Landscape and Landforms of Northern Somalia

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Abstract

The morphology of northern Somalia is substantially influenced by the tectonic activity caused by the rifting between the African and Arabic plates, known as Gulf of Aden rift. The Precambrian African shield with Late Mesozoic and Paleogene sedimentary cover was broken along a main line, commonly by several faults, subparallel to the rift (and the modern coast) and the inner southern section was uplifted and slightly tilted southward. The uplift caused the formation of a long East–West escarpment (about 750 km long, from the Ethiopian border to as the Bosaso valley) that divides Somaliland in a coastal plain and a plateau. This complex tectonic framework provided the region with unique landscapes and landforms that vary from the flatlands of the plateau, to dramatic escarpments dropping from more than 2000 m asl to 500 m of the coastal plain gently descending seaward. The strong erosion, partly due to the still active tectonic, plays an important role in the shaping of the modern landscapes and resulted in the incision of narrow gorges, with steep sides, in mountainous areas or sharp sandy banks in the wadis that cross the plateau and the coastal plain.

Keywords

Uplifting • Escarpment • Wadi • Gorge • Gypsum crust

10.1 Introduction

Northern Somalia includes the Republic of Somaliland and the western part of the Puntland Region of the Federal Republic of Somalia. The state of Somaliland is an autonomous republic, self-declared in the early 1990s, following a political agreement amongst the main clans of the area. Somaliland corresponds to the territories included in the British protectorate at the end of WWII.

Most of the research work on the geology and geomorphology of northern Somalia was carried out before the outburst of the civil war, especially by British and Italian scholars (see Hadden 2007, for a comprehensive bibliography). This chapter describes the main geomorphological features of the northern part of Somalia, which includes the Republic of Somaliland and the western region of the Puntland Region of the Federal Republic of Somalia and represents an update of existing regional geomorphological knowledge based on field work carried out in the region during the last two decades. The pictures and the description of the landscapes are the summary of 22 years of field work, during which I was never subjected to any hostile act and I could appreciate the friendliness of generous people.

10.2 Study Area

The study area includes the northern part of Somalia, commonly also known as Somaliland, and the adjacent part of Puntland region, where the town of Bosaso is located. The whole area faces the Gulf of Aden. Somaliland has constituted an autonomous state (Republic of Somaliland) since the early 1990s, following the collapse of the Siad Barre regimen, and today is still one of the most democratic states of Africa, with regular national elections every 5 years. Unfortunately, despite its democratic spirit and the peaceful behaviour of the population (the population has been always rejecting the influence of any terrorist group) the country is not recognized by the international community. Puntland, after a period of independence, decided to join the Federal Republic of Somalia, but the border between Somaliland and Puntland is still disputed.

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The main structural element of Somaliland is an escarpment, which is the country's main physiographic element separating the relatively flat highlands from the coastal plain (Fig. 10.1). The latter, whose elevation usually does not exceed 500 m asl, is mostly covered by alluvial and aeolian deposits, whereas the plateau is a gently southward sloping plain descending from the top of the escarpment (2500 m asl near Ceerigabo) to the Ethiopian border in the south. Whilst the altitude of the escarpment top varies within a narrow range of elevations, the plateau drops gently towards the Indian Ocean and the Ethiopian border, descending from elevations close to 1600 to almost 650 m asl at the triple border point amongst Somaliland, Ethiopia and Puntland. The great tectonic depression of the Nogal valley that hosts an important and deep sedimentary basin, occupies the central part of the plateau. In the Puntland region, south of Bosaso, the S–N trending Bosaso valley and another important tectonic feature, the Darror valley, oriented WNW–ESE and descending to the Indian Ocean, divide the escarpment edge and the Karkar plateau from the Ahl Miskat and Ahl Bari Mountains that extend up to the Indian Ocean and constitute the true Horn of Africa that from Cape Guardafui faces both seas (Fig. 10.2).

The climate is typically arid or semi-arid, with rainfall concentrated in two seasons, known as Gu, from March to May, in which the main rainy events occur, and Dayr, from September to November. However, minor rains may also occur from June to August. More intense rainstorms are localized at the escarpment top due to both elevation and the barrier effect of the mountains that force the humid air coming from the sea to rise. Here, the annual rainfall can be as much as 500–600 mm, whereas in the coastal plain that is a very arid area, the annual rainfall drops to less than 100 mm and it is not uncommon to record 2–3 consecutive years with no rain at all. In the same area summer temperature reaches peaks of more than 50 °C, whilst on the plateau it seldom exceeds 35 °C. Winter is characterized by strong winds from NE, whilst in summer the main air flow is from SE. There are no permanent rivers in the region, but some of them may exhibit a large discharge in response to intense rainfalls.

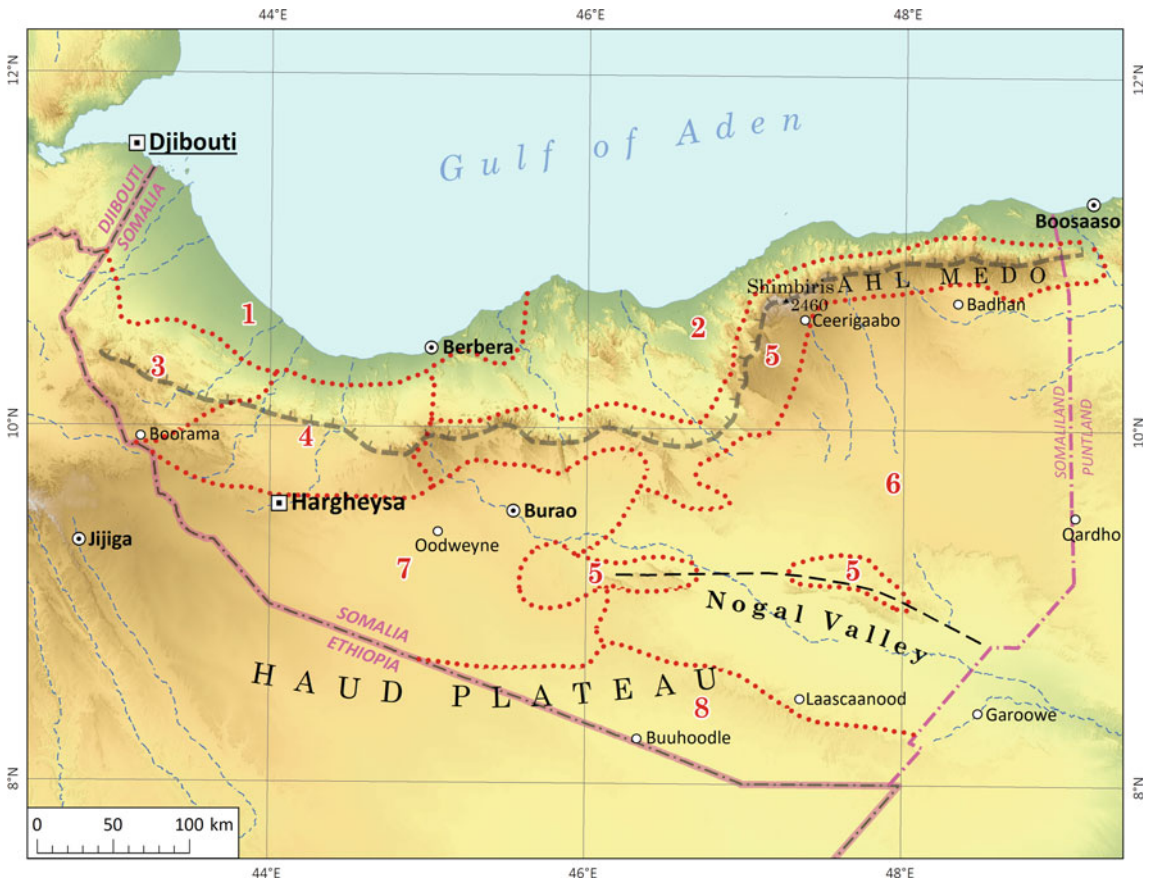

Fig. 10.1 Geomorphological provinces of Somaliland: (1) coastal plain; (2) hilly coastal belt; (3) limestones basement; (4) basement; (5) Auradu/basement; (6) Taleex Karkar; (7) Yesomma; (8) Karkar

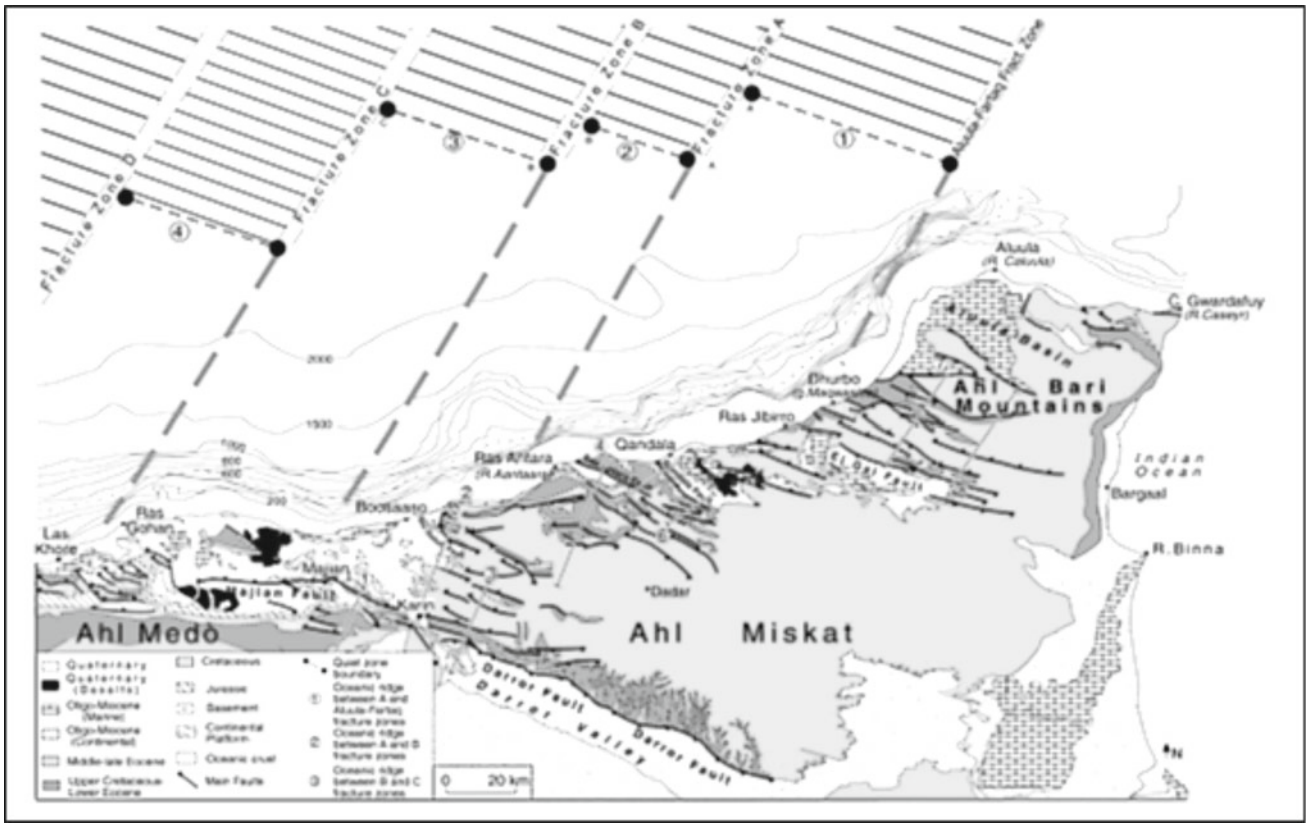

Fig. 10.2 Geological and tectonic scheme of NE Somalia (modified from Fantozzi et al. 2002)

10.3 Landscape and Landforms of the Awdal Region

The Awdal Region takes up the western section of Somaliland, adjacent to the Republic of Djibouti border (Fig. 10.3).

The Precambrian basement crops out at the base of the North Somali escarpment and is covered by different geological units that in the Awdal region are mostly calcareous (Figs. 10.1 and 10.3). The Jurassic Limestones unit forms sub-vertical slopes facing seaward and a gently descending plain towards SSW. The limestones form ridges parallel to the coastline both in the uplifted and in the downthrown blocks, normally separated by minor normal faults, parallel to the escarpment main fault and responsible for seaward lowering of crustal blocks. In this way, the basement—limestone succession is repeated several times (Fig. 10.3). Between the Jurassic limestones and the basement rocks a unit called the Adigrat Sandstones is commonly interposed. It is a basal conglomerate, few dozen of metres thick, which formed at the beginning of the Jurassic marine transgression.

The Jurassic unit mostly consists of stratified limestones with marly levels, which are more abundant at the bottom, at the transition from the Adigrat Sandstones formation. It is considered the best aquifer of the country for the high density of fractures and karstic structures in the upper calcareous portion and for the primary porosity of the Adigrat unit. The best exposed sections are in the Baki district, where a thickness of as much as 200 m of limestones is estimated, and significant springs and the only perennial river of the country (Durdur) occur. The Durdur River descends seaward forming a steep valley, on the bottom of which fruit trees and vegetables are cultivated. In the Xalimale area the escarpment is spectacular and offers a wide view of the lower plain and hill ranges (Fig. 10.4).

In the inner part of the region, such as at Boorama, limestone outcrops never exceed 100 m of thickness (Fig. 10.5). In western basin of the town, ground water exploration led to suppose an underground connection with the Jurassic series beyond the Ethiopian border, whose thicknesses is suspected to be more than 200 m.

Southward, beyond the northernmost ridge built of Jurassic limestones (Gerisa-Gargara), the coastal plain gently descends seaward, with gradients less than 1%. The plain consists of alluvial deposits laid down by the wadis during floods. This sediment is characterized by a downstream decreasing grain size (from gravel to silt), with the formation of small dunes where the sandy fraction prevails.

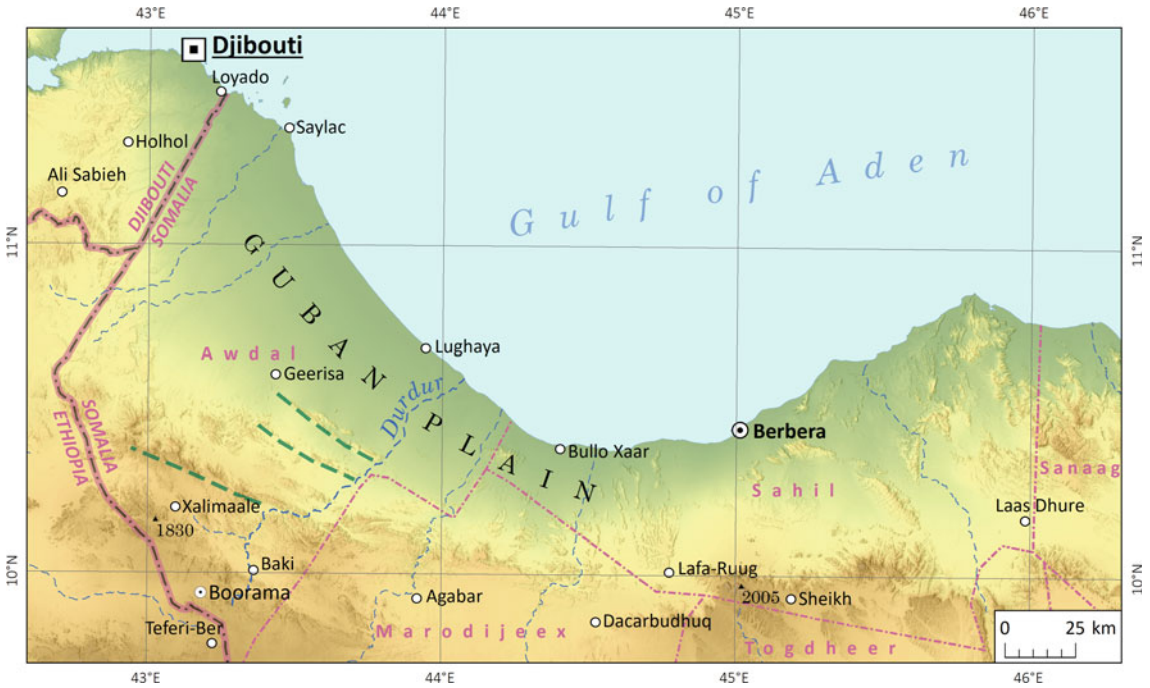

Fig. 10.3 Map of Awdal and Sahil regions. *Note* elongated limestone ridges between Boorama in the south and Geerisa in the north

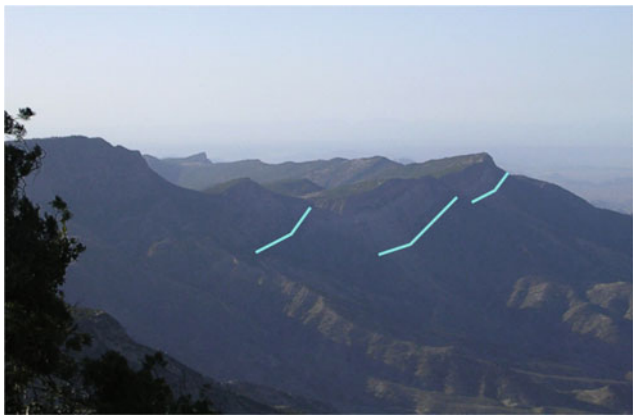

Fig. 10.4 The great escarpment topped by limestones at Xalimale; notice the steep slopes of the limestone crests (above the blue lines) and gentler slopes within the crystalline basement

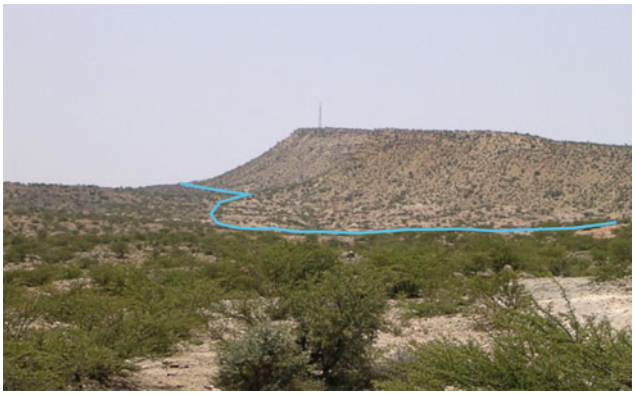

Fig. 10.5 Jurassic limestones (above blue line) resting on crystalline basement at Borama (Awdal capital city)

Fig. 10.6 Ruins of the old Turkish mosque made of white coral blocks at Zeila

Near the coastline wide reddish clayey tidal plains, well developed at Zeila (Saylac) and Lugaya (Lughaye), are found. In the area between Loyado (close to the Djibouti border) and Zeila there are small commercial activities that exploit salt lenses embedded within the clay layers. The town of Zeila was built during the Turkish dominion on an ancient coral reef, recently emerged, from which white coral blocks were taken to build the settlement (Fig. 10.6). The town was destroyed in 1990 by the concurrence of a stream flood and the high tide. The coastal plain is crossed by hazardous wadis. They remain dry, with white sandy beds for most of the time but they can unexpectedly resume high flows in response to intense rainfalls on the plateau,

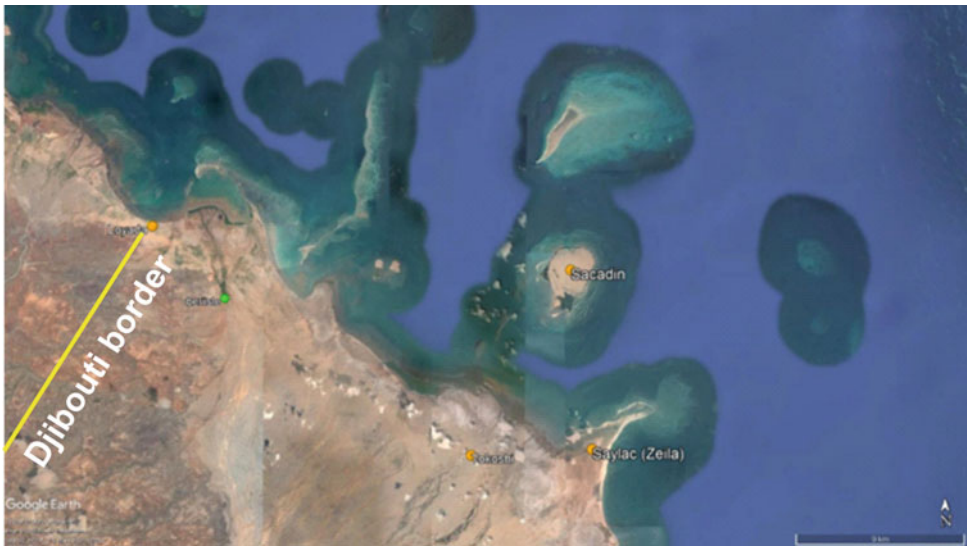

Fig. 10.7 Satellite image of Zeila-Loyado plain and of the Sahadin Islands

sometimes with one or two days of delay. The sea is not easily accessible because of the presence of lagoons, quick sands and, locally, mangrove strips.

Along the Djibouti border and widely beyond it, a volcanic belt less than 20 km wide and mostly made by Pliocene lava and pyroclastic products is present. Between Zeila and Djibouti, several islands of volcanic-coralline origin are present as well (Fig. 10.7). The largest one amongst them is Sacadin (Sahadin) and it is fully surrounded by mangroves and coralline reef.

10.4 Landscape and Landforms of the Marodijeex Region

Moving eastward into the Marodijeex (once Woqoy-Galbeed) region, where the state capital Hargeisa is located (Figs. 10.1 and 10.8), the plateau edge and part of the coastal strip are covered by a dark Pliocene lava flow (Late Miocene—Pleistocene—Abbate et al. 1994) (Fig. 10.8), probably coming from a linear effusive source. A volcanic edifice of similar age

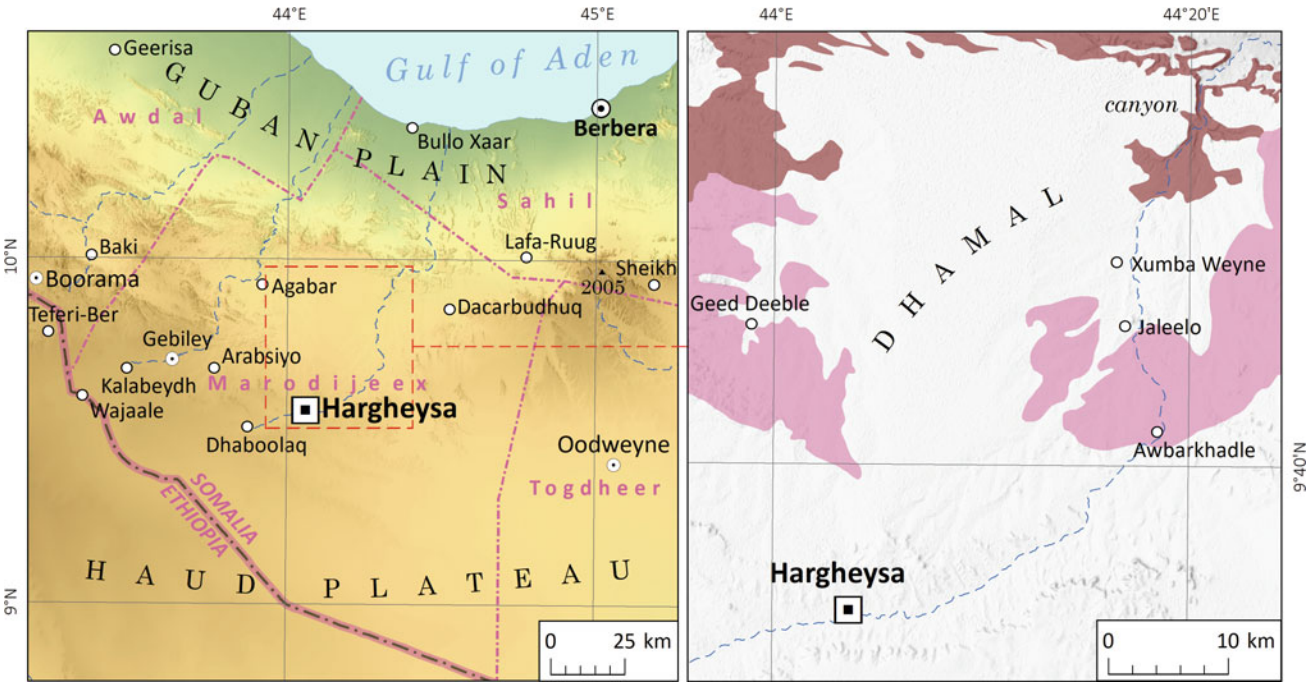

Fig. 10.8 Marodijeex (Woqooyi Galbeed) region and detail of Hargeisa surroundings; the areas coloured in purple mark the basement outcrops, dark areas are covered by basalt flows

and composition, mainly basaltic, Mount Elmis, formed on the coast about 90 km to the north of the Somaliland capital of Hargeisa (Fig. 10.9).

Near Hargeisa, scattered remains of the Auradu limestones form isolated hills. Two of them, located in the eastern suburbs of the town, are called the Hargeisa Breasts (*Naasablod* in the local language) and are considered the brand of the town (Fig. 10.10). The peculiar morphology of these hills results from the occurrence of a hard limestone top, which protects the underlying Yesomma sandstones from erosion. The Late Cretaceous Yesomma sandstones, which constitute most of the surrounding plain south of the town, are of fluvial origin and are the Somali equivalent of the Adigrat Sandstones extensively outcropping in Ethiopia.

In the Marodijeex region, the Yesomma sandstones are exposed over most of the plateau. This unit of continental environment consists of alluvial deposits, mostly sandy and silty that filled many depressions of tectonic nature and contributes, along with the deposition of a thin Quaternary alluvial blanket, to the contemporary flat morphology of the plateau. The unit is part of a widespread formation known in most of the Sahelian area as the Nubian Sandstones and in its thickest sections can reach more than 500 m. In the Hargeisa surroundings the escarpment is split into two main steps, with a deep tectonic depression in between, filled by Quaternary deposits that host some of the best aquifers of the country (Geed Deeble, Dhamal, Jaleelo).

Whilst the areas near the escarpment are characterized by strong erosion, which gives rise to spectacular structures, the Haud plateau (Fig. 10.1) and the coastal plain do not offer many landforms of particular interest. For the most part, the plateau is characterized by an arid, sandy-silty plain that appears slightly convex to the south of the capital or flat and dipping southward, as in the areas of Odoweyne or Burco (Togdheer Region), or northward, as in the coastal plain, everywhere covered by alluvial-aeolian deposits. The landscape is monotonous, only interrupted by isolated, flat-topped hill chains, a few dozen metres higher than the surrounding plain. Vegetation is scarce and mainly consisting of low bushes and scattered acacias. The plateau is gently inclined towards the Ethiopian border and it is crossed by drainage systems, along which many sandy dams (*balleys* in the local language) have been built to supply water for any use (civil, rural or livestock). In an area of many thousands of square km, in fact, deep wells and perennial aquifers are lacking. Here the population tries to extend the water supply beyond the rainy seasons harvesting the running water in wide structures like the *balleys* (Fig. 10.11) or smaller square trenches (*berkads* in the local language), normally 4–6 m deep, lined with concrete and commonly covered with iron sheets to reduce evaporation. Actually, the *balleys* can store larger volumes of water but

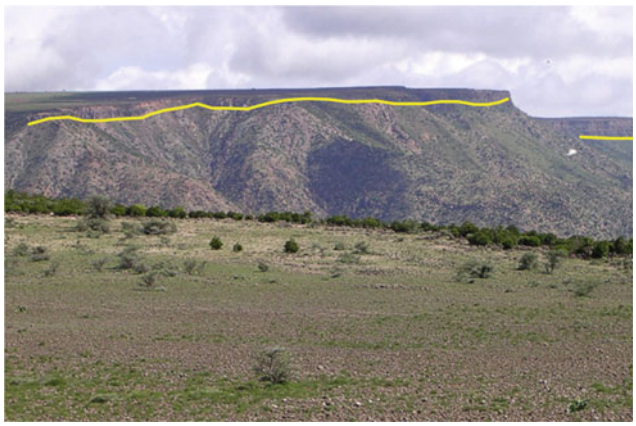

Fig. 10.9 The edge of the plateau near Hargeisa—notice the basalt cover (above the yellow line)

Fig. 10.10 Hargeisa twin hills (Naasablod) protruding from the plain: the hills are topped by a layer of Auradu limestones

Fig. 10.11 A dried-up balley at the peak of the rainy season at Botor (Gabiley)

seldom has the water supply lasted beyond the month of January, whereas the larger *berkads* are a reliable resource throughout a normal dry season, up to February, but cannot face prolonged droughts.

The region gets the name from the wadi that originates a few km east of the town. The river runs for about 60 km in the prevailing WSW–ENE direction as far as the settlement of Awbarakhadle, then it turns sharply northward as far as the village of Xomboweyne. In this area the wadi gets the name of Tog Wahen and the streambed becomes very wide, as much as 1 km. The alluvial deposits are abundantly recharged by the river flows and the subsurface water level is found at the depth of less than 1 m. The river subsurface flow is commonly exploited by means of trenches that capture the water and convey it to farms located downstream, mostly cultivating fruit trees. Shortly downstream of Xomboweyne the plain ends abruptly as the river enters the basalt flows that cover the crystalline basement. This section of the valley is deeply cut into the basalts, forming black sub-vertical walls on the flanks and acquiring a canyon-like morphology (Fig. 10.12).

In the rainy season, small ephemeral lakes form a few km downstream of the Xomboweyne village (Fig. 10.13). The surroundings of these small lakes are dangerous for the presence of quick sand.

Downstream of the village, the river descends from elevations of about 1000 m down to 500 m asl in the coastal plain. In this reach, the river has eroded deep and narrow gorges incised into the basalts and the basement rocks (Fig. 10.14). Just upstream of its fan delta, Tog Wahen River forms spectacular narrow gorges in granite and in the Yesomma sandstones (Figs. 10.14 and 10.15). The water flowing in the upstream reaches infiltrates in the fractured basement and, at the escarpment foot, the reddish granite gorge (Fig. 10.14) hosts only a small water flow in the dry

Fig. 10.13 Ephemeral lake near Xomboweyne (Hargeisa) formed by Tog Wahen. In this area the basalt is characterized by reddish colour

Fig. 10.14 Tog Wahen gorge cut into a reddish granite. Water flows can be as much as 10 m deep. In the upper part of the gorge typical weathering forms of granite rocks, such as spheroidal boulders, widened fissures and tors can be seen

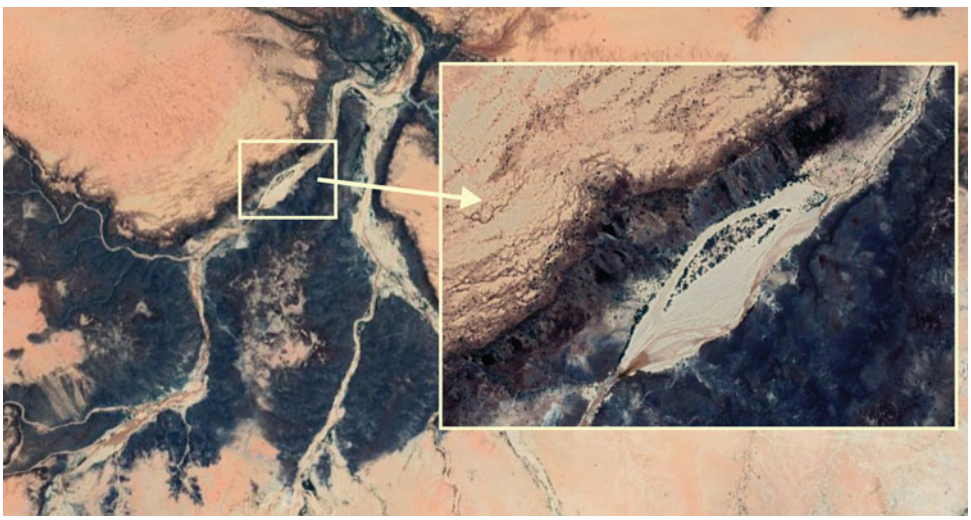

Fig. 10.12 The Tog Wahen river entering the basalt flows and forming a canyon with sub-vertical valley flanks. Tog or Togga means 'a river' in the local language

Fig. 10.15 Pink, criss-cross laminated Yesomma sandstones exposed in one of Tog Wahen gorges

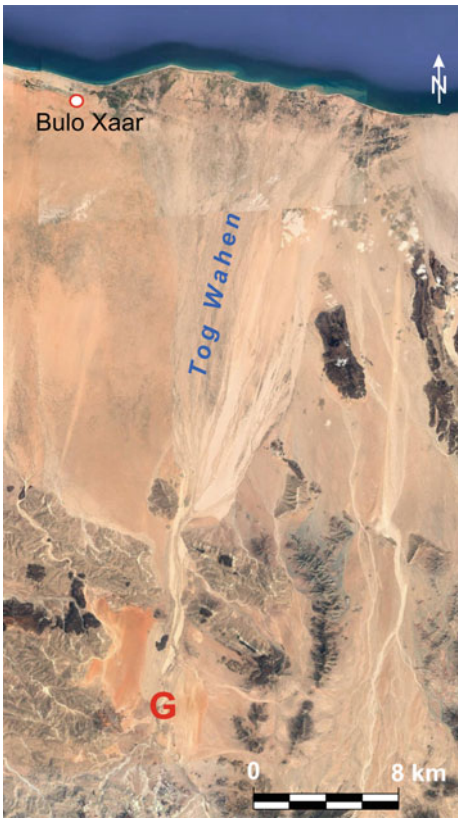

Fig. 10.16 The gorge (G) and fan delta of Tog Wahen

season, with scattered deeper pools. The gorges are not accessible in the rainy season since the risk to be flushed away by sudden flows is very high.

A few hundred metres downstream of the gorge, the Tog Wahen streambed widens and splits into a multiple channel system to form a fan delta, which is about 14 km wide (Fig. 10.16).

10.5 Sahil Region

Sahil region lies at the centre of the country, along the coast of the Gulf of Aden, and the capital is Berbera, once capital of the English protectorate. It extends up to the escarpment and to the northern section of the plateau, where the town of Shiik occurs (Fig. 10.17).

The Sahil geology is the outcome of an intense tectonic activity that formed several blocks with thick sedimentary series along the SW–NE chain (Fig. 10.17) that surrounds the coastal plain of Berbera. The coastal plain consists of Quaternary alluvial deposits with scattered hills built of Miocene-Pliocene deposits, whereas pre-Eocene units are not visible as far as the first hills chain south of the plain. The Jurassic limestones form a series of important blocks in the area south of Berbera, at Bixindhule (Fig. 10.17).

In this location the thickness of the unit is estimated for about 700 m and consists of different sub-units, with the presence of thick marly sections interbedded with medium-fine graded limestones (Figs. 10.18 and 10.19). The Adigrat sub-unit at the base may include thin pillow basalts.

The E–W alignment of limestone blocks is sharply bound, in the south, by a long normal fault that lowers the upper surface of the blocks to the level of the basement. Because of this tectonic structure and the southward dip of limestones, the calcareous sub-units constitute important aquifers that supply several springs (Fig. 10.19) and a permanent stream, running in a narrow valley cut into the basement (Fig. 10.20). The stream disappears in the sandy alluvial deposits of the Togga (wadi) Kalajab at Faradero site, where the well field of Berbera is located.

At Faradero it is possible to see the Precambrian basement and the Boulder Beds unit (Plio-Pleistocene), the latter normally 5000 m above the basement, but juxtaposed here because of a major geological fault that downshifted the eastern section of the valley. From geophysical data collected during oil surveys, the limestones extend widely at depth, between the Paleogene units and the Precambrian basement.

10.6 The Eastern Regions of Somaliland

The eastern section of Somaliland includes three regions: Togdheer, Sool and Sanaag, whose capitals are Burco, Laascaanood and Ceerigaabo (Fig. 10.21). To the east of the last two regions there is the disputed border with Puntland. In this area, on the top of the Cretaceous unit, a younger formation, the Auradu Limestones, marks a new marine transgression in the lower Eocene. The limestones thicken from west to east, from a few dozen metres in the Marodijeex valley to some hundreds of metres in the area east of

Fig. 10.17 Map of eastern part of Sahil coastal region and prominent inland escarpment. (1) Hills built of Cenozoic sedimentary rocks, (2) blocks of Jurassic limestone

Fig. 10.18 Bixindhule limestones interbedded with marly levels (between the green lines)

Burao (Burco). This suggests that the transgression came from the east. The Auradu unit forms spectacular cliffs on the top of the northern escarpment around the town of Ceerigaabo (Sanaag region) (Fig. 10.21), whilst in the central and southern sections of the plateau (Togdheer and Sool regions) it forms long multiple ridges subparallel to the escarpment. The unit consists of massive biogenic limestones, with lenses of sandy, clayey and marly limestones (Fig. 10.22).

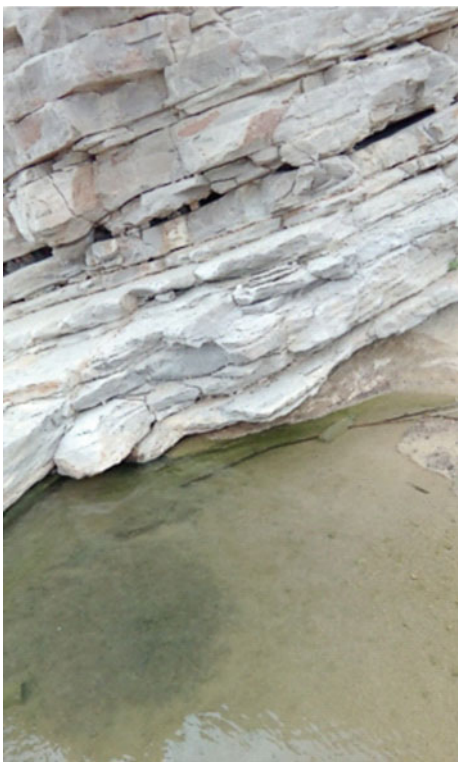

Fig. 10.19 Fresh water emerging at the foot of a limestone wall

Fig. 10.20 The stream fed by the Bixindule springs, running between black gabbro rocks and reddish orthoclase dikes, before disappearing in the sands of Kalajab valley

The Gulf of Aden pre-rifting succession continued in the lower to middle Eocene with the deposition of Taleh (Taleex) evaporites that mark a regressive phase, with a vast lagoon environment in which gypsum and anhydrites with limestones and cherty levels formed (Fig. 10.23).

The Taleex unit is dominant in the eastern regions (Togdheer, Sool, Sanaag) (Figs. 10.24 and 10.25) where it covers the older units (Auradu, Yesomma). The first outcrops appear in the headwaters of the Nugaal (Nogal) valley and from there, they extend northward and eastward. From a morphological point of view the Taleex evaporites form a wide plain dotted by rounded hills a few metres high. In the Sanaag region, on the top of these hills stone rings of uncertain origin are found. The local inhabitants declare that their function is unknown. They may be old gravestones or simple nomadic shields against the wind (Fig. 10.24).

Commonly, large gypsum crusts form near the ground surface, where the Taleex formation is present, though they

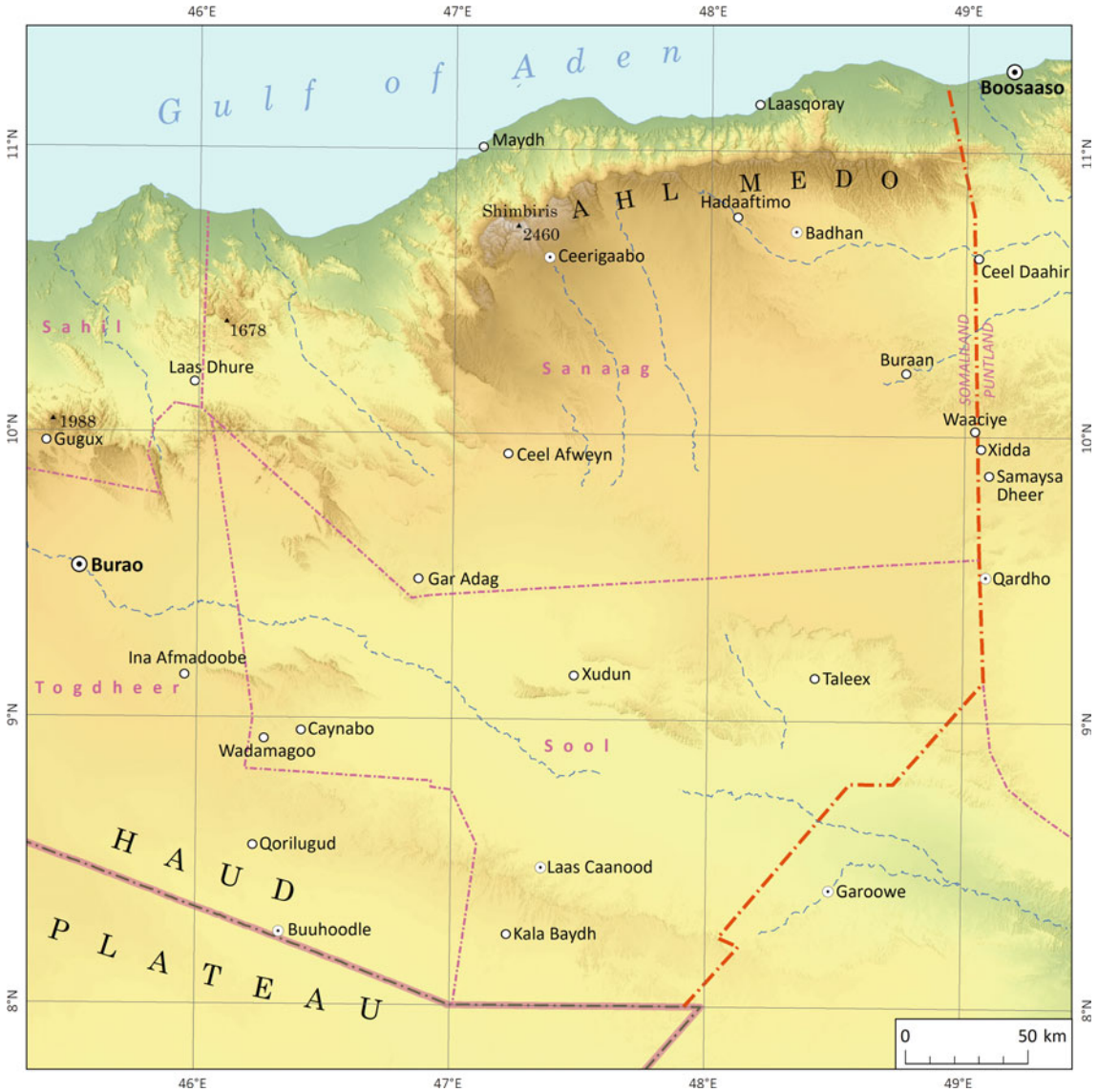

Fig. 10.21 Map of Eastern Somaliland

Fig. 10.22 The cliff of massive Auradu Limestones at Erigavo, facing the coastal plain

Fig. 10.23 Spectacular erosive landforms of the sub-horizontal Auradu layers on the escarpment top (aerial oblique view)

are not exposed. In some places, as in the Nugaal valley, the gypsum that forms the crusts comes from far away hills as ions in the water running across the ground surface during floods (Fig. 10.26). The evaporites are responsible for the salinity of shallow and deep waters of these regions and of most of the Karkar region in Puntland. The thickness of the Taleex formation can reach 300 m.

On the northern side of the Nugaal valley a high range rises to high elevation, providing termination of a tectonic trench that extends for most of the valley length and width. The trench bottom occurs a few kilometres below sea level, where the crystalline basement lies. At the northern edge, a big fault has caused uplift of the geological succession that includes deposits spanning a very long interval from more than 500 million (Precambrian) to 4–5 million years ago (Pliocene) and building the massive range, mostly made by Auradu limestones (Fig. 10.27).

Fig. 10.24 Typical gypsum hill in the Sanaag region. Notice the stone ring on the hill top

10.7 The Bosaso (Boossaso) Plain

At the eastern edge of the Nugaal valley, beyond Laas Canood, there is the disputed border with Puntland, presently part of the Federal Republic of Somalia. From Garowe to the escarpment facing the Gulf of Aden, the landscape consists of a wide monotonous calcareous plain, formed by gently undulated or flat layers of the Karkar Formation, with only a small outcrop of the whitish gypsum of Taleex formation in between; the flat Karkar limestones extend as far as the escarpment at the margin of the Haud Plateau (Fig. 10.1). The road that descends from the plateau to the sea enters a narrow valley excavated by the Dhagan wadi that drains a wide basin. With its headwaters behind the escarpment edge, the course receives a large amount of water because at the high elevation (>1.000 m asl) the rainfall is relatively abundant (300–400 mm yr^{-1}). For this reason, the water flows in the wadi for a few kilometres from the escarpment foot, near the Laag village, where it takes the name of Whadhod (Figs. 10.28 and 10.29). A few hundred metres beyond the Bosaso-Garowe road bridge the water disappears into coarse bed deposits and probably flows underground following the course of the wadi as far as the Kaw gorge that constitutes the river mouth into the sea (Fig. 10.30). The gorge is spectacular if seen from a plane when arriving or leaving the town. This is because during high tide it is occupied by sea water, whereas during low tide

Fig. 10.25 Taleex range at Laas Canood. The town extends in a wide, gently inclined valley between the hills

Fig. 10.26 The central part of the Nugaal Valley: yellow dust and gypsum crusts

Fig. 10.27 The Auradu range at the northern edge of the Nugaal valley

it becomes a muddy swamp, on which flamingos often walk. The site can be reached by a gravel road but, as everywhere in Puntland, an SPU escort and military permission are necessary since a military camp has to be crossed beyond the airport.

The Dhagan wadi, dry for more than 90% of its course, marks the eastern edge of the western escarpment, named as the Ahl Medo range in Puntland, and separates it from the Ahl Miskat range that forms most of the true Horn of Africa. From the Laag village, a wide plain extends seaward. It is formed by older Quaternary alluvial deposits and is punctuated by hills made of Mesozoic geological units. The area is very arid, almost devoid of vegetation, but in the surroundings of Laag, especially westward, there are many oases around springs (Duud Shabel, War War, Hilqad) (Fig. 10.31) and extending along other branches of Wadi Dhagan, where the water running otherwise underground comes to the surface and flows for a few hundred metres (Laag, Gub wadis). At Duud Shabel there are high palms, dwarf palms and several farms where greens are cultivated. A project to bring water from the springs to Boosaso is going on. From this area northward the landscape is rather monotonous, only interrupted by alluvial terraces, locally made of ochre or red coloured sandy-clayey deposits (Fig. 10.32) or outcrops of the Dubhar limestones.

The town of Bosaso rests on a low terrace between two wadis, Balade and Kulule and it is surrounded by a wide plain made of pebbles. A few kilometres to the east, the Ahl Miskat range closes the plain with beautiful cliffs formed by the Auradu Limestones, cut by an important fault and by deep valleys. In one of these valleys, formed by the Byio Kulule stream (Fig. 10.33), there are hot water springs and a thermal station with water pools of different temperatures, built during the early Italian occupation, surrounded by a beautiful oasis.

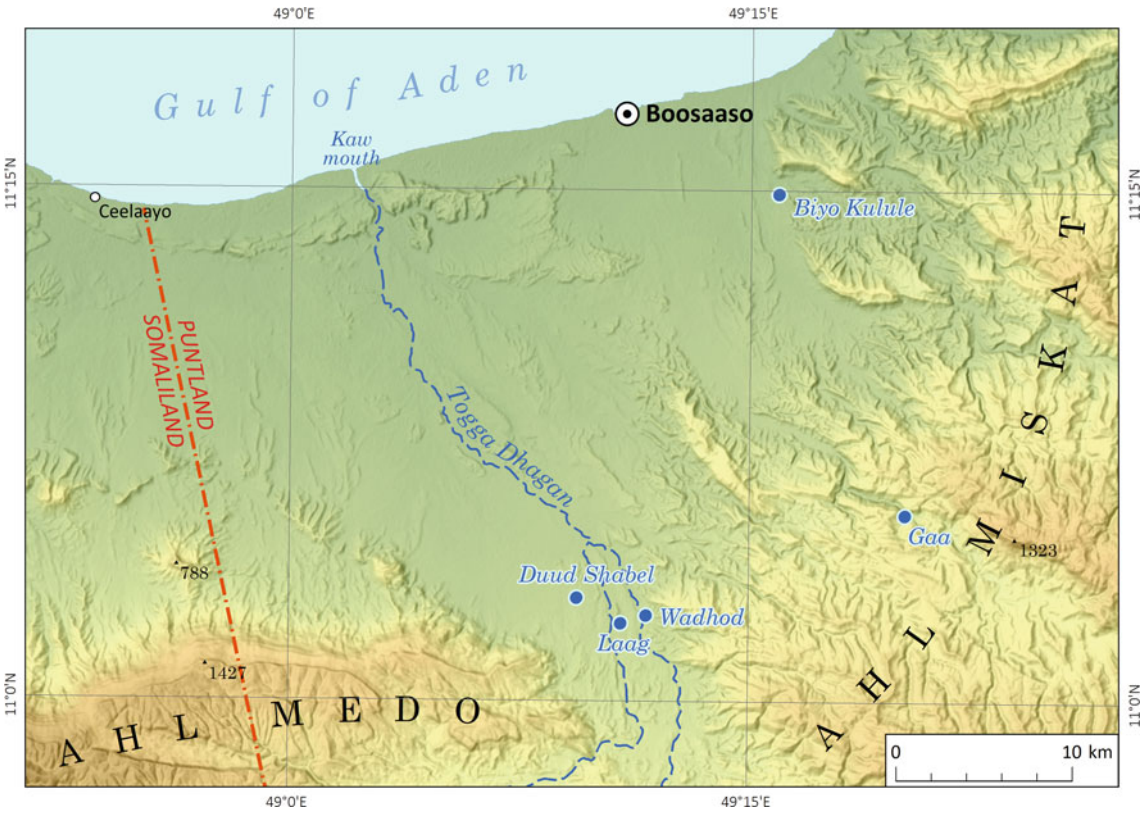

Fig. 10.28 Bosaso plain, the main springs and the course of Wadi Dhagan

Fig. 10.29 Water in Wadi Dhagan under the road bridge near the Laag village

Fig. 10.30 See water entering the Kaw mouth during high tide

10.8 Concluding Remarks

The contemporary geomorphological landscapes of northern Somalia reflect the long sequence of geological and tectonic events that affected this region. Planation of the crystalline basement, marine transgressions and deposition, and uplift associated with the doming of the Horn of Africa created a landscape with marked physiographic differences. The main, large-scale elements of northern Somalia landscape are the plateau, the escarpment and the coastal plain. The contrast between the sedimentary rocks resting on the crystalline basement provides the landscape with spectacular, sharp-crested top of the main escarpment in the Awdal region.

Fig. 10.31 The oasis encircling the Duud Shabel springs

Fig. 10.32 Desert view from Duud Shabel spring: in the background the edge of the plateau escarpment (Ahl Medo) descending from about 2000 to 500 m asl; in the foreground old alluvial terraces

Fig. 10.33 Byio Kulule valley, eastern flank

In the Marodijeex Region, variable resistance of limestone and sandy portion of the Yesomma sandstones to weathering gave rise to peculiar landforms such as the Naasablod hills, the famous twin conical hills that are a landmark of Hargeisa, the capital city of Somaliland. The twin hills protrude from a flat area like two isolated inselbergs and results from the presence of a hard limestone top preventing erosion of the underlying Yesomma sandstones, which otherwise make up the surrounding plain.

In eastern Somaliland, the Taleh (Taleex) evaporites cover the older units (Auradu, Yesomma) and are the prevailing surface rocks. This formation marks a regressive phase within a vast lagoon environment, in which gypsum and anhydrites with limestones and cherty levels formed. Weathering and erosion produced a flat landscape with scattered rounded hills only a few metres high. Commonly, this flat land is covered by a gypsum crust, which forms on the ground even if the Taleh formation is not close to the topographic surface. In the Nugaal valley, for instance, the gypsum crust is formed by precipitation from overland flow draining distant gypsum hills during floods. At the northern edge of the Nugaal valley, a big fault caused uplift of the geological series that includes deposits spanning a very long interval from more than 500 million years (Precambrian) up to 4–5 million years ago (Pliocene) building the massive range, mostly made by Auradu limestones, and forming spectacular cliffs near Ceerigabo.

In the eastern part of the plateau deep gorges, incised by ephemeral streams, occur. The larger of them, such as Wadi Dhagan, have large catchments, whose headwaters are located on the plateau, beyond the escarpment edge. On the plateau the annual rainfall is relatively high (300–400 mm). This geomorphological setting favours the collection of large quantities of water that flows in the wadi downstream of the escarpment foot, for a few kilometres in the coastal plain. This water is a very important resource for the communities living in the dry costal belt, where it can be used for small crops irrigation.

Though this chapter is a summary description of the main geomorphological landscapes of northern Somalia, the peculiar combination of a complex geological and structural evolution of the area and the prevailing dry climate of today resulted in landscapes and landforms, whose generating processes and controlling factors are known only superficially. Unfortunately, the state of permanent civil war and the resulting political instability that characterized the region during the last decades have discouraged geomorphologists from undertaking field investigation campaigns. In northern Somalia, however, many interesting scientific questions are still open and only the main geomorphological characteristics of this region were delineated in this chapter in order to stimulate further research as soon as sufficient security conditions will be restored in the region.

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