationships and dynamism over the surface of the Earth.

1.1.2. The Scope, Approaches and Themes of Geography

- ✓ Geography is the science that explains:
 - the arrangements of various natural and cultural features on the Earth surface.
- ✓ It is a holistic and interdisciplinary field contributing to:
 - ✓ the understanding of the **changing spatial structures from the past to the future**.

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- ✓ In its scope, it ranges from the physical sciences of Astronomy, climatology, Geology through natural histories of Botany and Zoology to the **human studies** of Anthropology, Ethnology, Sociology and History.
- ✓ Geography can be approached by considering two continuums:
 - ✓ a physical-human continuum and,
 - ✓ a topical-regional continuum.





Cont'd ...

- ✓ The topical (systematic) continuum: the study of one particular topic of physical or human analysis as it varies from place to place. Examples would include such topical approaches as Economic Geography, Cultural Geography, and Urban Geography.
- ✓ The Regional Continuum: The study of a particular region, both its human and environmental attributes. Geographers tend to focus their interests on certain regions, like East Africa or Africa, as an example.

Five Fundamental and Unifying Themes in Geography

- ✓ Geography has five basic themes namely ***location, place, human-environment interaction, movement, and region.***



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a) Location

Two types of location-

- Relative
- Absolute
- **Relative Location:** is based on the location of some physical or human created feature. Where something is located is based on the location of other things.
- **Absolute Location:** Based on a coordinate grid system that gives a precise location on the earth's surface. The most common coordinate grid system used is the **latitude-longitude coordinate** grid system found on most maps and globes.



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b) Place

- Place refers to the physical and human aspects of a location.
- This theme of geography is associated with toponym (the name of a place), site (the description of the features of the place), and situation (the environmental conditions of the place).
- Each place in the world has its unique characteristics expressed in terms of landforms, hydrology, biogeography, pedology, characteristics and size of its human population, and the distinct human cultures.
- The concept of “place” aids geographers to compare and contrast places on Earth.



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C) Human-Environment Interaction

- ✓ Humans have always been on ceaseless interaction with their natural environment.
- ✓ Human-environment interaction involves three distinct aspects:
 - ☞ dependency, adaptation, and modification.
 - ☞ Dependency: refers to the ways in which humans are dependent on nature for a living.
 - ☞ Adaptation: relates to how humans modify themselves, their lifestyles and their behavior to live in a new environment with new challenges.
 - ☞ Modification: allowed humans to “conquer” the world for their comfortable living.



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d) Movement

- ✓ It entails to the translocation of human beings, their goods, and their ideas from one end of the planet to another.
- ✓ It includes:
 - ☞ The physical movement of people
 - ☞ Transport of goods and services
 - ☞ flow of ideas that allows the unification of the human civilization and promotes its growth and prosperity.

e) Region

- ☞ Is an area of the earth's surface with similar characteristics.



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- ✓ Regions usually have more than one characteristic that unifies them. These may include physical, political, economic or cultural characteristics.
- ✓ **Geographers categorize regions into three:**
 - a) **Formal (Uniform) Regions:** characterized by a **common human property**. E.g. presence of people who share a language, religion, nationality, and political identity; and common physical property such as climate, landform, vegetation. They are **based on measurable data**.
 - b) **Functional (Nodal) regions:** are regions that is made up of **different places that are linked and function as a unit**.
 - ☞ Usually a functional region is characterized by a hub or central place, and defined by the linkages binding particular phenomena.
E.g. Addis Ababa is the center of Ethiopia linked with other regions.



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C) Perceptual Regions

- ✓ Is a region in which people perceive, or see the characteristics of a region in the same way.
- ✓ These regions are based on human feelings and attitudes.
- ✓ E.g. “Piassa” is the middle of Addis Ababa.



1.2 Location, Shape and Size of Ethiopia and the Horn

✓ Location of Ethiopia

✓ Astronomical location /mathematical location/,

- Ethiopia located:
 - 3°N (Moyale) – 15°N (Badme) Latitude (North-South 12°)
 - 33°E (Akobo) to 48°E (the tip of Ogaden) (East- West 15°)
- East - West distance (15°) is longer than the North - South distance (12°).



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✓ Relative location:

Vicinal location	In relation to water bodies & land masses
✓ Sudan to the west and northwest	✓ Southwest of the Arabian Peninsula
✓ South Sudan to southwest	✓ Northwest of the Indian Ocean
✓ Djibouti to the east	✓ In the Nile Basin
✓ Somalia to the east and southeast	
✓ Eritrea to the north and northeast	
✓ Kenya to the south	

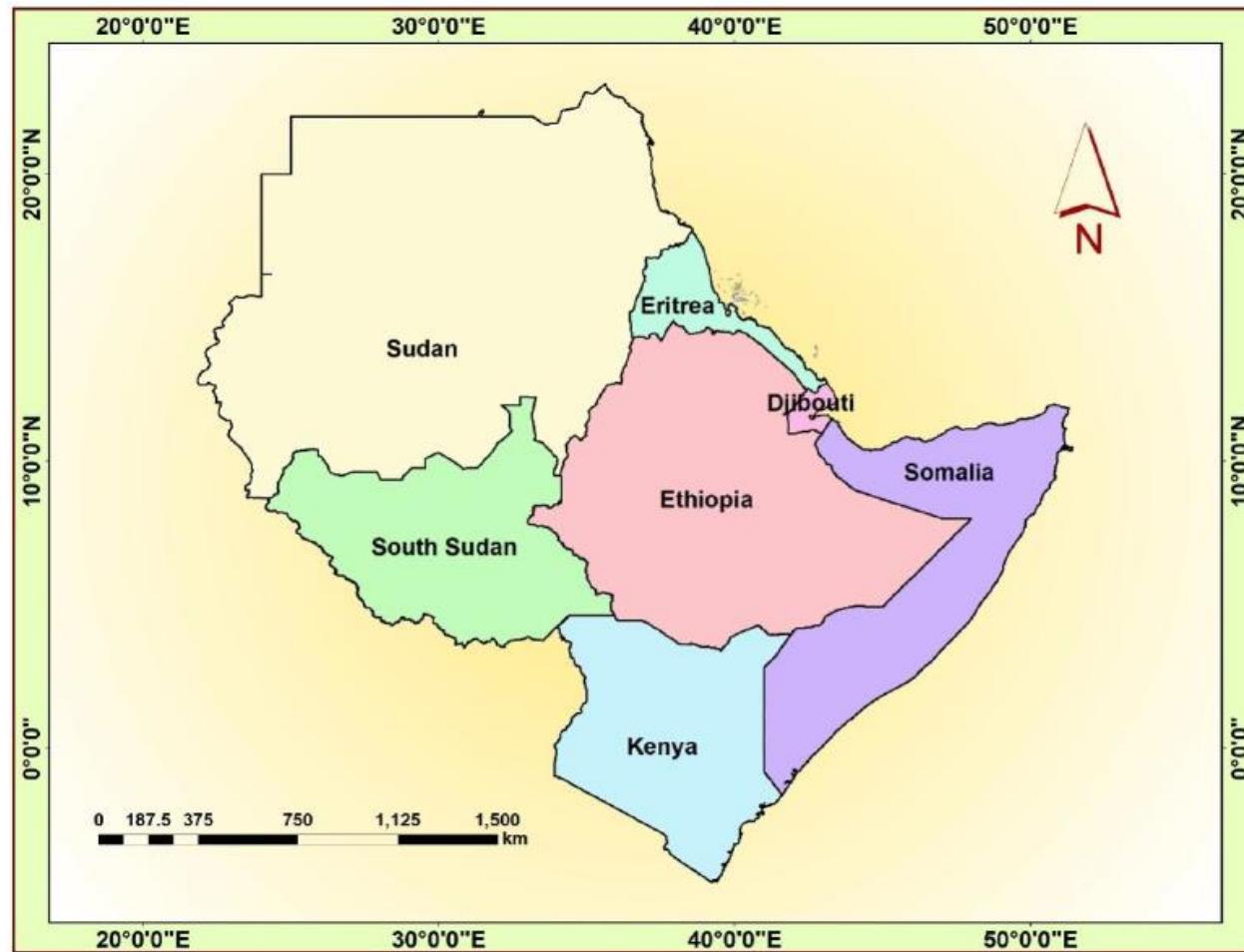


Figure 1.1.Ethiopia's location in relation to its neighboring countries

Source: Africa Map Library



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The implications of Ethiopian location, Size, shape

a) Climate

- ✓ 3°N and 15°N (between the Equator and Tropic of Cancer) implies that the country has a tropical climate, though modified by its altitude.
- ✓ The location of Ethiopia relative to the Indian Ocean, the Atlantic Ocean and the African and Asian landmass has also various bearings on the climate of Ethiopia.

b) Socio-cultural

- ✓ Ethiopia is one of the earliest recipients of the major world religions namely
 - ✓ Christianity,
 - ✓ Islam and
 - ✓ Judaism
- This due to its proximity to the Middle East
- The linguistic and other cultural relationships, which Ethiopia shares with its neighbors, reflect the influence of location.



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C) Political

- ✓ The political history of Ethiopia has been considerably influenced by:
 - ☞ Geopolitical considerations of superpowers.
 - ☞ Adjacency to the Red Sea (a major global trade route).
 - ☞ The Middle East geopolitical paradigms.
- ✓ As a result, Ethiopia has been exposed for external invasions in a number of times; though the country resisted foreign intervention and remains free of external domination.

d) Size of Ethiopia

- ✓ Ethiopia with a total area of approximately 1,106,000 square kilometers is the 8th largest country in Africa and 25th in the World.



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- It extends about 1,639 kilometers East-West, and 1,577 kilometers North-South.
- About 0.7% of the country is covered by water bodies.

Table: Advantages and disadvantages of Ethiopia's large size

Advantages	Disadvantages
Possess diverse agro ecological zones	Demands greater capital to construct infrastructural facilities
Variety of natural resources	Requires large army to protect its territory
Own extensive arable land	Difficult for effective administration
Have larger population size	Difficult for socio-economic integration
Home for diverse cultures	
Greater depth in defense external invasion	



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The shape of Ethiopia and its Implication

- ✓ Countries of the World have different kinds of shape that can be divided into five main categories:
 1. Compact: Poland, Burundi, Kenya, Uganda
 2. Fragmented: Philippines, Indonesia
 3. Elongated, Chile, Gambia
 4. Perforated: South Africa
 5. Protruded. Eretria Myanmar
- ✓ These shapes have implications on defense, administration and economic integration within a country.



Cont'd ...

- Compact shape countries: The distance from the geographic centre of the state to any of the borders does not vary greatly. It is easier for defence, socioeconomic and cultural integration.
- Fragmented shape countries: They are divided from their other parts by either water, land or other countries. E.g. Philippines.

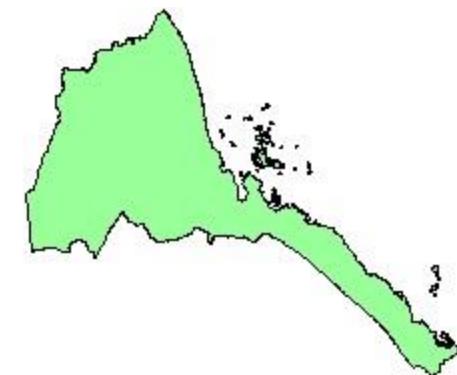


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- **Elongated shape countries:** They are geographically long and relatively narrow like Chile.
- **Perforated shape countries:** A country that completely surrounds another country like the Republic of South Africa.



In the Middle there is one independent country called Lesotho.



- **Protrude shape countries:** Countries that have one portion that is much more elongated than the rest of the country like Myanmar and Eritrea.



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- ✓ There are various ways of measuring shape of countries, known as the indices of compactness.
- ✓ It measure the deviation of the shape of a country from a circular shape.
- ✓ There are four most commonly used measures of compactness. These are:

1. ***The ratio of area of country to its boundary length:***

- It is also called Area-Boundary ratio.
- The higher the A/B ratio, the greater the degree of compactness and the smaller A/B ratio , the lesser the degree of compactness
- A border/area ratio of zero indicates that the country has no land borders.



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2. **Boundary-Circumference ratio.** It measures how far the boundary of a country approximates the circumference of a circle of its own size.
3. **Area-Circumference ratio.** It compares the area of the country with the circumference of a circle that passes touching the extreme points on the boundary of the country. The higher the A/C ratio, the greater the degree of compactness.
4. Area-Area (A/A'') ratio. The area of the inscribing circle is the area of the smallest possible circle whose circumference passes through the extreme points on the boundary. The nearer the ratio to 1, the more compact the country is.



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Table: Ethiopia's shape compared to its neighbors in the Horn

Country	Area(km ²)	Boundary (km)	A/B ratio	B/C ratio	A/C ratio
Ethiopia	1,106,000	5,260	210.27	1.41	296.61
Djibouti	22,000	820	26.83	1.56	41.83
Eritrea	117,400	2,420	48.51	1.99	96.83
Kenya	582,644	3,600	161.85	1.33	215.28
Somalia	637,657	5,100	125.03	1.80	225.22



1.3. Basic Skills of Map Reading

- A map is a two-dimensional scaled representation of part or whole of the Earth surface on a flat body such as piece of paper, black board, wood or cloth.
- Map reading encompasses a systematic identification of natural features and manmade features.
- Natural features include mountains, plateaus, hills, valleys, river, ocean, rocks, plain etc.
- .



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- On the other hand, manmade features include roads, railway, buildings, dam etc.
- Although many disciplines use maps, they have a special significance for Geographers as primary tools for displaying and analyzing spatial distributions, patterns and relations.
- Since these features cannot easily be observed and interpreted in real landscapes, maps are essential to Geographers



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Importance of maps

- ✓ Provide the basis for making geographical details of regions represented i.e. the geographical facts of an area such as relief, drainage, settlement etc.
- ✓ Powerful tools for making spatial analysis of geographical facts of areas represented.
- ✓ Useful for giving location of geographical features by varied methods of grid reference, place naming etc.
- ✓ Maps are used on various disciplines like land use planning, military science, aviation, tourism, marine science, population studies, epidemiology, geology, economics, history, archaeology, agriculture etc.
- ✓ Map makes storage of the geographical data of areas represented.
- ✓ Maps are potentially used to assess reliable measurements of the geographical features.
The measurements can be of area size, distance etc.



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Types of Map

- ✓ There are many types of maps according to their purpose and functions. For now, only topographical and statistical maps are considered .
- A. Topographical maps: Topographic maps depict one or more natural and cultural features of an area.
 - ✓ They could be small, medium or large scale depending on the size of the area represented.
 - ✓ Contents of topographical maps depend on purpose of a map, scale of a map, date of compilation, and nature of the land represented.
- B. Special purpose/statistical maps: These are maps, which show distribution of different aspects such as temperature, rainfall, settlement, vegetation etc.



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Marginal Information on Maps (Elements of Maps)

- ✓ **Title, Key, Legend, Scale, North Arrow, Margin, Date of compilation.**

Basic Principles of Map Reading

- ✓ The first symbols introduced should be those, which refer to landscape features of which the reader already has some images.
- ✓ Secondly, knowledge of directions is an important principle in reading maps.
- ✓ Maps are covered in a series of lines that make up a grid. This description, which will be a series of numbers, is known as a grid reference.



Basic Principles of Map Reading

- Map Readers must have ideas about the symbol and also the real World (landscapes).
- Every map symbol must be visualized by the reader to read a map.
- **Land scape features**
- The first symbols introduced should be those, which refer to **landscape features** of which the reader already has some images.
- Map symbols should be introduced as needed.
- E.g. Mountains, rivers, lakes



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- **Direction**
- Secondly, **knowledge of directions is an important principle** in reading maps.
- One of the basic functions of maps is to help us to orient ourselves and to locate places on the earth.
- Unless a reader knows the basic directions, he or she may not use a map effectively.
- Before locating features using a map, north (the north arrow) should be determined and the readers should have practice in finding this direction.
- Next they should learn to read direction on a specific map and the location of the features shown on the map in relation to one another.



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- **Grid lines**
- Maps are covered in a series of lines that make up a grid.
- The lines have numbers accompanying them that allow you to accurately pinpoint your location on a map.
- Once you have located where you are, the grid system makes it simple to give an accurate description of your location.
- This description, which will be a series of numbers, is known as a grid reference.



Review Questions

Answer the following questions briefly.

1. What are the implications of location, shape and size of Ethiopia and the Horn on the physical environment, socioeconomic and political aspects?
2. Explain the themes of Geography.
3. What are the basic principles of map reading?



Chapter Two

THE GEOLOGY OF ETHIOPIA AND THE HORN



Chapter Contents

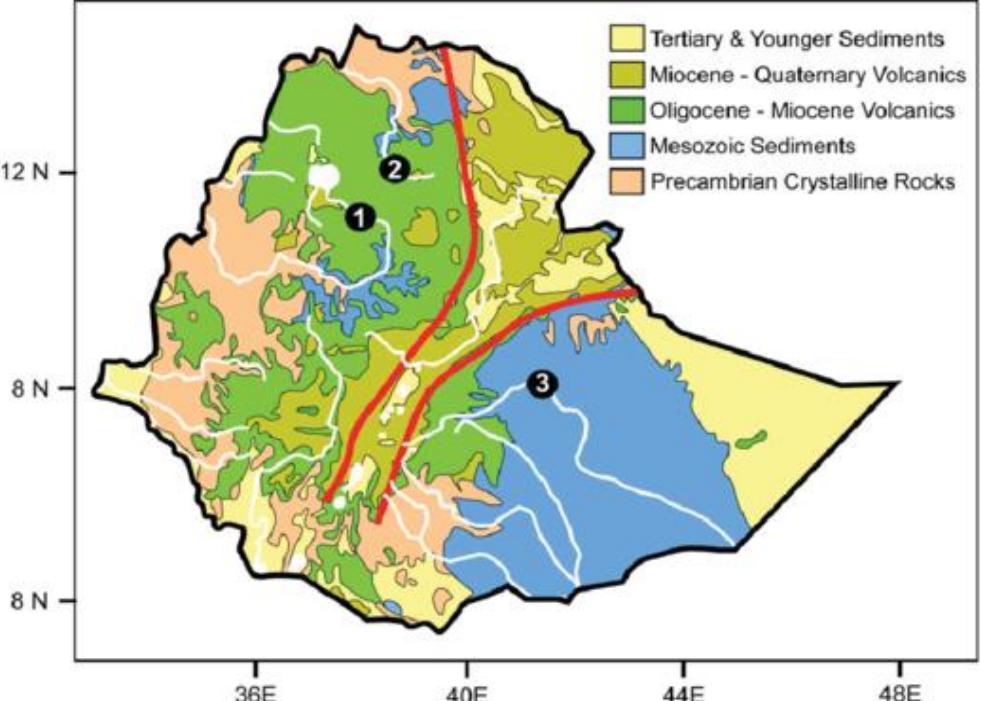
- 2.1. Introduction
- 2.2. The Geologic Processes: Endogenic and Exogenic Forces
- 2.3. The Geological Time Scale and Age Dating Techniques
- 2.4. Geological Processes and the Resulting Landforms of Ethiopia and the Horn
 - 2.4.1. The Precambrian Era Geologic Processes (4.5 billion - 600 million years ago)
 - 2.4.2. The Paleozoic Era Geologic Processes (600 million - 225 million years ago)
 - 2.4.3. The Mesozoic Era Geologic Processes (225-70 million years ago)
 - 2.4.4. The Cenozoic Era Geologic Processes (70million years ago - Present)
- 2.5. Rock and Mineral Resources of Ethiopia
 - 2.5.1. Brief Facts and Current State of Main Minerals in Ethiopia
 - 2.5.2. Mineral Potential Sites of Ethiopia



Chapter Two

Chapter Objectives

1. Analyze the geologic processes and the resultant land forms of Ethiopia and the Horn.
2. Examine the formation of the Rift Valley.
3. Recognize the current status of Ethiopian mineral endowment associated with geologic processes.





2.1. Introduction

- **Definition:** Geology is an earth science that deals with the evolution of the earth processes that shape the earth's surface.
- **Much of Geology is concerned with events that**
- took place in the remote past when no one was around to witness them and
- are far beneath the earth's surface where no one can see them
- ***The clues to study Geology includes:***

Geophysics: studying earthquake waves

Geochemistry: analysis of the detailed composition of rocks

Geochronology: methods for finding the ages of rocks

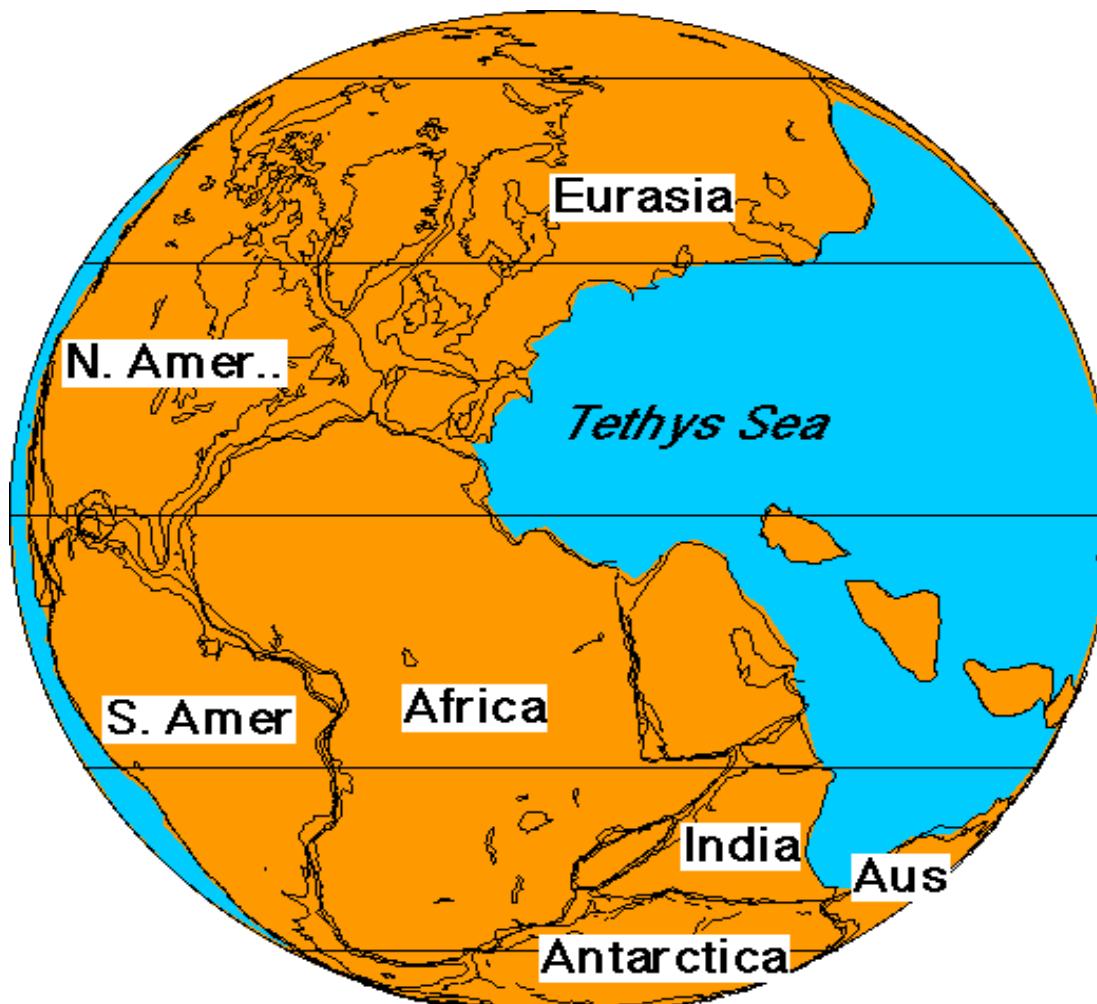


2.1. Introduction

- *The earth's continents were once bunched up together in to a single huge continent (Pangaea)*
- Pangaea was then split into Gondwanaland where Africa is a part and Laurasia; and
- later into smaller fragments over the last million years.
- Then gradually drifted apart to form the present arrangement of continents.



2.1. Introduction



Pangea 245 m.y.



2.1. Introduction





2.1. Introduction

Continental drift Theory

- proposed by an Australian Climatologist Alfred Wegener
- is about the assembling of continents together and formed a supercontinent

His principal observations includes:

- *Fit of the continents*
- *Match of mountain belts, rock types*
- *Distribution of fossils*
- *Paleoclimates*



2.1. Introduction

CONTINENTAL DRIFT OF PLATES



225 Million Years Ago



150 Million Years Ago



100 Million Years Ago



Earth Today

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2.2. Geological Processes: Endogenic and Exogenic Forces

- Geology studies of how Earth's materials, structures, processes and organisms have changed over time

These processes are divided in to two major groups:

1. Internal (Endogenic)
2. External (Exogenic) processes.



2.2. Geological Processes...

I. The internal processes (endogenic)

- Are volcanic activity and all tectonic processes like folding, faulting, rifting, warping & sinking.
- **Orogenesis** (mountain building) & **epeirogenesis** (slow rising and sinking of the landmass)
- These geologic forces build up various landforms such as mountains, plateaus, depressions, etc

2. The external processes (exogenic),

- Are on the contrary, act upon the deformed landscapes by sculpturing (smoothing) and leveling.
- The major processes are weathering, denudation, deposition, peneplanation and mass movement.
- These two forces operate over the surface of the earth and likely over Ethiopia.



2.3. The Geological Time Scale & Age Dating Techniques

- The geological history is divided in to Eras.
- Each Era is divided into periods.
- The Eras are given names that indicate the kind of life that existed in them
- **Example:** Paleozoic Era: ancient life
- Cenozoic Era: recent life and so on



2.3. The Geological Time Scale ...

Geological Time divisions differ one another by:

- relative position of land and sea
- kind of climate
- the kind of animal and plant life

The geological time scale measures time on a scale involving four main units:

1. An *epoch*: smallest unit of time on the scale & millions of years
2. Chronologically, epochs are clumped together into larger units called *periods*
3. Periods are combined to make subdivisions called *Eras*
4. An *eon* is the largest period of geological time

Table 2.1: The Geological time scale

Era	Period	Began (in Million Years)	End (my)	Major Events (million years ago)
Cenozoic	Quaternary	1.6	Present	Major glaciers in North America and Europe (1.5)
	Tertiary	70	1.6	Rocky Mountains (65), individual continents take shape.
Mesozoic	Cretaceous	146	70	Dinosaurs extinct (65), western interior seaway and marine reptiles (144 – 65)
	Jurassic	208	146	Pangaea (one land mass) begins to break up (200)
	Triassic	225	208	First mammals and dinosaurs
Paleozoic	Permian	290	225	Greatest extinction on Earth (245)
	Pennsylvani an	322	290	First reptiles
	Mississippi an	362	322	Coal-forming forests
	Devonian	408	362	First land animals and first forests (408)
	Silurian	439	408	Life invades land
	Ordovician	510	439	First fish appeared
	Cambria	600	510	Great diversity of marine invertebrates
Precambrian	Proterozoic	2,500	600	Marine fossil invertebrates (600)
	Archean	4,500	2,500	Earliest fossils recorded (3,500), earliest rock formation (4,000)



2.3. The Geological Time Scale ...

Age Dating Techniques

- Two techniques of knowing the age of rocks:
- Relative and absolute age dating
- **Relative Dating**
 - uses geological evidence to assign comparative ages of fossils
- **Two ways of relative dating**
 - 1. to look at any fossils the rock may contain
 - 2. to use the "What is on top of the older rocks?"
- **Demerit:** these two methods only give the relative age of rocks -which one is younger and which is older.



2.3. The Geological Time Scale ...

Absolute Dating

- Also said Radiometric techniques
- was developed with discovery of radioactivity in 1896
- The regular rates of decay for unstable, radioactive elements were found to constitute virtual “clocks” within the earth’s rocks
- Examples: Uranium [U] & Thorium [Th]
- Every radioactive element has its own half-life



2.3. The Geological Time Scale ...

- **Two major techniques are:**
- ***Carbon-14 Technique:***
- Upon the organism's death, carbon-14 begins to disintegrate at a known rate, and no further replacement of carbon from atmospheric carbon dioxide can take place.
- Carbon-14 has half-life of 5730 years.



2.3. The Geological Time Scale ...

B. Potassium-Argon Technique:

- *The decay is widely used for dating rocks.*
- *Geologists are able to date entire rock samples in this way, because potassium-40 is abundant in micas, feldspars, and hornblendes.*
- *Leakage of argon is a problem if the rock has been exposed to temperatures above 125° C (257° F), because the age of the rock will then reflect the last episode of heating rather than the time of original rock formation.*



2.3. The Geological Time Scale ⋯

NUMERICAL DATING

Relative Dating

tells us the age of Rock A
compared to Rock B

Numerical Dating

tells us the age of Rock A
in X number of years



2.4. Geological Processes and the Resulting Landforms of Ethiopia and the Horn

- Since the time of our earth appeared as a planet in the solar system (about 4.5 billion years ago) four major geological eras have elapsed/
- There had been different geological & biological events in these eras.
 1. Precambrian era (4.5 billion-600 million years ago)
 2. Paleozoic era (600-225 million years ago)
 3. The Mesozoic era (225-70 million years ago)
 4. Cenozoic Era (70 million years ago – present)



2.4. Geological Processes and the Resulting...

a) **Precambrian era (4.5 billion-600 million years ago)**

- It is the *oldest* and *longest* geological era covering 5/6th of the earth's geological time scale.
- This era was characterized by *repeated Orogenic episodes (mountain building)*. i.e. the land was subjected to *intense folding & accompanied by intrusive igneous activity*.
- Due to continuous denudation (wearing away) of the covering rocks, these mountains are reduced to near-level (peneplained) rock surfaces.
- the other rocks, forming the basement rocks.



2.4. Geological Processes and the Resulting...

- This “leveled” surfaces of the Precambrian era were latter (in the Mesozoic & Cenozoic eras) covered by younger rocks formations
- Thus, in most parts of Ethiopia, rocks belonging to Precambrian era are found beneath all
- Since they have been subjected to *pressure and heat from overlying weight, earth movements (folding, orogenesis) and to intrusive igneous activity*, the original rocks (both **sedimentary & igneous**) were altered into **metamorphic rocks** of varying stages of metamorphism.



2.4. Geological Processes and the Resulting...

- Today, in a few areas of Ethiopia, outcrops of *old crystalline basement complex rocks* are found on the surface, due to continuous denudation.
- **Example:**
 - I. In the western Part: Gambella, Benishangul-Gumuz (Metekel and Asossa), western Gojjam, western Wellega, Illuababora, and Abay gorge.
 2. In the southern Part: Guji, southern Omo, and parts of southern Bale and Borena.
 3. In the eastern part: Eastern Hararghe.
- During Precambrian era *structural formation* had also taken place



2.4. Geological Processes and the Resulting...

b) Paleozoic era (600-225 million years ago)

- *Denudation and peneplanation* was the major geological processes of this era.
- The gigantic mountains that were formed by the Precambrian orogeny were *subjected to intense & prolonged denudation*.
- The *sediments were transported* southward and eastward to form *continental (in Africa)* and *marine deposits*, respectively.
- Because of the *limited deposition within Ethiopia*, rocks belonging to this era are *rare in the country*.
- This was *the era when no structural formation (mountain building) took place*.
- The Paleozoic era is known for the *predominance of invertebrates*.



2.4. Geological Processes and the Resulting...

C) The Mesozoic era (225-70 million years ago)

- The most important geological occurrences of the Mesozoic era in the Horn were the sinking and uplifting of the landmass
- This era has three periods

Periods	Geological time scale
Cretaceous	70 m
Jurassic	142 m
Triassic	250 m



2.4. Geological Processes and the Resulting...

- In the *Triassic Period*, the landmass sank due to internal forces.
- This event was followed by *transgression* of a nearby sea into the mainland of today's *Somalia*, and *southeastern Ethiopia*.
- During the Triassic Period, the *oldest sedimentary rock* known as *Adigrat sandstone* was formed.



2.4. Geological Processes and the Resulting...

- In the **Jurassic Period**, the *transgression of the sea continued into the mainland in the northwest direction*.
- This event *deposited another sedimentary rock known as Hintalo limestone*.
- In the **Cretaceous Period**, the landmass began to rise and the sea started to regress towards the southeast, depositing sedimentary rock known as *Upper Sandstone*.
- Upper Sandstone is the *youngest sedimentary rock*, and therefore overlies the rest.



2.4. Geological Processes and the Resulting...

- The Mesozoic Era was an *era of sedimentary rock formation in Ethiopia and the Horn*.
- The Mesozoic is also *known for the predominance of reptiles*.
- Huge reptiles, such as **dinosaurs**, were dominant.
- However, *at the end of this era*, two other significant biological events occurred:
- Dinosaurs disappeared, and mammals, birds and flowering plants emerged.
- Mesozoic rocks are considered to have the greatest potential for oil and gas deposits



30°0'0"E

37°0'0"E

44°0'0"E



8°0'0"N

8°0'0"N

Lake**Mineral Potential sites**

High Grade Migmatites

Low Grade Volcano Sedimentary

Mesozoic Sediments

Quaternary Superficial Deposite

Quaternary Volcanos with Associated Sediments

Tertiary Deposits

Tertiary Volcanics

0 87.5 175 350 525 700 kms

30°0'0"E

37°0'0"E

44°0'0"E

Figure 2.1. Geological map of Ethiopia Source: CSA Shapefile, 2012



2.4. Geological Processes and the Resulting...

d) Cenozoic Era (70 million years ago – present)

- It is the most *recent of the geologic eras*.
- The tectonic and volcanic activities that took place in this era have an *important effect in the making of the present-day landmass of Ethiopia and the surrounding areas*.
- Very significant *structural, climatic and biological events* have occurred in the Horn
- the uplifting that began in the Cretaceous Period of the Mesozoic Era *continued and reached its maximum height*.



2.4. Geological Processes and the Resulting...

Major geologic structures events that took place during this time include:

- a. Uplifting of the Arabo-Ethiopian landmass and outpouring of huge quantity of lava.
- b. Formation of the Rift Valley.
- c. Quaternary volcanism and deposition.



2.4. Geological Processes and the Resulting...

a) Tertiary Period (70 million - 2 million years ago)

- In Ethiopia and the Horn it formed *huge blocks of dome over the greater part of the region*.
- As the uplifting continued through time, *great cracks opened in the crust and resulted in the pouring out of extensive basaltic lava* (known as the *Trappean lava series*).
- The lava resulted in the formation of:
 - *The Eritrean Highlands, The Northwestern Highlands, The Southeastern Highlands, and The Somali plateaus*
 - As the cracking continued during the period, it formed the *Great East African Rift Valley System* of which the *Ethiopian Rift Valley System is part*.



Great East African Rift Valley System





2.4. Geological Processes and the Resulting...

- ***The spatial extents of the Rift Valley***
- The Ethiopian Rift valley is part of the Great Rift Valley distance of about 7200 km.
- Of these *5,600 km is in Africa and 1,700kms in Eritrea and Ethiopia.*
- On land, the *widest part of the rift valley is the Afar Triangle (200-300 km)*

The formation of the rift valley has the following structural effects.

1. Divide the Ethiopian plateau in to two
2. Separate the Arabian landmass from African landmass
3. Caused the formation of dead sea, Red Sea and Gulf of Aden troughs
4. Created basins and fault depressions on which the Rift Valley lakes were formed



2.4. Geological Processes and the Resulting...

b) Quaternary Period (2 million - recent years)

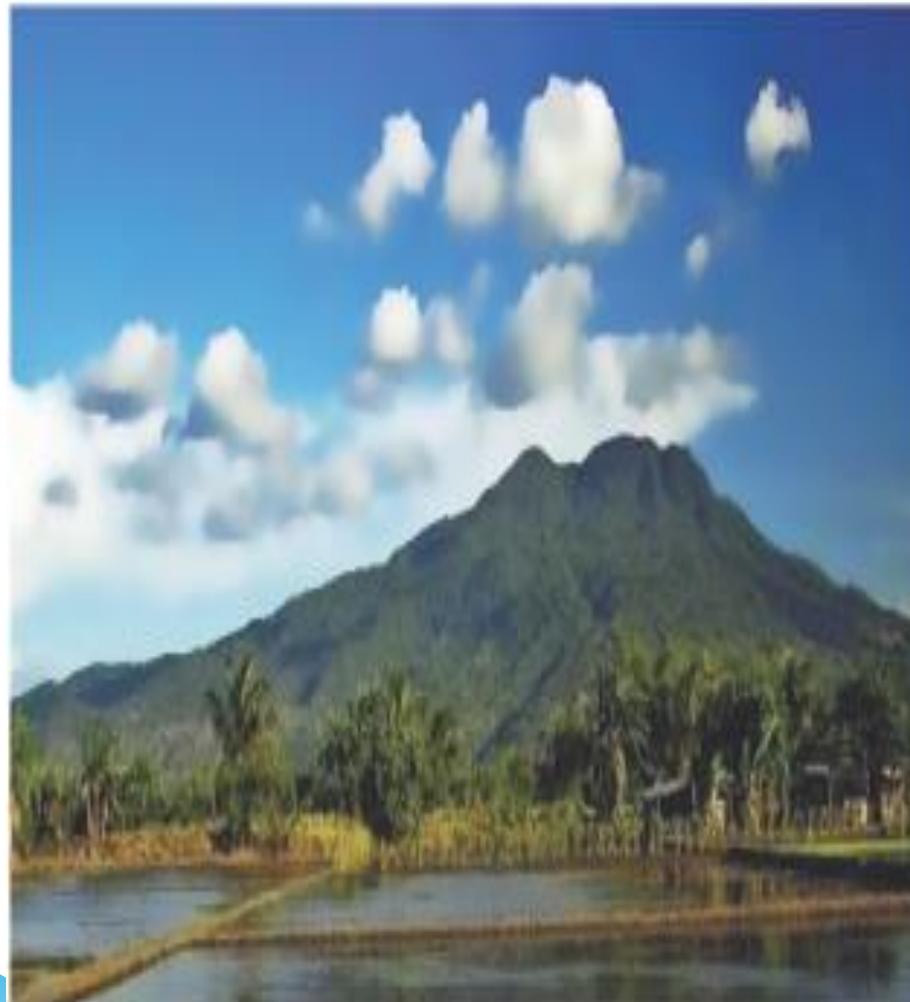
In the Quaternary Period, these structures were formed in Ethiopia:

1. *The Afar Horst that extends into Djibouti*
2. *The active volcano of Ertalle in Afar*
3. *The dormant volcanic mountain of Fentalle in Eastern Oromia*
4. *The extensive lava field of Methara.*



Eritalle





Photograph 3.2 Mount Fentalle



Photograph 3.3 The Lava field of Methara



2.4. Geological Processes and the Resulting...

- **b) Quaternary Period (2 million - recent years)...**
- ***Quaternary volcanism***
- known as Aden Volcanoes or Aden Series
- limited to the floor of the Rift Valley and the region south of Lake Tana
- more extensively developed in the Afar region
- rift valley is still unstable



2.4. Geological Processes and the Resulting...

- **b) Quaternary Period (2 million - recent years)...**
- **The basic volcanic features of the Aden series include the following:**
- Numerous and freshly preserved volcanic cones Eg. Dubi, Erta Ale, Afrera etc. *Of these, Erta Ale is the most active volcano in Ethiopia.*
- Volcanic hills and mountains, some of which are semi-dormant (Fantale, Boseti-Gouda near Adama, Aletu north of Lake Ziway, Chebbi north of Lake Hawassa etc.).
- Extensive lava fields and lava sheets some of which are very recent.
- Lava ridges.
- Thermal springs, fumaroles etc



2.4. Geological Processes and the Resulting...

- *Quaternary Deposition*
- much of the areas (except the high mountains) were periods of an excessively high rainfall.
- This is called the pluvial period
- which resulted in an excessive surface flow that carry a lot of sediments and deposited these on the lower areas



2.4. Geological Processes and the Resulting...

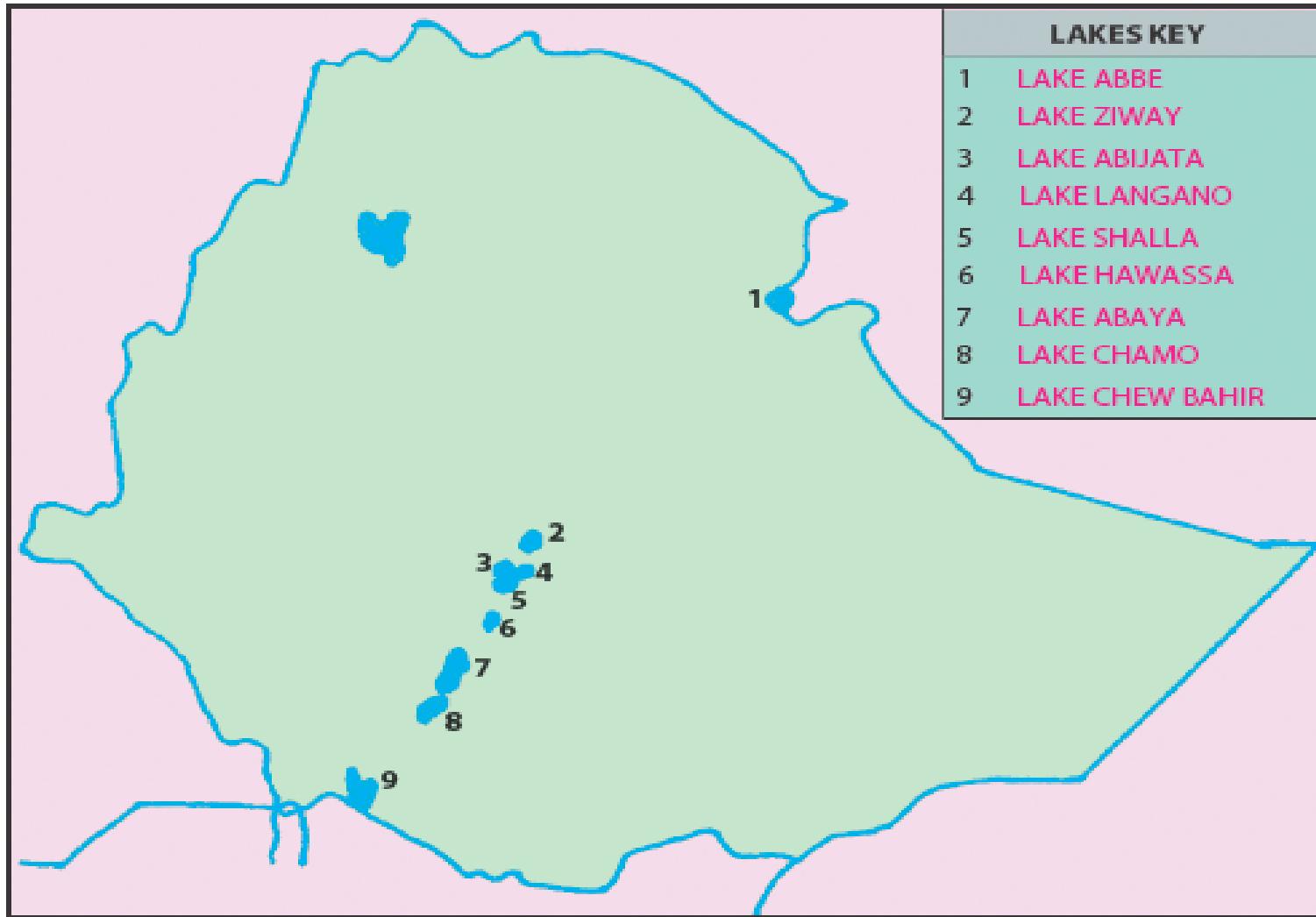
Quaternary Deposition...

According to the **place** and **manner of deposition** and depositing agents these deposits are divided as follow.

- a. **Lacustrine deposits:** Deposits on former lakebeds, and swampy depressions.
- b. **Fluvial deposits:** Deposits on the banks of rivers, flood plains both in plateau, foothills etc.
- c. **Glacio-fluvial deposits and erosional features:** These are occurred on high mountains, such as Bale and Kaka Mountains.
- d. **Aeolian deposits:** Are windblown deposits.
- e. **Coastal and marine deposits:** Deposits on sea invaded and sea-covered places.



There were many rivers, lakes & even these lakes merge together e.g.
Ziway-Langano; Awasa-Shalla; Chamo-Abaya; etc.





2.5.Rock & Mineral Resources in Ethiopia

- The occurrence of metallic minerals in Ethiopia is associated with the **Precambrian rocks**
- The exploitation and search for mineral deposits in Ethiopia has a history of **> 2,000 years**
- However, presently mineral production from Ethiopia has been **negligible by World standards**.



Brief Facts and Current State of Main

Minerals	Main Locations but not limited to
Gold	Benishangul-Gumuz (Metekel), Adola,,,
Platinum	Yubdo area in Wellega,,,
Tantalum	southern Ethiopia, Adola area,,,
Gemstones	Amhara and Oromia region,,,
Potash	Danakil (Dallol Depression) of
Gypsum and Anhydrite	Danakil Depression, Ogaden, Shewa
Clay	Ambo and Adola,,,
Marble	Tigray, Amhara, Oromia
Construction stones	Diredawa, Amhara, Tigray,,,



2.5.Rock & Mineral Resources in Ethiopia...

Mineral Potential Sites of Ethiopia

1. The Western and South-western-greenstone belt:
Gold, Platinum
2. The Southern greenstone belt: Called Adola Belt:
Primarly gold deposit
3. The Northern greenstone belt(Tigray):
gold deposit



Chapter review questions

1. What were the major geologic processes of the Precambrian and Paleozoic Eras in the Horn of Africa?
2. Explain the formation of the oldest sedimentary rocks in Ethiopia and the Horn.
3. Discuss the major geologic events of Ethiopia that took place during the Cenozoic Era.
4. Where are the major mineral potential sites of Ethiopia? Discuss each of them with the help of examples.



Chapter Three

The Topography of Ethiopia and The Horn



Chapter Contents

3.1. Introduction

3.2. The Physiographic Divisions of Ethiopia

 3.2.1. The Western Highlands and Lowlands

 3.2.2. The Southeastern Highlands and Lowlands

 3.2.3. The Rift Valley

3.3. The Impacts of Relief on Biophysical and
Socioeconomic Conditions

Review Questions



Chapter Objectives

- Describe the topography of Ethiopia and the Horn.
- Identify the physiographic divisions of Ethiopia.
- Elucidate the physiographic characteristics of the Rift Valley.
- Explain the impacts of relief on biophysical and socioeconomic conditions



3.1. Introduction

- The topography of Ethiopia is largely determined by the geologic activities of the Cenozoic Era.
- The uplifting of the Arabo-Ethiopian swell and the subsequent outpouring, spreading and thick accumulation of Trapean lava have given rise to an outward sloping highland plateau and mountains.
- The major faulting resulted in the division of the plateau into two broad units and the formation of a great structural valley.
- Faulting elsewhere and on the floor guided part of the course of some rivers.
- They also formed depressions on which lakes were subsequently created.
- Geomorphic processes brought some modification to the structural landform by river dissection and roughening on the highlands, and deposition on the lower areas.

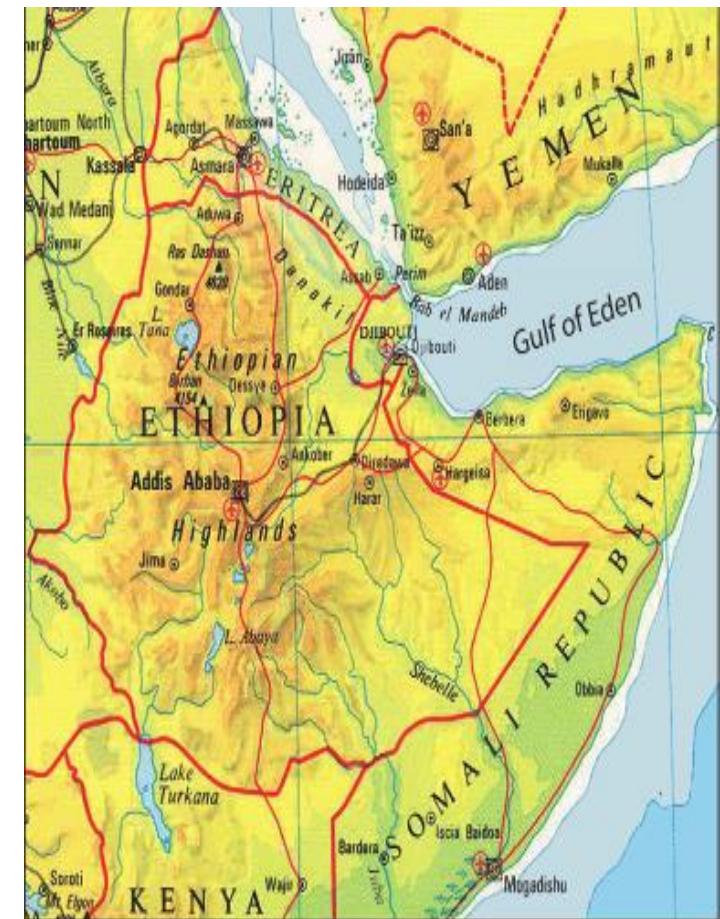


3.1. Introduction

- The Ethiopia's topography is characterized by great diversity
 - flat-topped plateaus, high and rugged mountains, deep river gorges and vast plains
 - Altitude ranges from 125 meters below sea level (**Kobar Sink**) to 4620m amsl (Ras-Dashen).
 - Ethiopia has the largest proportion of elevated landmass in the African continent.
 - More than 50% of the Ethiopian landmass is above 1,000 meters of elevation; and above 1,500 meters makes 44% of the country.
 - Because of this, Ethiopia is said to be the “roof of eastern Africa.”

General Characteristics of the Ethiopian Physiography

- Most of the Ethiopian Highlands are part of central and northern Ethiopia, and its northernmost portion extends into Eritrea.
 - the most significant physical features of the country, which form the largest continuous area of its elevation in the continent.
 - Dissected by rivers and deep gorges
 - Divided into several mountains and plateau that can be the source of many rivers
 - As a result, Ethiopian plateau is called “the water tower of north east Africa.”





General Characteristics of the Ethiopian Physiography

- The diversity in topography is accompanied by differences in other natural features such as soil, climate, vegetation and wild life as well as socio-cultural and economic phenomena.
- 1000m is considered as a demarcation between highlands and lowlands
- The cumulative effect of all this is that, the highlands have been significant throughout Ethiopian history in the economic, cultural and political life of the people.
 - These highlands make up nearly 56% of the area of the Ethiopia.
 - This is further subdivided into lower highland (1,000 - 2,000 m.a.s.l), which make up 35% and higher highland (>2,000 m.a.s.l) constituting nearly 22%.

Characteristics of Highlands vs Lowlands

highlands

- Moderate and high amount of rainfall (>600 mm per year).
- Lower mean annual temperature (<20°C).
- The climate is favorable for biotic life.
- Rain-fed agriculture is possible.
- Free from tropical diseases.
- Attractive for human habitation and densely settled.

lowlands

- Fewer amounts of rainfall and higher temperature.
- High prevalence of tropical diseases.
- Lower population densities.
- Nomadic and semi-nomadic economic life.
- Vast plain lands favorable for irrigation agriculture along the lower river basins.

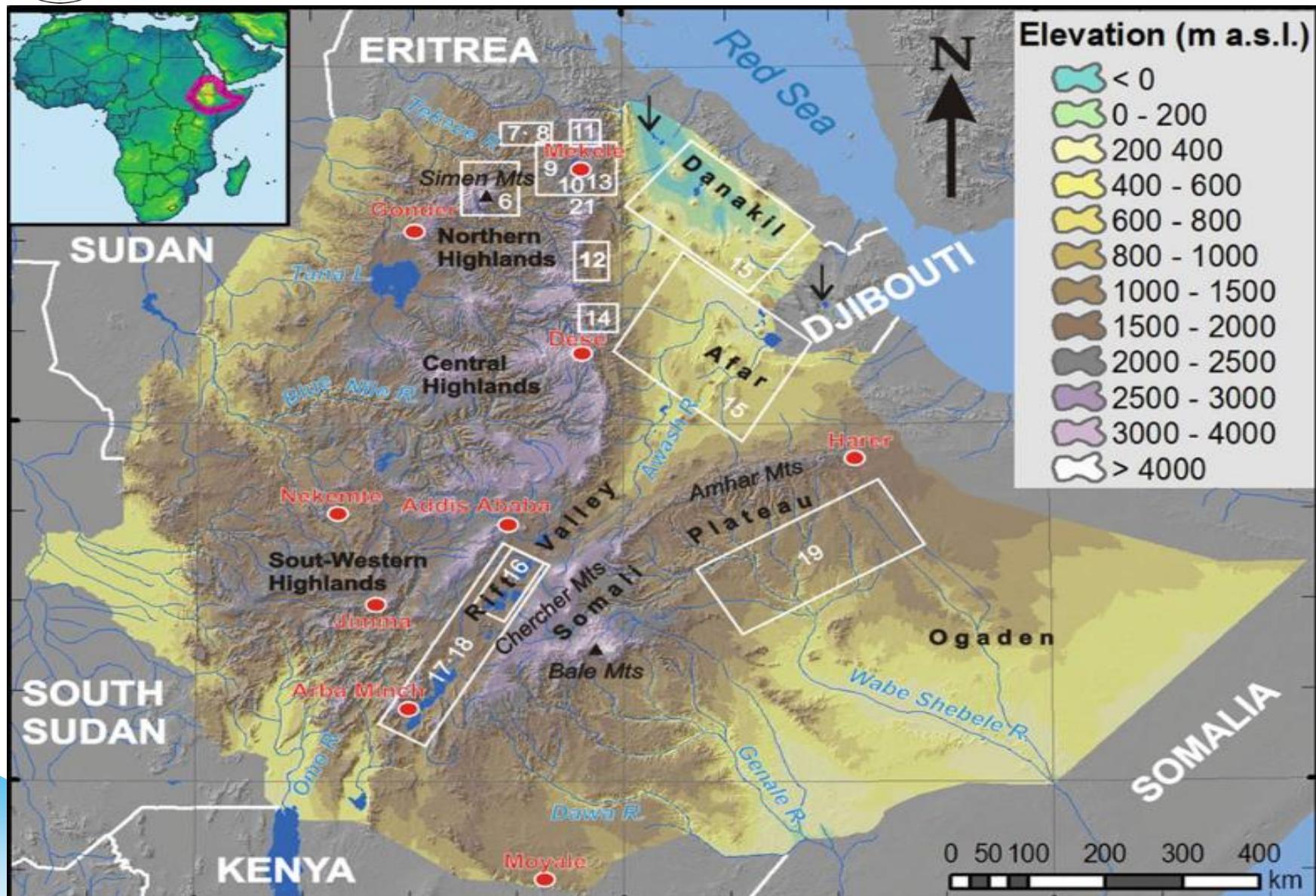


3.2. The Physiographic Divisions of Ethiopia

- Following the structural divisions brought about by the geologic processes of the Cenozoic Era, three major physiographic units can be identified in Ethiopia.
- These are:
 - The Western highlands and lowlands
 - The South-eastern (Eastern) highlands and lowlands
 - The Rift Valley



Elevation in Ethiopia



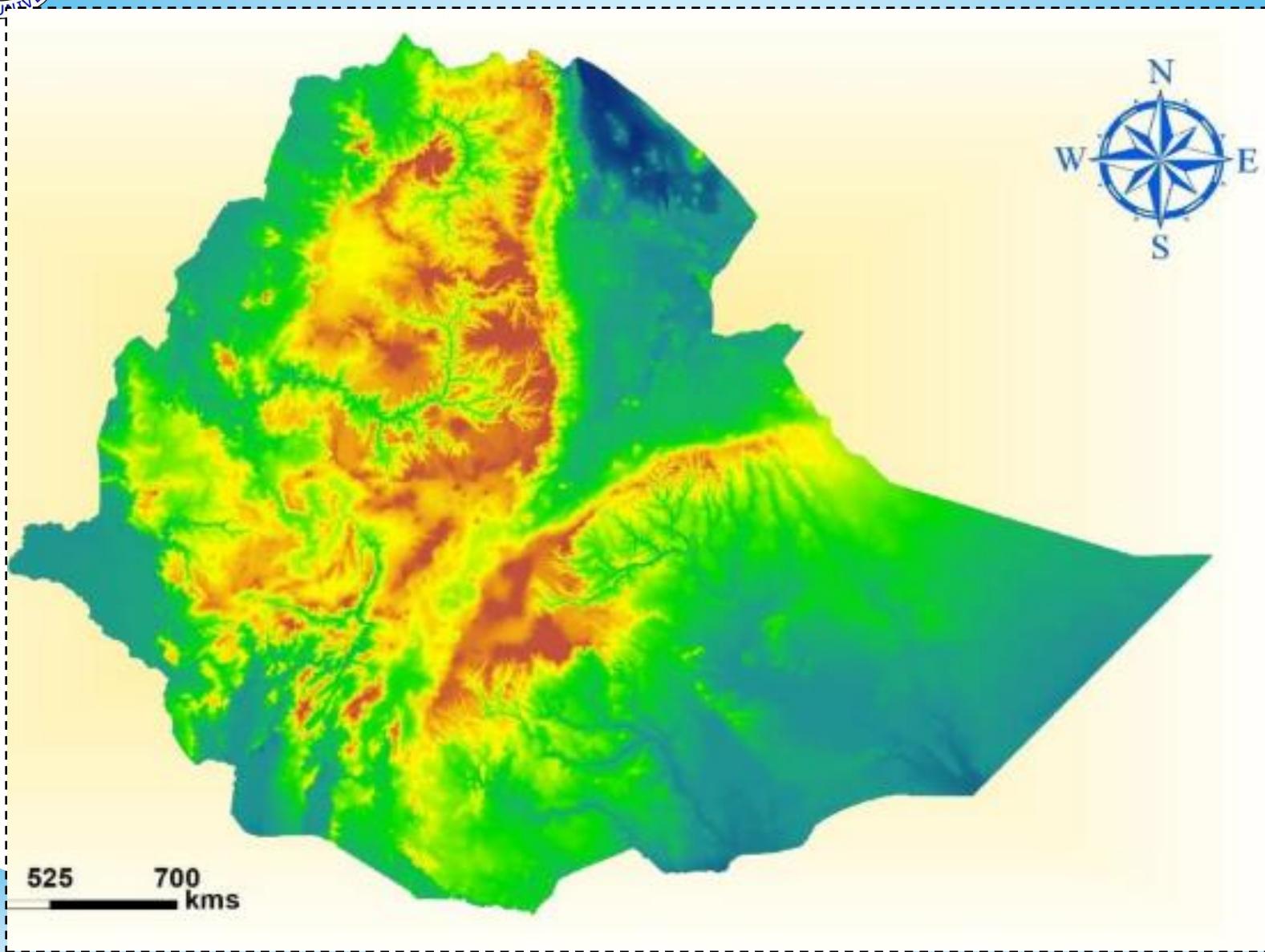


The Western Highlands and Lowlands

- includes all the area west of the Rift Valley.
- It extends from north to south encompassing nearly the whole western half of Ethiopia.
- makes up about **44%** of the area of the country.
- In the east the western escarpment of the Rift Valley bound it whereas westward, the land gradually descends in altitude until it merges into the western foothills and lowlands, along the Sudan and South Sudan border.
- further subdivided into four groups of highlands (76.3%) and four groups of lowlands (23.7%).



The Ethiopian Topography





Western highlands

Western highlands

Tigray plateau

North central
Massifs

The Shewa
Plateau/central
highlands

Southwestern
highlands

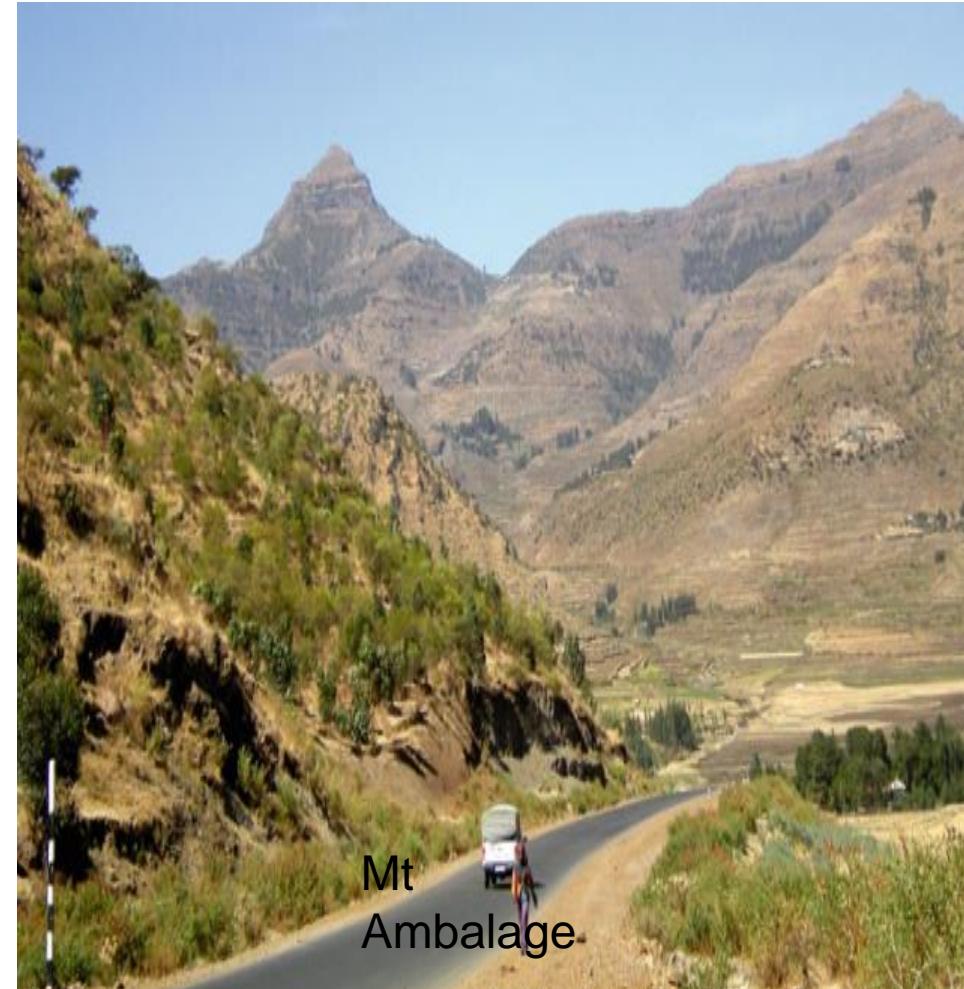


A. Tigray plateau

- extends from the Tekeze gorge in the south to central Eritrean highlands.
- separated from the Eritrean plateau by the **Mereb River**
- constitutes about 13% of the area of the region.
- elongated highland with most of the land being in between 1,000 and 2,000 meters above sea level.
- The right bank tributaries of Tekeze drain this plateau.
- Long period of denudation has created residual features of granite hills, rugged topography, and Ambas.

Continued

- There are high mountains in this plateau with elevations of over 3000 meters, namely
 - Mount Tsibet (3988 m.a.s.l)
 - Mount Ambalage (3291 m.a.s.l), and
 - Mount Assimba (3248 m.a.s.l).
- famous monastery at Debre-Damo, a tableland that can only be climbed by a rope pulley is located in this region





B. North Central massifs

- the largest in the western highlands.
- Much of its northern and southern limit follows the Abay and Tekeze gorges.
 - The Abay, Tekeze and their tributaries have cut into this region a maze of gorges, steep sided river valleys, dividing the land into many isolated plateau blocks, precipitous tablelands and other rugged surface forms.
 - But much of these plateau and tablelands are still capped by the Trappian lava.
- In its central part, the physiographic unit also accommodates the Lake Tana basin surrounded by plains of Fogera and Dembia in the north and an upland plain in its south.



North... continued

- Fifty-eight percent of the region is at an altitude of more than 2,000 meters, making it, next to the Shewan Plateau, the second highest physiographic division.
 - The region consists of the Gonder, Wello and Gojjam Massifs.
- Out of the 26 mountain peaks with altitude of more than 4,000m.a.s.l in Ethiopia, 19 mountain peaks are found in this physiographic region.
- Among these, the most popular ones include
 - Mount Ras Dashen (4,620 m.a.s.l),
 - Mount Weynobar/Ancua (4462 m.a.s.l),
 - Mount KidisYared (4453 m.a.s.l), and
 - Mount Bwahit (4437 m.a.s.l) in the Simen Mountain System.
 - Mount Guna (4,231m.a.s.l) in the Debre Tabour Mountain System,
 - Abune Yoseph (4,260 m.a.s.l) in the Lasta highlands of Wello and
 - Mount Birhan (4,154 m.a.s.l) in the Choke Mountain System



North... Continued

- The Mountain systems in Gonder and Gojjam are separated from the eastern group of mountains in Wello by impenetrable and deep gorges.
 - At one point though, they are connected by Yeju-Wadla Delanta land bridge (ridge).
- This land bridge has been significant in history.
 - served as a route of penetration by the Turks, Portuguese, and Italians etc.
 - The Woreta-Debre Tabor-Woldya road constructed to link the northwestern region with Asseb through Woldya and Dessie took advantage of this land bridge.



C. The Shewa Plateau/central highlands

- bounded by the Rift Valley in the east and southeast, by the Abay gorge in its northern and western limit, and the Omo gorge in the south and west.
 - occupies a central geographical position in Ethiopia.
- With only 11% of the area of the whole physiographic region, the Shewa Plateau is the smallest of the Western highlands.
- Nearly three fourth of its area is at an altitude of more than 2,000 meters above sea level.
- It has, therefore, the largest proportion of elevated ground.



C. Shewan.... continued

- Drained by the tributaries of Abbay, Omo and Awash
- The tributaries of
 - Abay Guder,
 - Muger,
 - Jema etc. have cut deep gorges and steep sided river valleys.
- Omo and Awash have dissected the other sides of the plateau.
- The highest mountain in the Shewan plateau is
 - Mount Abuye-Meda (4,000 m.a.s.l) in Northern Shewa,
 - Mount Guraghe in the south is 3,721 meters high.



D. The Southwestern Highlands

- consists of the highlands of Wellega, Illuababora, Jimma, Kaffa, Gamo and Gofa.
- separated from the adjacent highlands by the Abay and Omo river valleys.
- extends from the Abay gorge in the north to the Kenya border and Chew Bahir in the south.
- accounts for **22.7%** of the area of the region.
 - is the second largest in the Western highlands.
 - About 70% of its area lies within 1,000-2,000 meters altitude.



D. South... continued

- The southwestern plateau is the wettest in Ethiopia.
- It is drained by
 - Dabus
 - Deddessa (tributaries of Abay),
 - Baro,
 - Akobo and the Gibe/Omo rivers.
 - The numerous streams have cut these highlands to produce the most dissected and rugged terrain that accommodates the most numerous and diverse ethnic linguistic groups in Ethiopia.
- With a height of 4,200 meters above sea level, Guge Mountain is the highest peak in this physiographic subdivision.



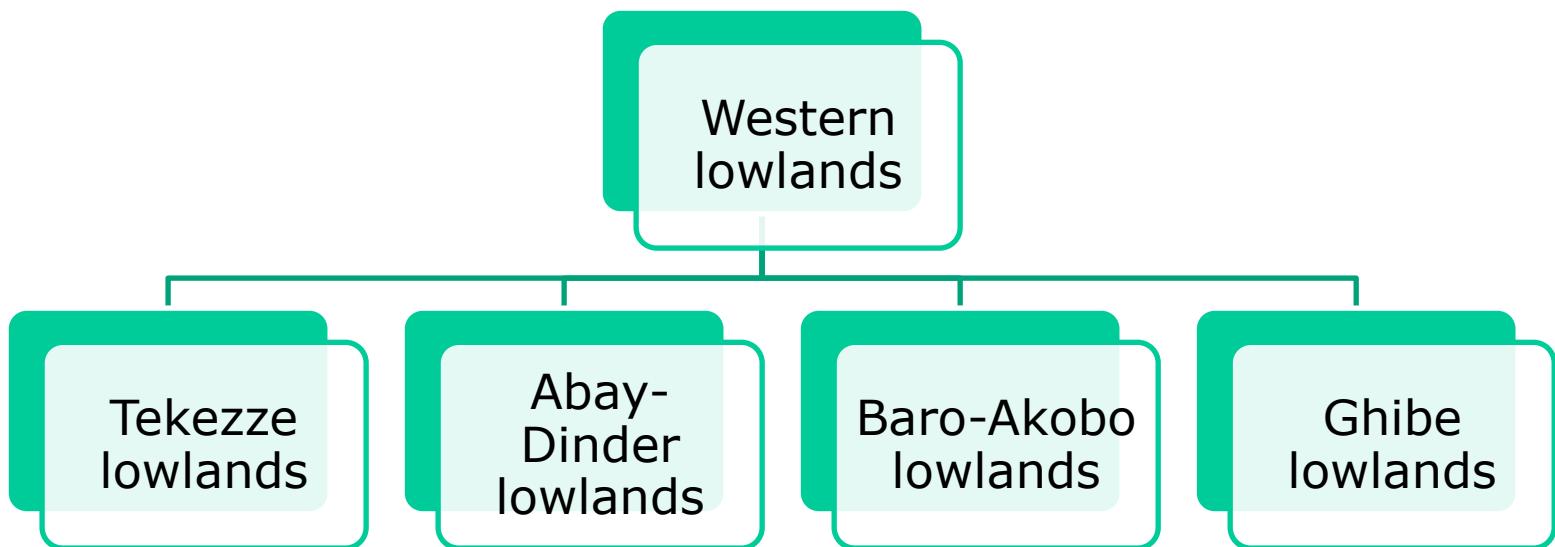
The Western Lowlands

- western foothills and border plains that extend from Western Tigray in the north to southern Gamo-Gofa in the South.
- In certain places, ridges or part of the highlands protrude into the lowlands, interrupting their continuity.
- They make 11% of the area of the physiographic region.
- The general elevation ranges between 500 and 1000 meters above sea level.



Continued

It can be subdivided into four categories





Continued

- With the exception of the Baro lowland, the region is generally characterized by arid or semi-arid conditions.
 - Pastoral or semi-pastoral economic activities dominate the area.
 - As one moves northwards, the degree of aridity increases, making rain-fed agriculture more difficult.
- Since one or two rivers cross all of these lowlands, irrigation agriculture is highly feasible.
- For example, the Baro lowland has an extensive flat area suitable for mechanized agriculture.



...con'd

- The Ghibe/Omo lowland, which includes the lower Ghibe/Omo Valley and the northern section of the Turkana basin, is classified in the Western lowlands from its geographical location.
 - But structurally it also belongs to the Rift Valley.
 - It is an area, which is both faulted and tectonically depressed.
- In the Western lowlands, there are small but important towns.
 - Their importance could be related to agriculture, history, or are simply border towns and frontier ports.
 - These are Humera, Metema, Omedla, Kurmuk, Gambella etc.



The Southeastern Highlands and Lowlands

- **South east highlands**
 - Arsi- Bale-Sidama
 - Hararghe Plateau
- **South eastern Lowlands**
 - Ogaden
 - Elkerie
 - Borena



...con'd

- **A. Arsi-Bale-Sidama Highlands**
- the second largest in terms of area.
- accounts for 37% of the area of Ethiopia.
 - The highlands make up 46% of the physiographic division while the rest is lowland.
- In the west and north, the eastern escarpment of the Rift Valley makes the western and northern limit.
- land raises so abruptly that from the edge of the plateau one literally looks down the Rift Valley.
 - the land gradually descends southeastward
- further subdivided into
 - two units of highlands and
 - two units of extensive lowlands.



Continued...

- are found to the east of the Lakes Region.
- They are located in the south western section of the physiographic region.
 - make up 28.5% of the area of the region and 62% of the south - Eastern Highlands.
- The Arsi Highlands are made up of flat rolling uplands and dissected mountains.
 - The well-known mountains in this area are
 - Mount Kaka (4,180 m.a.s.l),
 - Mount Bada (4,139 m.a.s.l) and
 - Mount Chilalo (4,036 m.a.s.l).



Continued...

- **The Bale highlands are separated from the Arsi highlands by the head and main stream of Wabishebelle.**
 - They consist of a platform looking basaltic plateau in the north-central part and high mountain massif to the south.
- **The Afro-Alpine summit of Senetti plateau is found on the latter group.**
 - The highest mountain peaks in this region are Tulu-Dimtu (4,377 m.a.s.l) and Mount Batu (4,307 m.a.s.l).
- **Erosion features belonging to Pleistocene glaciation but later modified by fluvial processes**
- **The Arsi-Bale Highlands are important grains producing areas with still high potential.**



...con'd

- **The Sidama Highlands are separated from the Bale Highlands by the Ghenale river valley.**
 - occupy the southwestern corner of this region.
 - The prominent feature here is the **Jemjem** plateau, an important coffee growing area.
- **Rivers Wabishebelle and Ghenale along with their tributaries have dissected this physiographic region.**
- **Specially, Weyb River, tributary of Ghenale, has cut an underground passage (Sof Omar cave) through the Mesozoic Limestone rocks.**
 - The cave is found near Bale Mountains.
 - It is one of the World's most spectacular and extensive underground caverns creating a magnificent view accessible only by an underground stream.



The Hararghe Plateau

- is a north-easterly extension of the south-eastern highlands.
- It extends from the Chercher highlands in the south-west to Jigjiga in the east.
- It makes up 38% of the South Eastern highlands and 17.4% of the whole physiographic region.
- It has the smallest proportion of upper highland ($>2,000$ meters).
- It is a low lying and elongated region.

Hararghean plateau

- Rising sharply from the Rift Valley floor, it immediately but gently descends east and southeastward.
- The left-bank tributaries of Wabishebelle drain it.
- Much of the Trappian lava is removed and the Mesozoic rocks are extensively exposed.
- The highest mountain here is Mount Gara-Muleta (3,381 m.a.s.l.).





The Southeastern Lowlands

- located in the southeastern part of the country and they are the most extensive lowlands in Ethiopia.
- make up 54% of the area of the physiographic region and around one-fifth of the country.
- divided into Wabishebelle plain (60%) and the Ghenale Plain (40%).
 - include the plains of Ogaden, Elkere, and Borena. Southeastward sloping plains characterize these lowlands.
- These extensive plains are interrupted here and there, by low hills, low ridges, inselbergs and by shallow and broad river valleys and depressions.



...con'd

- Because of the harsh climatic conditions, these lowlands are little used and support very small population.
 - They are sparsely inhabited by pastoral and semi-pastoral communities.
 - The economic potential for this region includes animal husbandry, irrigation, agriculture and perhaps exploitation of petroleum and natural gas.



...con'd

- **The Rift Valley is a tectonically formed structural depression.**
 - It is bounded by two major and more or less parallel escarpments.
- **The formation of the Rift Valley has separated the Ethiopian Highlands and Lowlands in to two.**
 - It extends from the Afar triangle in the north to Chew Bahir for about 1,700 km².
 - It covers 18% of the area of Ethiopia.
 - It is elongated and funnel shaped, with a NE-SW orientation.
 - It opens out in the Afar Triangle, where it is the widest, and narrows down to the south.



...con'd

- **The floor of the Rift Valley is made up of interconnected troughs, grabens and depressions.**
 - Volcanic rocks, fluvial and lacustrine deposits cover the floor.
 - In many places, numerous volcanic domes, hills and cinder cones rise from the floor.
- **Altitude in the floor ranges from 125 meters below sea level at Dallol Depression, to as high as 2,000 meters above sea level in the Lakes region.**
- **The bounding escarpments are also of varying heights.**
 - From the floor to the edge of the escarpment, the heights vary from 200 to 1500 meters.
 - Because of its altitudinal variation and positional differences, the climate also varies from warm, hot and dry to cool and moderately moist conditions.



...con'd

- **Similarly, the social and economic life reflects this pattern.**
 - There are places, which are desolate and sparsely inhabited by pastoralists where as in others parts people practice some rain-fed agriculture.
- **The Rift Valley is further subdivided into three physiographic sub-regions.**
 - the Afar Triangle,
 - the Main Ethiopian Rift, and
 - the Chew Bahir Rift



Afar Triangle

- **The Afar Triangle is the largest and widest part of the Rift Valley. It makes up 54% of the Rift Valley area.**
 - It is bounded by the high western and eastern escarpments in the west and east respectively, and by the Afar and Aisha Horst in the northeast.
- **The area is generally of low altitude (300-700 meters).**
 - Quite different is the morphology of the Afar depression, triangular-shape lowland, where elevation drops uniformly from approximately 1,000 meters in the southwest to below sea level in the north (Danakil depression) and in the east, where the shores of Lake Asal, fluctuating at around 125 meters below sea level, represent the lowest subaerial point of the African continent.

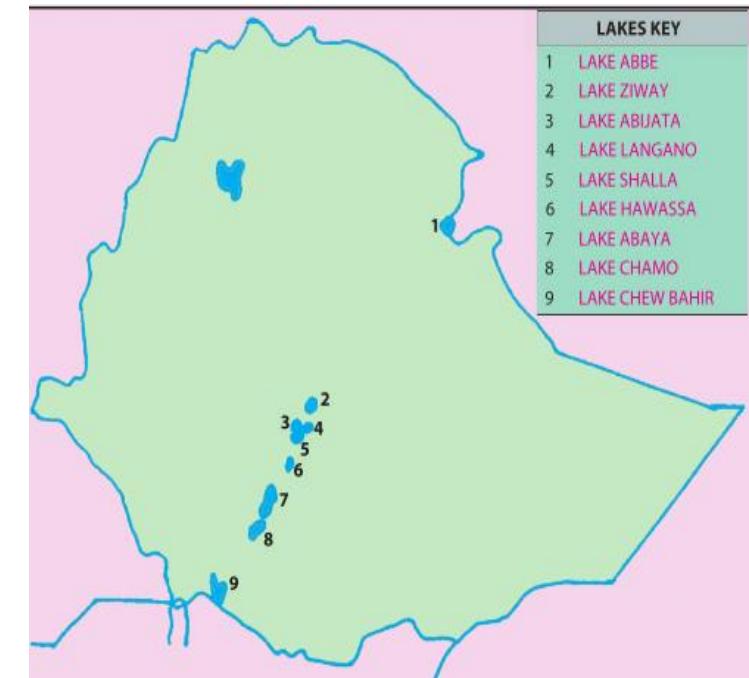


...con'd

- The depression, which hosts one of the most hostile environments on Earth (maximum temperatures can exceed 50°C during the summer wet season; Dallol, at the northern tip of Afar).
- It is characterized by
 - faulted depressions (grabens), volcanic hills, active volcanoes, volcanic ridges, lava fields and low lava platforms
 - Lakes (Abe, Asale, and Afrera)
 - Denakil Depression (Kobar Sink).
 - Salt plain
 - Hot and dry climate
 - The economic importance of this region includes salt extraction, irrigation along the Awash River and electric potential from geothermal energy.

The Main Ethiopian Rift/Central Rift

- it refers to the narrow belt of the Rift Valley that extends from Awash River in the north to Lake Chamo in the south.
- It is bounded by the western and eastern escarpments.
- With the exception of the Arba-minch area, the bounding escarpments are generally low.
- This part of the Rift Valley is the narrowest and the highest.
- It has an average width of 50-80 kilometers and general elevation of 1,000-2,000 meters above sea level.





...con'd

- The floor in many places is dotted by cinder cones and volcanic mountains.
 - The big ones include Mount Fentale, Boseti-guda (near Adama), Aletu (north of Lake Ziway) and Chebi (north of Lake Hawasa).
 - The northern section has more of these cinder cones and lava fields.
- The prominent features, however, are the numerous lakes formed on tectonic sags and fault depressions.
- It is mild and wet, people practices rain-fed agriculture, recreational value of the lakes, the agricultural importance of some streams and lakes, and the geothermal energy potential.



The Chew Bahir Rift

- This is the smallest and the southern-most part of the Rift Valley.
- Gneissic highlands of Konso and the surrounding highlands separate it from the Main Ethiopian Rift to the north.
- The characteristic feature of this region is the broad and shallow depression, which is a marshy area covered by tall grass, into which the Segen and Woito streams empty.



3.3. The Impacts of Relief on Biophysical and Socioeconomic Conditions

- Ethiopia's topography has influence on the various socioeconomic aspects of Ethiopia

1. Agricultural practices

- Choice of farming techniques and farm implements are highly influenced by relief
- crop production
 - as some corps are well adapted to higher altitudes (barley, wheat) and others to low altitude (sorghum, maize).
- The practice of animal husbandry
 - most equines and sheep are reared in the higher altitudes and camels and goat are well adapted to lower altitudes



...con'd

2. Settlement pattern

- Highlands of Ethiopia that experience a temperate type of climatic condition that are mainly free from most of the tropical diseases are densely settled.
- Rugged and difficult terrain hinders the development of settlement and its expansion.
- The highlands of Ethiopia are characterized by sedentary life and permanent settlements while lowlands that are inhabited by pastoralists have temporary settlements.



...con'd

3 Transportation and communication

- The highly dissected nature of the landscape is a barrier to the development of internal surface transportation that resulted in the long-term isolation of many communities
- The difficult terrain makes infrastructure development and maintenance costly.
- TV and radio communications are also highly influenced by relief.
- The rugged topography rendered rivers less navigable due to the waterfalls, deep gorges and steep cliffs.



...con'd

4. Hydroelectric power potential

- The great difference in altitude coupled with high rainfall created suitable conditions for a very high potential for the production of hydroelectric power in Ethiopia.

5. Socio-cultural feeling

- The rugged terrain as a result of excessive surface dissection resulted in the long-term isolation of communities that led to the occurrence of cultural diversity.
- People who live in the highlands have been identifying themselves as degegnas (mountaineers) and those who live in the lowlands as kollegnas (lowlanders).



...con'd

6. Impacts on climate

- The climate of Ethiopia is a result of the tropical position of the country and the great altitudinal variation of the general topography.
- Highlands with higher amount of rainfall and lower rate of evapo-transpiration tend to be moisture surplus compared to the moisture deficit lowlands.

7. Impacts on soil

- Steep mountain slopes provide low angle of rest, unstable surface materials and subject to degradation processes and relatively form shallow and little developed soils.

8. Impacts on natural vegetation

- Relief through its effect on climate and hydrology affect the type of natural vegetation grown in an area



Review Questions

1. What are the three Physiographic Divisions of Ethiopia
2. What are the impacts of relief on the biophysical and socioeconomic conditions of Ethiopia?
3. Discuss the physiographic characteristics of the southeastern highlands and lowlands.