Plateau Formation & Types of Plateaus : A Study

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Abstract

This paper attempts to study how **Plateaus Formation; that** can occur from magma rising up from inside the earth, erosion by water and glaciers, or the collision of tectonic plates also look into **Types of Plateaus**. Plateaus are elevated uplands with extensive level surfaces, and usually descend steeply into the surrounding low lands. They are also referred to as 'table lands'. Like any other form of high lands, plateaus are also subject to erosion, which change their original characteristics. According to their mode of formation, Plateaus are elevated uplands with extensive level surfaces, and usually descend steeply into the surrounding low lands. They are also referred to as 'table lands'. Like any other form of high lands, plateaus are also subject to erosion, which change their original characteristics. Forces inside and outside the earth can change the shape of the earth's surface.

The formation and deformation of landforms on the surface of the earth are a continuous process which is due to the continuous influence of external and internal forces. The internal and external forces causing stresses and chemical action on earth materials and bringing about changes in the configuration of the surface of the earth are known as geomorphic processes. Endogenic forces and exogenic forces can create a lot of landforms. A landform is a natural feature of the solid surface of the Earth. Examples include Mountains, Plateaus, and Plains. the earth's surface is being continuously subjected to external forces originating within the earth's atmosphere and the internal forces of different intensities from within the earth. The difference in the internal forces and external forces built up the crust has been accountable for the modifications in the outer surface of the crust.

These internal and external forces cause stress and chemical action on earth materials and lead to changes in the configuration of the surface of the earth, understood as geomorphic processes. All these changes take place under the influence of forces working continuously within the earth as well as over the surface of the earth. These movements lead to the transfer of the mass of rock debris down the slope under the immediate influence of gravity. Mass movements are divided into slow movements and rapid movements.

Key words: plateau *fracture, Plateaus, landform, deformation, formation, plains.*

Introduction

In physical geography, a plateau (plural plateaus or plateaux), also called a high plain or a tableland, is an area of a highland consisting of flat terrain that is raised sharply above the surrounding area on at least one side. Often one or more sides have deep hills. Plateaus can be formed by a number of processes, including upwelling of volcanic magma, extrusion of lava, and erosion by water and glaciers. Plateaus are classified according to their surrounding environment as intermontane, piedmont, or continental. A few plateaus may have a small flat top while others have wide ones.

Lava plateaus are formed by highly fluid basaltic lava during numerous successive eruptions through numerous vents without violent explosions (quiet eruptions). These eruptions are quiet because of low viscosity of lava, so that it is very fluid and contains a small amount of trapped gases. The resulting sheet lava flows may be extruded from linear fissures or rifts or gigantic volcanic eruptions through multiple vents characteristic of the prehistoric era which produced giant flood basalts. Multiple successive and extensive lava flows cover the original landscape to eventually form a plateau, which may contain lava fields, cinder cones, shield volcanoes and other volcanic landforms. In some cases, a lava plateau may be part of a single volcano. An example is the massive Level Mountain shield volcano in northern British Columbia, Canada, which covers an area of 1,800 km2 (690 sq mi) and a volume of 860 km3 (210 cu mi).

Perhaps the most extensive of all the subaerial basaltic plateaus existed during the Paleogene and possibly extended over 1,800,000 km2 (690,000 sq mi) of the northern Atlantic Ocean region. This region, known as the Thulean Plateau, is generally believed to have been broken up by foundering of the Earth's crust to form the present ocean basin.

The Earth features numerous subaerial and submarine volcanic plateaus such as the Columbia River Plateau (subaerial) and the vast Ontong Java Plateau (submarine).

Objective:

This paper intends to explore and analyze process through which **plateaus** are formed; Volcanic processes, crustal shortening, and thermal expansion can drive the **formation** of **plateaus**. Also study the **kinds of plateaus** based on their composition

Formation

Plateaus can be formed by a number of processes, including upwelling of volcanic magma, extrusion of lava, and erosion by water and glaciers.

Volcanic

Volcanic plateaus are produced by volcanic activity. The Columbia Plateau in the north-western United States is an example. They may be formed by upwelling of volcanic magma or extrusion of lava.

The underlining mechanism in forming plateaus from upwelling starts when magma rises from the mantle, causing the ground to swell upward. In this way, large, flat areas of rock are uplifted to form a plateau. For plateaus formed by extrusion, the rock is built up from lava spreading outward from cracks and weak areas in the crust.

Endogenic Forces

- Endogenic forces are those internal forces which derive their strength from the earth's interior and play a crucial role in shaping the earth crust.
- Examples – mountain building forces, continent building forces, earthquakes, volcanism etc.
- The endogenic forces are mainly land building forces.

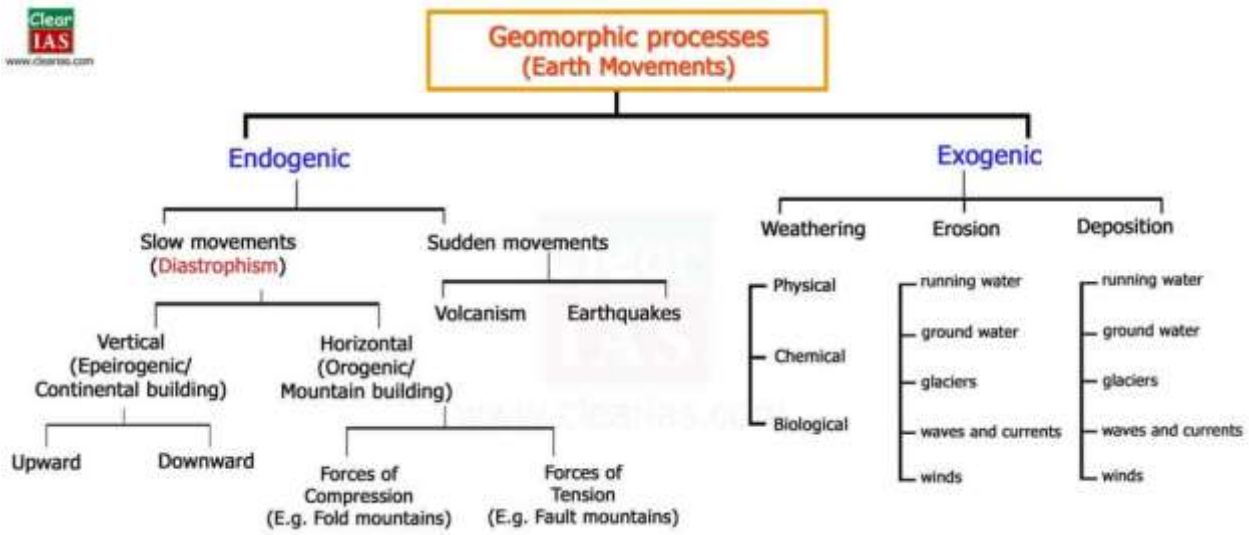
The energy emanating from within the earth is the main force behind endogenic geomorphic processes. This energy is mostly generated by radioactivity, rotational and tidal friction and primordial heat from the origin of the earth.

Exogenic Forces

- Exogenic forces are those forces which derive their strength from the earth's exterior or are originated within the earth's atmosphere.
- Examples of forces – the wind, waves, water etc.
- Examples of exogenic processes – weathering, mass movement, erosion, deposition.
- Exogenic forces are mainly land wearing forces.

Exogenic forces can take the form of weathering, erosion, and deposition. Weathering is the breaking of rocks on the earth's surface by different agents like rivers, wind, sea waves and glaciers. Erosion is the carrying of broken rocks from one place to another by natural agents like wind, water, and glaciers.

The actions of exogenic forces result in wearing down (**degradation**) of relief/elevations and filling up (**aggradation**) of basins/ depressions, on the earth's surface. The phenomenon of wearing down of relief variations of the surface of the earth through erosion is known as **gradation**.



Erosion

Plateaus can also be formed by the erosional processes of glaciers on mountain ranges, leaving them sitting between the mountain ranges. Water can also erode mountains and other landforms down into plateaus. Dissected plateaus are highly eroded plateaus cut by rivers and broken by deep narrow valleys. Computer modeling studies suggest that high plateaus may also be partially a result from the feedback between tectonic deformation and dry climatic conditions created at the lee side of growing orogens.

Classification

Plateaus are classified according to their surrounding environment.

Intermontane plateaus are the highest in the world, bordered by mountains. The Tibetan Plateau is one such plateau.

Lava or volcanic plateaus are the plateau that occur in areas of widespread volcanic eruptions. The magma that comes out through narrow cracks or fissures in the crust spread over large area and solidifies. These layers of lava sheets form lava or volcanic plateaus. The Antrim plateau in Northern Ireland, The Deccan Plateau in India and the Columbia Plateau in the United States are examples of lava plateaus.

Piedmont plateaus are bordered on one side by mountains and on the other by a plain or a sea. The Piedmont Plateau of the Eastern United States between the Appalachian Mountains and the Atlantic Coastal Plain is an example.

Continental plateaus are bordered on all sides by plains or oceans, forming away from the mountains. An example of a continental plateau is the Antarctic Plateau in East Antarctica.

Large plateaus

Asia

The largest and highest plateau in the world is the Tibetan Plateau, sometimes metaphorically described as the "Roof of the World", which is still being formed by the collisions of the Indo-Australian and Eurasian tectonic plates. The Tibetan plateau covers approximately 2,500,000 km2 (970,000 sq mi), at about 5,000 m (16,000 ft) above sea level. The plateau is sufficiently high to reverse the Hadley cell convection cycles and to drive the monsoons of India towards the south. The Deosai Plains in Pakistan are situated at an average elevation of 4,114 meters (13,497 ft) above sea level. They are considered to be the second highest plateaus in the world.

Other major plateaus in Asia are: Najd in the Arabian Peninsula elevation 762 to 1,525 m (2,500 to 5,003 ft), Armenian Highlands (≈400,000 km2 (150,000 sq mi), elevation 900–2,100 metres (3,000–6,900 ft)), Iranian plateau (≈3,700,000 km2 (1,400,000 sq mi), elevation 300–1,500 metres (980–4,920 ft)), Anatolian Plateau, Mongolian Plateau (≈2,600,000 km2 (1,000,000 sq mi), elevation 1,000–1,500 metres (3,300–4,900 ft)), and the Deccan Plateau (≈1,900,000 km2 (730,000 sq mi), elevation 300–600 metres (980–1,970 ft)).

Antarctica

Another very large plateau is the icy Antarctic Plateau, which is sometimes referred to as the Polar Plateau or King Haakon VII Plateau, home to the geographic South Pole and the Amundsen-Scott South Pole Station, which covers most of East Antarctica where there are no known mountains but rather 3,000 m (9,800 ft) high of superficial ice and which spreads very slowly toward the surrounding coastline through enormous glaciers. The polar ice cap is so massive that the echolocation measurements of ice thickness have shown that large areas are below sea level. But, as the ice melts, the land beneath will rebound through isostasy and ultimately rise above sea level.

North America

A large plateau in North America is the Colorado Plateau, which covers about 337,000 km2 (130,000 sq mi) in Colorado, Utah, Arizona and New Mexico.

In northern Arizona and southern Utah the Colorado Plateau is bisected by the Colorado River and the Grand Canyon. How this came to be is that over 10 million years ago, a river was already there, though not necessarily on exactly the same course. Then, subterranean geological forces caused the land in that part of North America to gradually rise by about a centimeter per year for millions of years. An unusual balance occurred: the river that would become the Colorado River was able to erode into the crust of the Earth at a nearly equal rate to the uplift of the plateau. Now, millions of years later, the North Rim of the Grand Canyon is at an elevation of about 2,450 m (8,040 ft) above sea level, and the South Rim of the Grand Canyon is about 2,150 m (7,050 ft) above sea level. At its deepest, the Colorado River is about 1,830 m (6,000 ft) below the level of the North Rim.

Another high altitude plateau in North America is the Mexican Plateau. With an area of 601,882 km2 (232,388 sq mi) and average height of 1,825 m, it is the home of more than 70 million people.

South America

A tepui (/ˈtɛpwi/), or tepuy (Spanish:), is a table-top mountain or mesa found in the Guiana Highlands of South America, especially in Venezuela and western Guyana. The word tepui means "house of the gods" in the native tongue of the Pemon, the indigenous people who inhabit the Gran Sabana.

Tepuis can be considered minute plateaus and tend to be found as isolated entities rather than in connected ranges, which makes them the host of a unique array of endemic plant and animal species. Some of the most outstanding tepuis are Neblina, Autana, Auyan and Mount Roraima. They are typically composed of sheer blocks of Precambrian quartz arenite

sandstone that rise abruptly from the jungle, giving rise to spectacular natural scenery. Auyantepui is the source of Angel Falls, the world's tallest waterfall.

The Colombian capital city of Bogota sits on an Andean plateau known as the Altiplano Cundiboyacense roughly the size of Switzerland. Averaging a height of 2,600 m (8,500 ft) above sea level, this northern Andean plateau is situated in the country's eastern range and is divided into three main flat regions: the Bogotá savanna, the valleys of Ubaté and Chiquinquirá, and the valleys of Duitama and Sogamoso.

Road to the ALMA's Operations Support Facility and then on further to the Chajnantor Plateau at 5000 meters above sea level.

The parallel Sierra of Andes delimit one of the world highest plateaux: the Altiplano, (Spanish for "high plain"), Andean Plateau or Bolivian Plateau. It lies in west-central South America, where the Andes are at their widest, is the most extensive area of high plateau on Earth outside of Tibet. The bulk of the Altiplano lies within Bolivian and Peruvian territory while its southern parts lie in Chile. The Altiplano plateau hosts several cities like Puno, Oruro, El Alto and La Paz the administrative seat of Bolivia. Northeastern Altiplano is more humid than the Southwestern, the latter of which hosts several salares, or salt flats, due to its aridity. At the Bolivia-Peru border lies Lake Titicaca, the largest lake in South America.

Africa

The highest African plateau is the Ethiopian Highlands which cover the central part of Ethiopia. It forms the largest continuous area of its altitude in the continent, with little of its surface falling below 1500 m (4,921 ft), while the summits reach heights of up to 4550 m (14,928 ft). It is sometimes called the Roof of Africa due to its height and large area.

Another example is the Highveld which is the portion of the South African inland plateau which has an altitude above approximately 1500 m, but below 2100 m, thus excluding the Lesotho mountain regions. It is home to some of largest South-African urban agglomerations.

In Egypt are the Giza Plateau and Galala Mountain, which was once called Gallayat Plateaus, raising 3,300 above sea level.

The Western Plateau, part of the Australian Shield, is an ancient craton covering much of the continent's southwest, an area of some 700,000 square kilometres. It has an average elevation of between 305 and 460 m.

The North Island Volcanic Plateau is an area of high land occupying much of the centre of the North Island of New Zealand, with volcanoes, lava plateaus, and crater lakes, the most notable of which is the country's largest lake, Lake Taupō. The plateau stretches approximately 100 km east to west and 130 km north to south. The majority of the plateau is more than 600 m above sea level.

Conclusion

There are two kinds of plateaus: dissected plateaus and volcanic plateaus. A dissected plateau forms as a result of upward movement in the Earths crust. The uplift is caused by the slow collision of tectonic plates. The Colorado Plateau, in the western United States, has been rising about .03 centimeter (.01 inch) a year for more than 10 million years.

A volcanic plateau is formed by numerous small volcanic eruptions that slowly build up over time, forming a plateau from the resulting lava flows. The North Island Volcanic Plateau covers most of the central part of the North Island of New Zealand. This volcanic plateau still has three active volcanoes: Mount Tongariro, Mount Ngauruhoe, and Mount Ruapehu.

Erosion can influence the shape of a plateau. Soft rock often erodes away on the top of a plateau. Many plateaus are therefore topped with a hard, durable surface called caprock. Caprock protects the plateau from erosion of the soil underneath it.

Valleys form when river water cuts through the plateau. The Columbia Plateau, between the Cascade and Rocky mountains in the northwestern United States, is cut through by the Columbia River.

Erosion shapes plateaus in other ways. Sometimes, a plateau is so eroded that it is broken up into smaller raised sections called outliers. Many outlier plateaus are composed of very old, dense rock formations. Iron ore and coal often are found in plateau outliers.

References

1. Hornby, William F.; Jones, Melvyn (29 June 1991). An introduction to Settlement Geography. Cambridge University Press. ISBN 978-0-521-28263-5. Archived from the original on 25 December 2016.
2. Hough, Carole; Izdebska, Daria (2016). "Names and Geography". In Gammeltoft, Peder (ed.). The Oxford Handbook of Names and Naming (First ed.). Oxford, United Kingdom: Oxford University Press. ISBN 978-0-19-965643-1.
3. Johnston, Ron (2000). "Human Geography". In Johnston, Ron; Gregory, Derek; Pratt, Geraldine; et al. (eds.). The Dictionary of Human Geography. Oxford: Blackwell. pp. 353–360.
4. King, David A. (1996). Rashed, Roshdi (ed.). Astronomy and Islamic society: Qibla, gnomics and timekeeping (PDF). Encyclopedia of the History of Arabic Science. 1. ISBN 978-0-203-71184-2. Archived (PDF) from the original on 11 November 2016.
5. Kish, George (1978). A Source Book in Geography. Harvard University Press. ISBN 978-0-674-82270-2.
6. Lockyer, Norman (1900). "Physiography and Physical Geography". Nature. 63 (1626): 207–208. Bibcode:1900Natur..63..207R. doi:10.1038/063207a0. ISSN 0028-0836.
7. Minshull, Roger (5 July 2017). Regional Geography: Theory and Practice. Routledge. ISBN 978-1-351-49408-3.
8. Nawwab, Ismail I.; Hoye, Paul F.; Speers, Peter C. (5 September 2018). "Islam and Islamic History and The Middle East". islamicity.com. Archived from the original on 17 June 2016. Retrieved 10 November 2016.

9. Needham, Joseph (1959). Mathematics and the Sciences of the Heavens and the Earth. Science and Civilization in China. 3. Taipei: Caves Books, Ltd. ISBN 978-0-521-05801-8. Archived from the original on 25 September 2016.
10. Pattison, William D. (1990). "The Four Traditions of Geography" (PDF). Journal of Geography (published 1964). September/October 1990 (5): 202–206. doi:10.1080/00221349008979196. ISSN 0022-1341. Archived (PDF) from the original on 30 November 2016. Retrieved 10 November 2016.
11. Pidwirny, Dr. Michael; Jones, Scott (2009). "Elements of Geography". physicalgeography.net (2nd ed.). Okanagan: University of British Columbia Okanagan. Archived from the original on 1 May 2009. Retrieved 10 November 2016.
12. Raaflaub, Kurt A.; Talbert, Richard J.A. (2009). Geography and Ethnography: Perceptions of the World in Pre-Modern Societies. John Wiley & Sons. ISBN 978-1-4051-9146-3.
13. Roller, Duane W. (24 January 2010). Eratosthenes' Geography. Translated by Roller, Duane W. Princeton: Princeton University Press. ISBN 978-0-691-14267-8. Archived from the original on 19 November 2015.
14. Siebold, Jim (1998). "Babylonian clay tablet, 600 B.C." henry-davis.com. Henry Davis Consulting Inc. Archived from the original on 9 November 2016. Retrieved 10 November 2016.
15. Smith, Sir William (1846). Dictionary of Greek and Roman Biography and Mythology: Earinus-Nyx. 2nd. London: Taylor and Walton.
16. Société de Géographie (2016). "Société de Géographie, Paris, France" . socgeo.com (in French). Société de Géographie. Archived from the original on 6 November 2016. Retrieved 10 November 2016.
17. Sullivan, Dan (2000). "Mapmaking and its History". rutgers.edu. Rutgers University. Archived from the original on 4 March 2016. Retrieved 10 November 2016.
18. Tassoul, Jean-Louis; Tassoul, Monique (2004). A Concise History of Solar and Stellar Physics. London: Princeton University Press. ISBN 978-0-691-11711-9.
19. Tibbetts, Gerald R. (1997). "The Beginnings of a Cartographic Tradition". In Harley, John Brian; Woodward, David (eds.). The history of cartography. 2. Chicago: Brill. ISBN 0-226-31633-5.
20. Wang, Jiaoe (2017). "Economic Geography: Spatial Interaction". International Encyclopedia of Geography: People, the Earth, Environment and Technology. American Cancer Society. pp. 1–4. doi:10.1002/9781118786352.wbieg0641. ISBN 978-1-118-78635-2.
21. Willett, Sean D.; Brandon, Mark T. (January 2002). "On steady states in mountain belts". Geology. 30 (2): 175–178. Bibcode:2002Geo....30..175W. doi:10.1130/0091-7613(2002)030<0175:OSSIMB>2.0.CO;2. S2CID 8571776.
22. Roe, Gerard H.; Whipple, Kelin X.; Fletcher, Jennifer K. (September 2008). "Feedbacks among climate, erosion, and tectonics in a critical wedge orogen" (PDF). American Journal of Science. 308 (7): 815–842. Bibcode:2008AmJS..308..815R. CiteSeerX 10.1.1.598.4768. doi:10.2475/07.2008.01. S2CID 13802645.
23. Summerfield, M.A., 1991, Global Geomorphology, Pearson Education Ltd, 537 p. ISBN 0-582-30156-4.
24. Dunai, T.J., 2010, Cosmogenic Nucleides, Cambridge University Press, 187 p. ISBN 978-0-521-87380-2.
25. Messina, Paul (2 May 1997). "What is Digital Terrain Analysis?". Hunter College Department of Geography, New York.

26. Hargitai, Henrik; Kereszturi, Ákos, eds. (2015). Encyclopedia of Planetary Landforms. New York, NY: Springer New York. doi:10.1007/978-1-4614-3134-3. ISBN 978-1-4614-3133-6. S2CID 132406061.
27. "International Conference of Geomorphology". Europa Organization. Archived from the original on 2013-03-17.
28. Patowary, Kaushik (16 July 2014). "Cono de Arita in Argentina". amusingplanet.com.
29. Bierman, Paul R., and David R. Montgomery. Key Concepts in Geomorphology. Macmillan Higher Education, 2014.
30. Rafferty, John P. (2012). Geological Sciences; Geology: Landforms, Minerals, and Rocks. New York: Britannica Educational Publishing, pp. 8–9. ISBN 9781615305445