Soil profiles are the results of the operation of soil-forming processes. Discuss (2014 Q17)

Soil processes are chemical, physical or biological actions that may affect characteristics and development of soils. The characteristics that they may develop include colour, texture, pH, humus content, water content and mineral content all of which affect the appearance of the soil profile. In this answer I will discuss humification, weathering and lateralization to show how these processes affect the development of soils, and the soil profile.

Humification:

The humification process affects a number of soil characteristics. Humification is the way the dead organic matter, leaves, twigs etc.. is converted to humus by action of decomposers such as bacteria and fungi. These microorganisms in the soil turn the plant matter into humus. Humus is a gel-like substance that is washed into the soil by rainfall. This humus is located in the O(organic) horizon of the soil profile, above the topsoil layer. The O horizon is thin in some soils, thick in others, and not present at all in some soil. This organic matter usually accounts for 5% of the soil, with minerals accounting for 45%, and empty space filled with air or water occupying the other 50%.

Humification affects the development of soil by determining its colour. Soils with a dark brown to black colour are usually high in humus. Brown earth soils have a very high humus content. Brown earths are found in sheltered, low-lying areas of Ireland where conditions favour this process. Humification also influences the amount of water in the soil. It helps to bind the soil particles together and, therefore, influences the crumb structure of the soil. This structure determines the size and amount of pore spaces between the soil crumbs and the amount of water the soil can gold. Another element of soil development influenced by humification is pH. Humus-rich soils don’t tend to be highly acidic or alkaline as the micro-organisms need a suitable pH range to survive.

Weathering:

This is the breakdown of rocks into smaller pieces by chemical or mechanical means. It is important in the formation and development of soils, and the soil profile. Weathering provides the mineral content of soils. These minerals influence the characteristics of a soil. Chemical weathering of rock affects soil pH. Carbonation releases calcium, which makes the soil more alkaline. Chemical weathering can also affect soil texture. Hydrolysis turns feldspar in granite into kaolin clay which gives the soil a clay-like texture. The colour of soil seen across the horizons can

also be affected by chemical weathering. Oxidation of rocks in areas such as Brazil causes a latosol soil of red/orange colour which is seen in the A and B horizons. In latosols, the E horizon is often missing as it has been leached of clay, minerals and organic matter. The oxides of iron stain the soil red, and hydrated oxides produce this red/yellow colouration. Mechanical weathering influences the structure of the soil. Freeze-thaw action or exfoliation can influence the size of the grains in the soil, giving it a crumbly or platy texture. Soils in mountainous areas tend to have a sandy texture as the rocks are weathered more severely into smaller grains.

Lateralisation:

This is a form of chemical weathering that involves carbonation, oxidation and leaching. High temperatures and heavy rainfall result in the rapid weathering of rocks and minerals. Movement of large amounts of water through the soil causes eluviation and leaching to occur. This natural process can influence the development of the soil, directly influencing soil structure, pH and water content. This process occurs in hot areas such as equatorial settings (The Amazon in South America). Lateralisation causes zonal soils, soils that form in response to the climate and processes of an area. Lateralisation affects the soil texture. Mineral grains are dissolved which prevents the soil from forming a crumbly texture. The B horizon is usually rich in minerals that have been leached from the A and E horizons. This in turn creates platy soils like latosols. Lateralisation also affects the pH of soils. In areas like equatorial rainforests with heavy monsoon rainfall, extreme leaching occurs. The minerals are removed by the leaching process, leaving more acidic soil water in place. Therefore, laterization causes a more acidic pH in the soil.