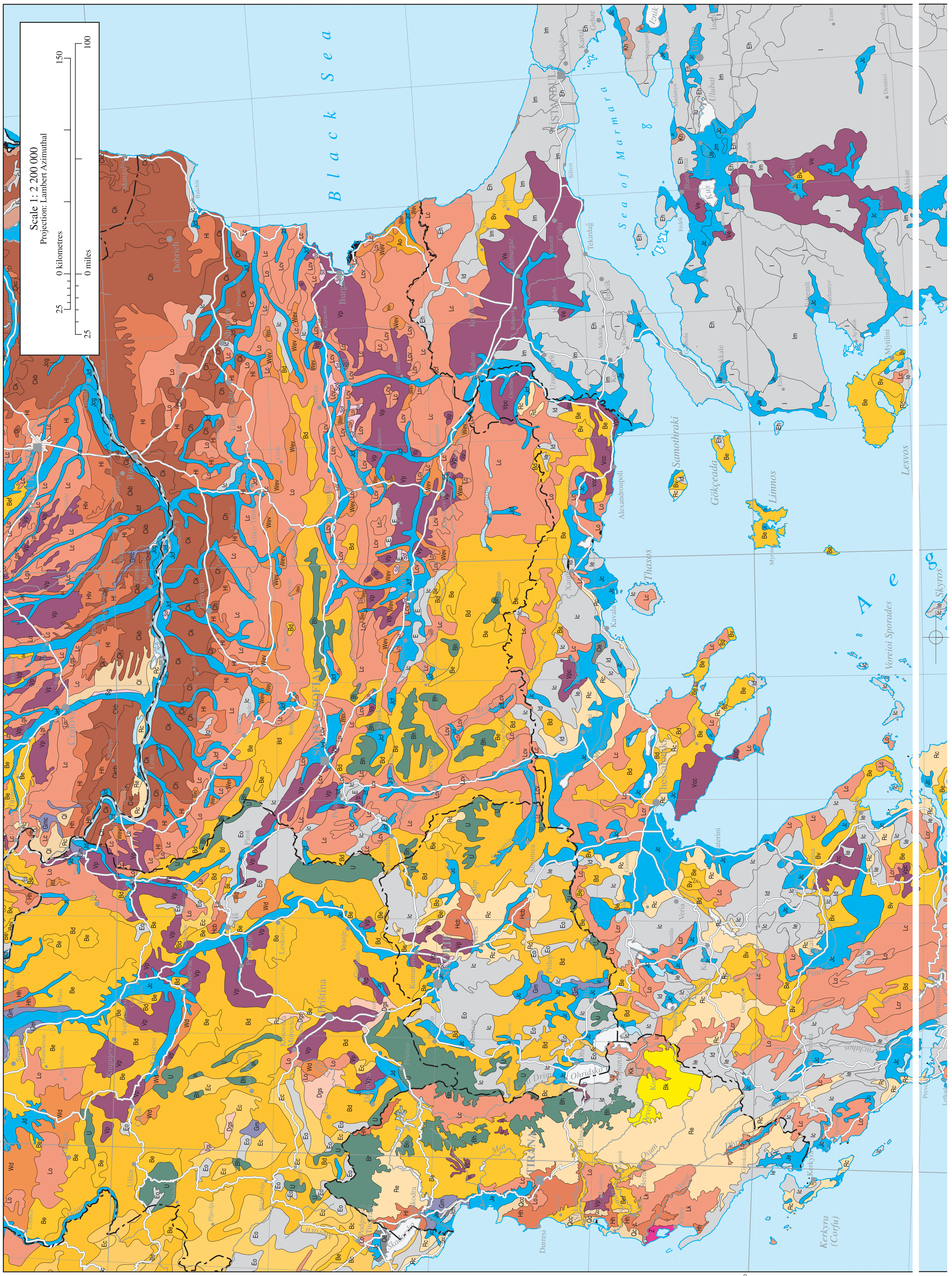
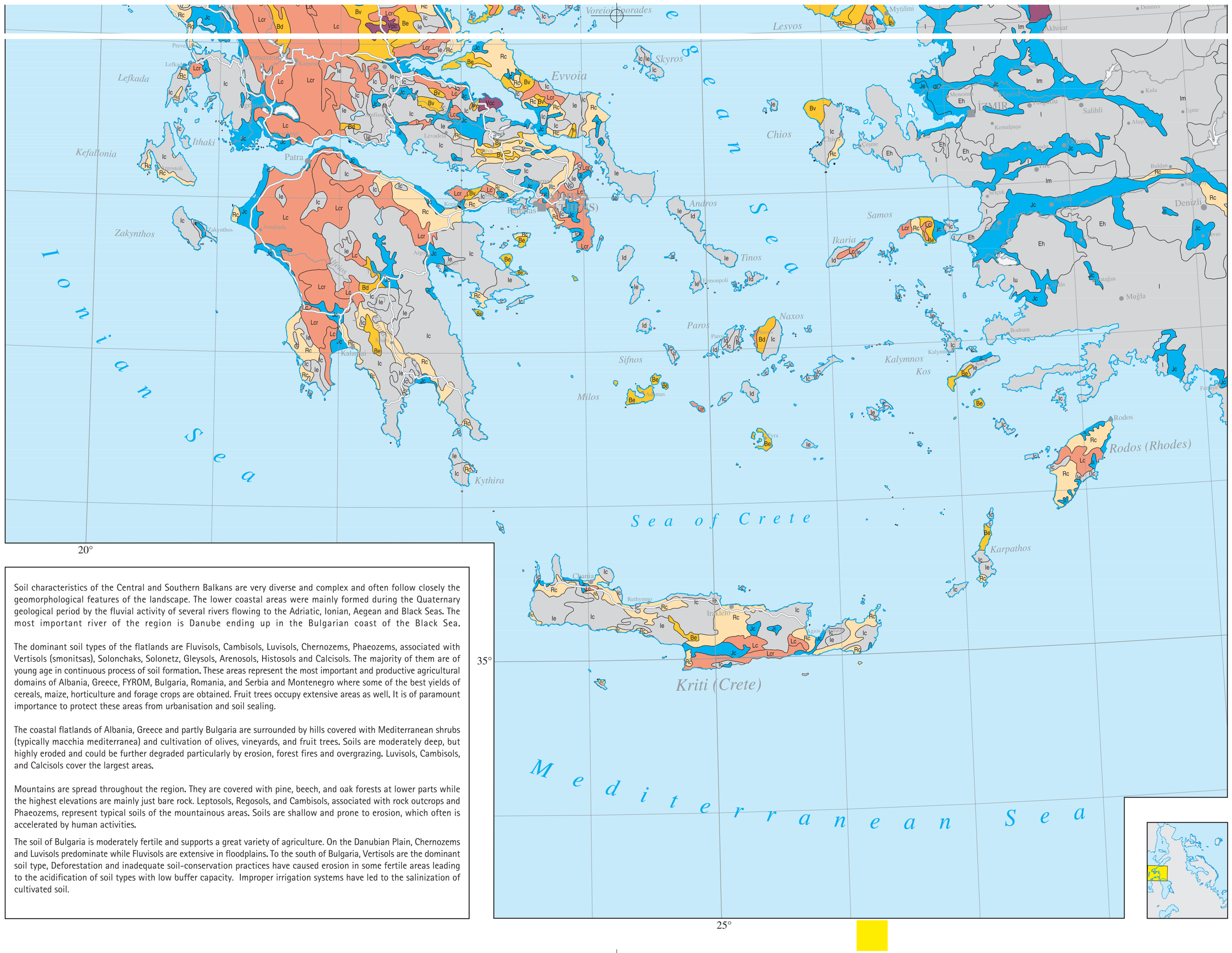
72



68

66



Soil characteristics of the Central and Southern Balkans are very diverse and complex and often follow closely the geomorphological features of the landscape. The lower coastal areas were mainly formed during the Quaternary geological period by the fluvial activity of several rivers flowing to the Adriatic, Ionian, Aegean and Black Seas. The most important river of the region is Danube ending up in the Bulgarian coast of the Black Sea.

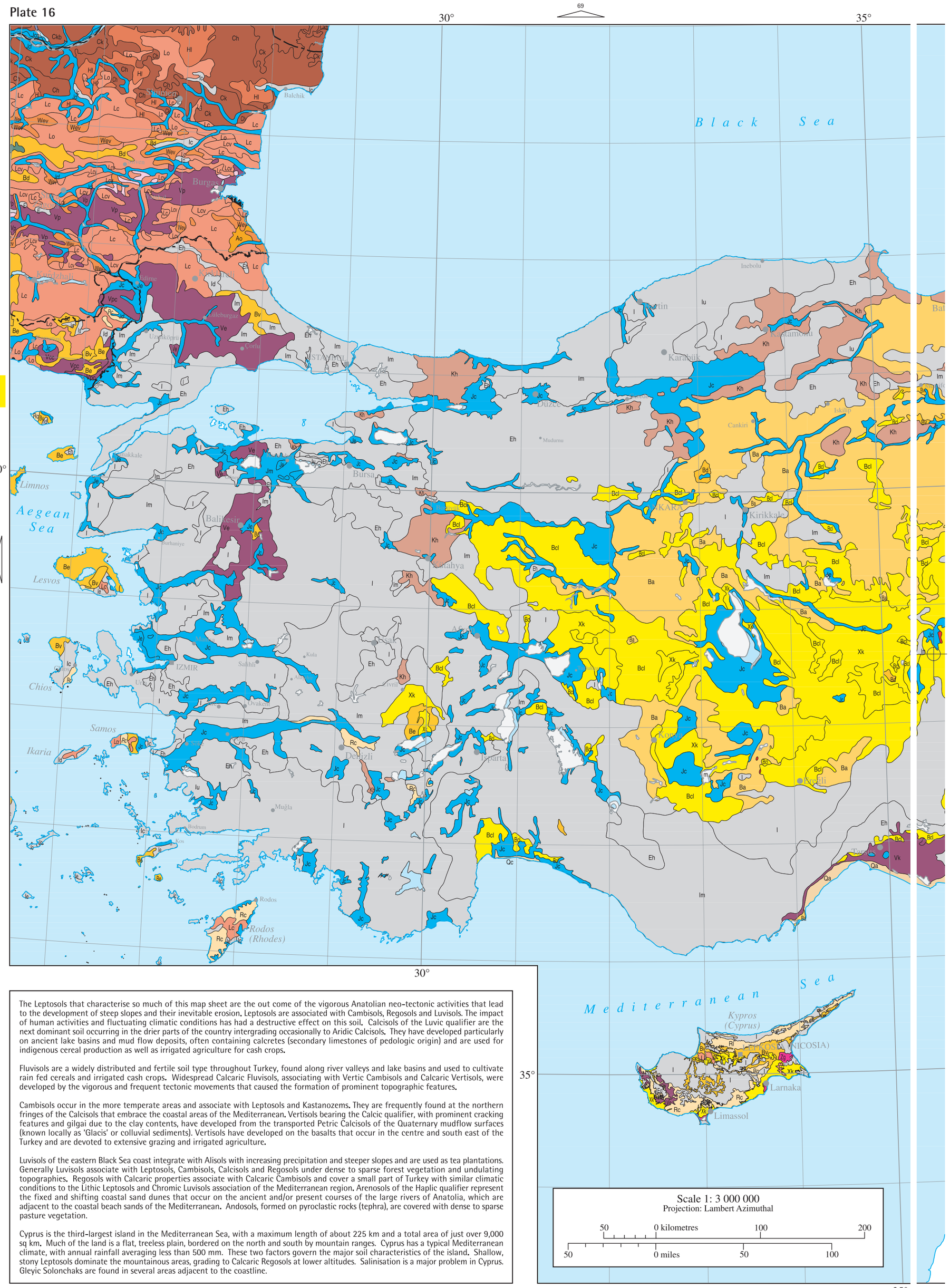
The dominant soil types of the flatlands are Fluvisols, Cambisols, Luvisols, Chernozems, Phaeozems, associated with Vertisols (smonitsas), Solonchaks, Solonetz, Gleysols, Arenosols, Histosols and Calcisols. The majority of them are of young age in continuous process of soil formation. These areas represent the most important and productive agricultural domains of Albania, Greece, FYROM, Bulgaria, Romania, and Serbia and Montenegro where some of the best yields of cereals, maize, horticulture and forage crops are obtained. Fruit trees occupy extensive areas as well. It is of paramount importance to protect these areas from urbanisation and soil sealing.

The coastal flatlands of Albania, Greece and partly Bulgaria are surrounded by hills covered with Mediterranean shrubs (typically macchia mediterranea) and cultivation of olives, vineyards, and fruit trees. Soils are moderately deep, but highly eroded and could be further degraded particularly by erosion, forest fires and overgrazing. Luvisols, Cambisols, and Calcisols cover the largest areas.

Mountains are spread throughout the region. They are covered with pine, beech, and oak forests at lower parts while the highest elevations are mainly just bare rock. Leptosols, Regosols, and Cambisols, associated with rock outcrops and Phaeozems, represent typical soils of the mountainous areas. Soils are shallow and prone to erosion, which often is accelerated by human activities.

The soil of Bulgaria is moderately fertile and supports a great variety of agriculture. On the Danubian Plain, Chernozems and Luvisols predominate while Fluvisols are extensive in floodplains. To the south of Bulgaria, Vertisols are the dominant soil type, Deforestation and inadequate soil-conservation practices have caused erosion in some fertile areas leading to the acidification of soil types with low buffer capacity. Improper irrigation systems have led to the salinization of cultivated soil.

Plate 16



The Leptosols that characterise so much of this map sheet are the out come of the vigorous Anatolian neo-tectonic activities that lead to the development of steep slopes and their inevitable erosion. Leptosols are associated with Cambisols, Regosols and Luvisols. The impact of human activities and fluctuating climatic conditions has had a destructive effect on this soil. Calcisols of the Luvic qualifier are the next dominant soil occurring in the drier parts of the country intergrading occasionally to Aridic Calcisols. They have developed particularly on ancient lake basins and mud flow deposits, often containing calcretes (secondary limestones of pedologic origin) and are used for indigenous cereal production as well as irrigated agriculture for cash crops.

Fluvisols are a widely distributed and fertile soil type throughout Turkey, found along river valleys and lake basins and used to cultivate rain fed cereals and irrigated cash crops. Widespread Calcaric Fluvisols, associating with Vertic Cambisols and Calcaric Vertisols, were developed by the vigorous and frequent tectonic movements that caused the formation of prominent topographic features.

Cambisols occur in the more temperate areas and associate with Leptosols and Kastanozems. They are frequently found at the northern fringes of the Calcisols that embrace the coastal areas of the Mediterranean. Vertisols bearing the Calcic qualifier, with prominent cracking features and gilgai due to the clay contents, have developed from the transported Petric Calcisols of the Quaternary mudflow surfaces (known locally as 'Glacis' or colluvial sediments). Vertisols have developed on the basalts that occur in the centre and south east of the Turkey and are devoted to extensive grazing and irrigated agriculture.

Luvisols of the eastern Black Sea coast integrate with Alisols with increasing precipitation and steeper slopes and are used as tea plantations. Generally Luvisols associate with Leptosols, Cambisols, Calcisols and Regosols under dense to sparse forest vegetation and undulating topographies. Regosols with Calcaric properties associate with Calcaric Cambisols and cover a small part of Turkey with similar climatic conditions to the Lithic Leptosols and Chromic Luvisols association of the Mediterranean region. Arenosols of the Haplic qualifier represent the fixed and shifting coastal sand dunes that occur on the ancient and/or present courses of the large rivers of Anatolia, which are adjacent to the coastal beach sands of the Mediterranean. Andosols, formed on pyroclastic rocks (tephra), are covered with dense to sparse pasture vegetation.

Cyprus is the third-largest island in the Mediterranean Sea, with a maximum length of about 225 km and a total area of just over 9,000 sq km. Much of the land is a flat, treeless plain, bordered on the north and south by mountain ranges. Cyprus has a typical Mediterranean climate, with annual rainfall averaging less than 500 mm. These two factors govern the major soil characteristics of the island. Shallow, stony Leptosols dominate the mountainous areas, grading to Calcaric Regosols at lower altitudes. Salinisation is a major problem in Cyprus. Gleyic Solonchaks are found in several areas adjacent to the coastline.

Plate 16

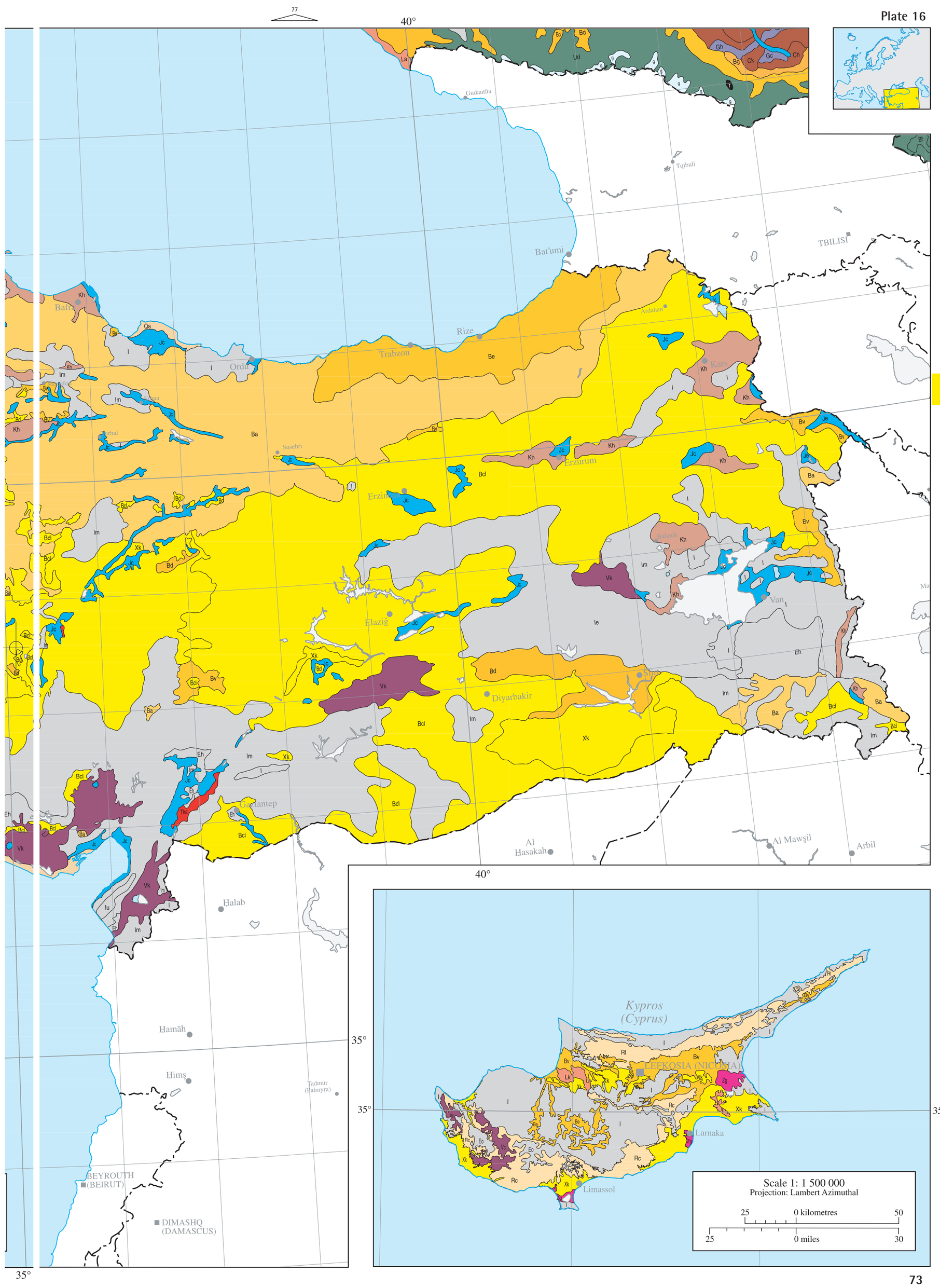

77
40°
Gudautŭa
Tqibuli
Bat'umi
TBILISI
Rize
Trabzon
Ordu
Ardahan
Kars
Susehri
Erzurum
Erzincan
Balanik
Van
Elazığ
Diyarbakir
Gaziantep
Al Hasakah
Al Mawşil
Arbil
Halab
Hamāh
Hims
Tadmur (Palmyra)
BEYROUTH (BEIRUT)
DIMASHQ (DAMASCUS)
35°
Kypros (Cyprus)
LEFKOSIA (NICOSIA)
Larnaka
Limassol
Scale 1: 1 500 000
Projection: Lambert Azimuthal
25 0 kilometres 50
25 0 miles 30

Plate 17

Belarus is dominated by a humid temperate climate and covered mainly by mixed and coniferous forests (taiga). Fluvial and fluvial-glacial deposits prevail. The diversity of soil types is represented by six Reference Groups. Most show features of podzolization as indicated by strongly leached alluvial topsoil of ash-grey colour containing abundant bleached uncoated mineral particles. The underlying layer possesses illuvial characteristics and has clay films enriched with sesquioxides and associated humus. These soil types occupy drained interfluves. Depressions have a shallow water table and contain waterlogged soil displaying gley properties and accumulations of peat.

Albeluvisols are the most common Reference Soil Group in the country. They occupy nearly 137 million ha or 67% of the soil cover, and exhibit a combination of podzolization features (a strongly bleached topsoil with iron-depleted material) and of clay illuviation (Argic horizon). The latter has an irregular upper boundary resulting in albeluvic tonguing into argic horizon. This Reference Soil Group includes Umbric, Stagnic and Gleyic Soil Units. Umbric soil is formed on well-drained sites with a humus horizon of 15-20 cm thick containing about 1-2% of humus. Soil reaction is acid (pH 4.5-5.5). Base saturation is less than 50% and the soil is poor in nutrients. About 50% (119 million ha) are in agricultural use but organic and mineral fertilization is necessary. Forest occupies nearly 40% (83 million ha) of the territory and about 10% (9.5 million ha) is covered by wetlands, half of which are drained for growing crops. Soil structure is not water stable and about 50% of the cultivated soils are affected by water erosion. Soil contamination by heavy metals is not that high due limited application of fertilizers. Nearly 9% of the soils are polluted by radionuclides caused by the Chernobyl accident.

Some unusual and abrupt changes in soil types at national boundaries can be seen on this map. These are due to differences in interpretation and mapping scales between individual countries (e.g. Poland, Latvia & Ukraine). Work is ongoing to resolve these differences.

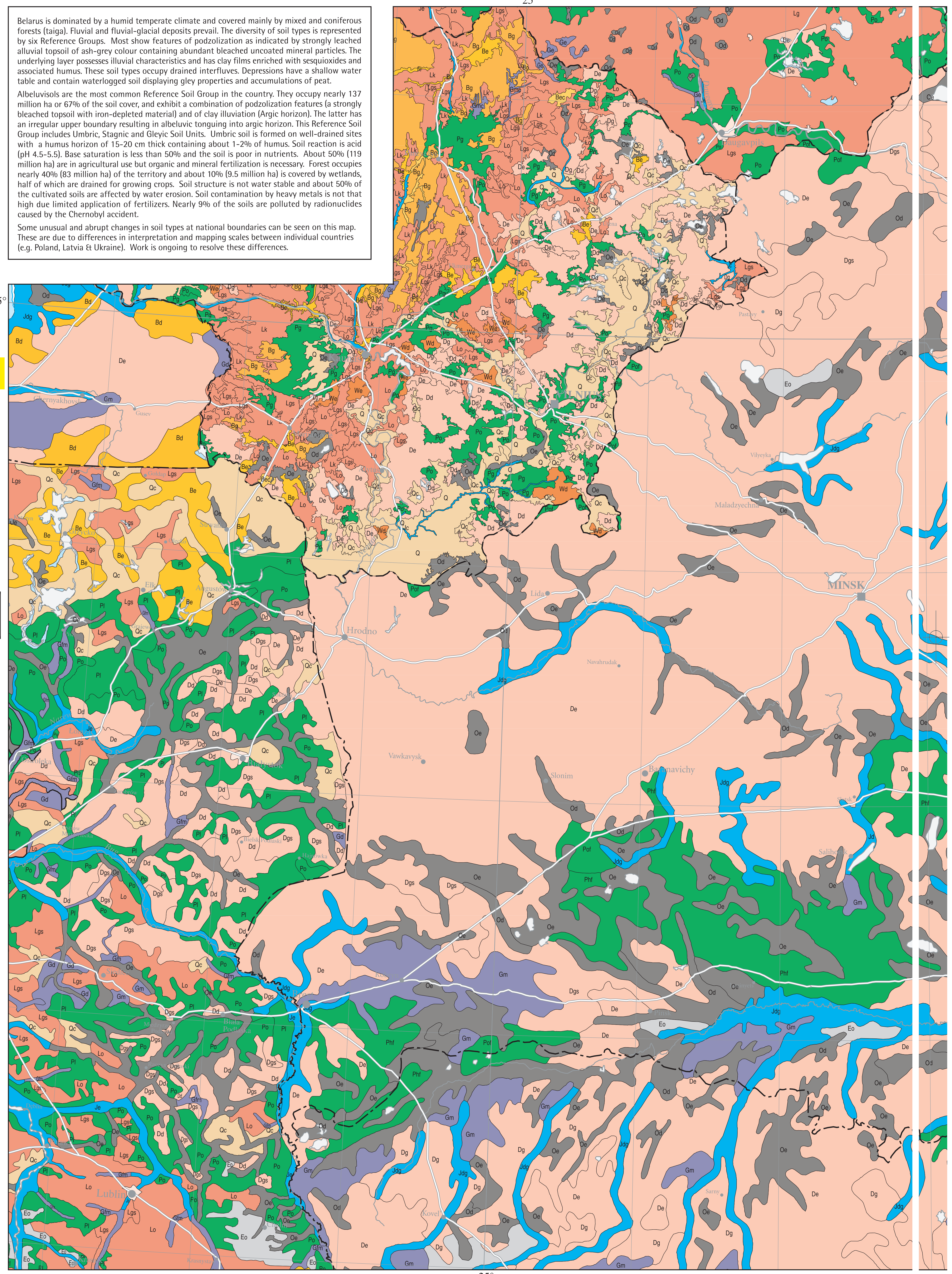


Plate 17

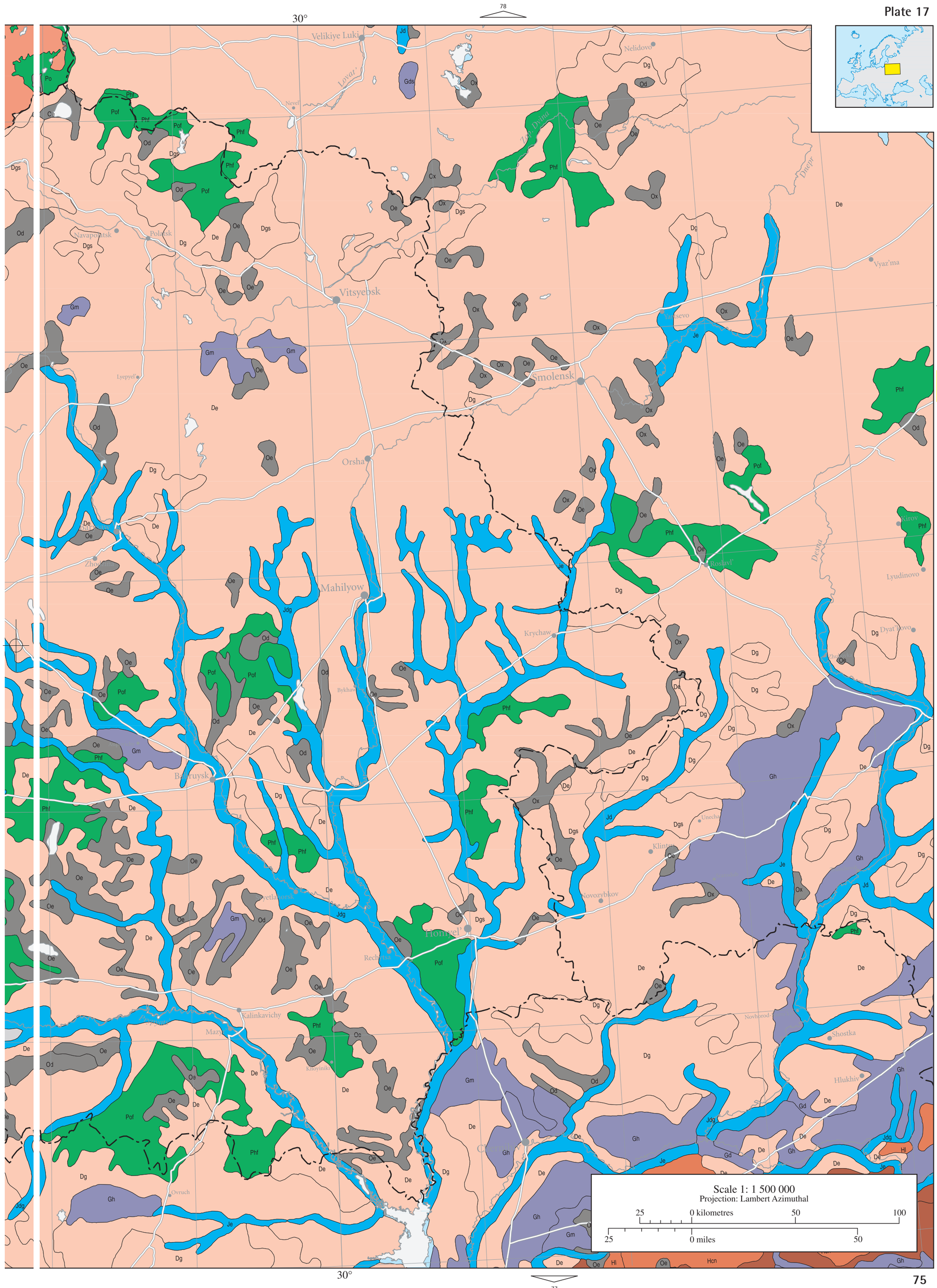
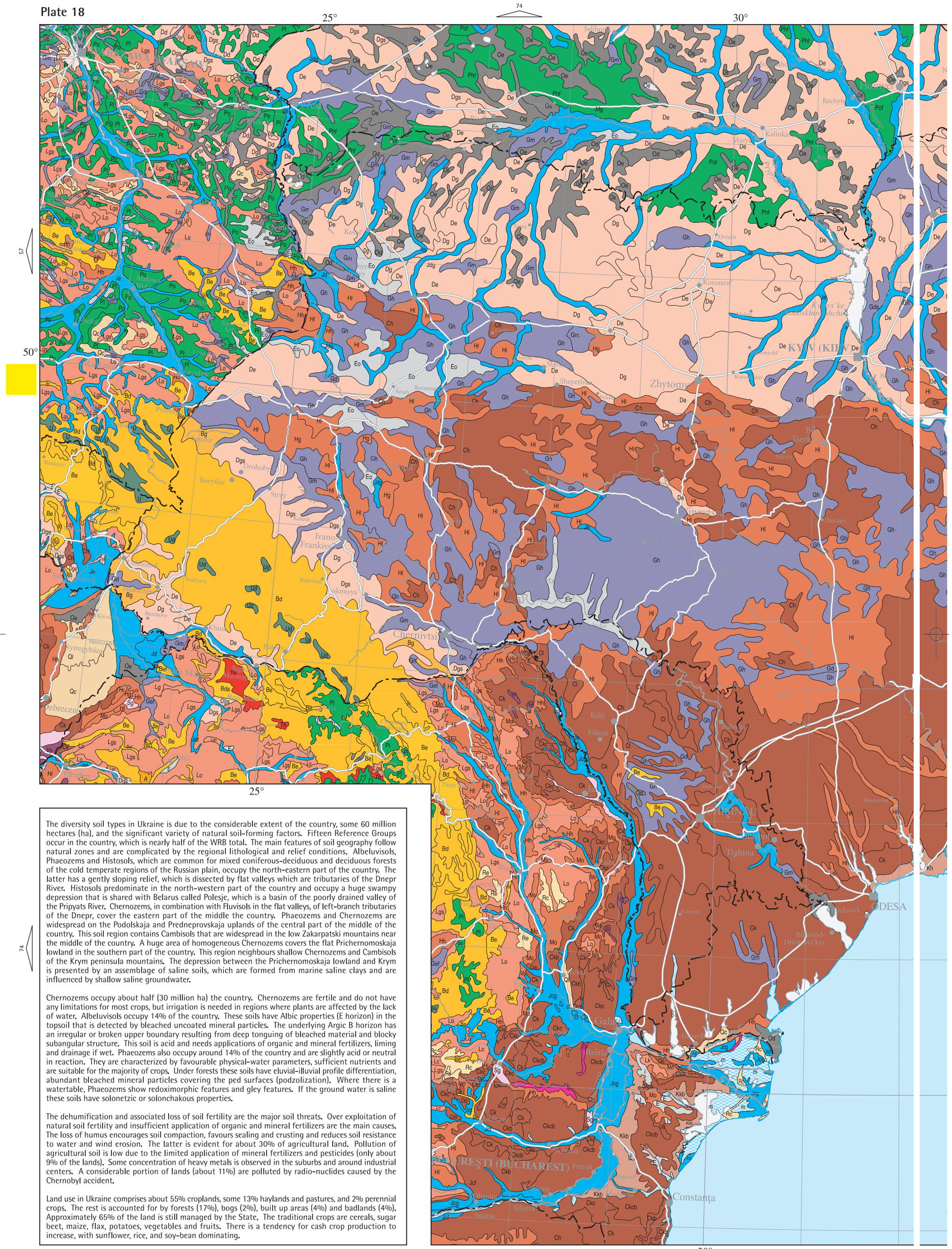

30°
78
Velikiye Luki
Nelidovo
Nevel'
Lovat'
Zap. Dvina
Dnepr
Vyaz'ma
Vitsyebsk
Smolensk
Yartsevo
Lyepyel'
Orsha
Roslavl'
Kirov
Lyudinovo
Mahilyow
Krychaw
Dyat'kovo
Bykhaw
Babruysk
Unecha
Klintsy
Novozybkov
Homyel'
Rechitsa
Kalinkavichy
Mazyr
Khoyniki
Novhorod-Siversky
Shostka
Hlukhiv
Ovruch
Scale 1: 1 500 000
Projection: Lambert Azimuthal
25 0 kilometres 50 100
25 0 miles 50
55°
78
77
30°

Plate 18



The diversity soil types in Ukraine is due to the considerable extent of the country, some 60 million hectares (ha), and the significant variety of natural soil-forming factors. Fifteen Reference Groups occur in the country, which is nearly half of the WRB total. The main features of soil geography follow natural zones and are complicated by the regional lithological and relief conditions. Albeluvisols, Phaeozems and Histosols, which are common for mixed coniferous-deciduous and deciduous forests of the cold temperate regions of the Russian plain, occupy the north-eastern part of the country. The latter has a gently sloping relief, which is dissected by flat valleys which are tributaries of the Dnepr River. Histosols predominate in the north-western part of the country and occupy a huge swampy depression that is shared with Belarus called Polesje, which is a basin of the poorly drained valley of the Pripyats River. Chernozems, in combination with Fluvisols in the flat valleys, of left-branch tributaries of the Dnepr, cover the eastern part of the middle the country. Phaeozems and Chernozems are widespread on the Podolskaja and Prednеprovskaja uplands of the central part of the middle of the country. This soil region contains Cambisols that are widespread in the low Zakarpatski mountains near the middle of the country. A huge area of homogeneous Chernozems covers the flat Prichernomoskaja lowland in the southern part of the country. This region neighbours shallow Chernozems and Cambisols of the Krym peninsula mountains. The depression between the Prichernomoskaja lowland and Krym is presented by an assemblage of saline soils, which are formed from marine saline clays and are influenced by shallow saline groundwater.

Chernozems occupy about half (30 million ha) the country. Chernozems are fertile and do not have any limitations for most crops, but irrigation is needed in regions where plants are affected by the lack of water. Albeluvisols occupy 14% of the country. These soils have Albic properties (E horizon) in the topsoil that is detected by bleached uncoated mineral particles. The underlying Argic B horizon has an irregular or broken upper boundary resulting from deep tonguing of bleached material and blocky subangular structure. This soil is acid and needs applications of organic and mineral fertilizers, liming and drainage if wet. Phaeozems also occupy around 14% of the country and are slightly acid or neutral in reaction. They are characterized by favourable physical-water parameters, sufficient nutrients and are suitable for the majority of crops. Under forests these soils have eluvial-illuvial profile differentiation, abundant bleached mineral particles covering the ped surfaces (podzolization). Where there is a watertable, Phaeozems show redoximorphic features and gley features. If the ground water is saline these soils have solonetzic or solonchakous properties.

The dehumification and associated loss of soil fertility are the major soil threats. Over exploitation of natural soil fertility and insufficient application of organic and mineral fertilizers are the main causes. The loss of humus encourages soil compaction, favours sealing and crusting and reduces soil resistance to water and wind erosion. The latter is evident for about 30% of agricultural land. Pollution of agricultural soil is low due to the limited application of mineral fertilizers and pesticides (only about 9% of the lands). Some concentration of heavy metals is observed in the suburbs and around industrial centers. A considerable portion of lands (about 11%) are polluted by radio-nuclides caused by the Chernobyl accident.

Land use in Ukraine comprises about 55% croplands, some 13% haylands and pastures, and 2% perennial crops. The rest is accounted for by forests (17%), bogs (2%), built up areas (4%) and badlands (4%). Approximately 65% of the land is still managed by the State. The traditional crops are cereals, sugar beet, maize, flax, potatoes, vegetables and fruits. There is a tendency for cash crop production to increase, with sunflower, rice, and soy-bean dominating.

Plate 18

Scale 1: 2 500 000
Projection: Lambert Azimuthal

25 0 kilometres 100 200

25 0 miles 50 100

Sea of Azov

Black Sea

35° 40° 45° 50°

79 72

The soil of Russia, as far as the Ural Mountains, is formed under the influence of a wide range of climates, which drive the formation of major natural zones: polar desert, tundra, boreal (called taiga) and temperate forests, steppe, semi-desert and deserts. Each natural zone has a specific bio-geochemical turnover of organic substances and essential nutrients that control major pedogenic processes and soil characteristics. The close dependence of soil on the zonality of natural factors is well-observed for many regions. However, it is particularly well expressed in the soils of European Russia, due to a uniformity of other soil-forming factors (e.g. the flat relief of the East-European plain and relative similarity of parent material). Soil zonality in European Russia is expressed by Cryosols and Regosols occupying the polar desert in the Spitzbergen Island with Gleysols and Histosols covering the tundra zone. Peat formation is limited in this zone because of the cold and shallow permafrost layer. Where warmer climates prevail, Podzols, Gleysols and deep Histosols form in the forest-tundra and the northern taiga zones. Albeluvisols, Podzols and deep Histosols dominate the Middle taiga zone, with Albeluvisols dominant in the southern taiga zone. Phaeozems and Chernozems occur in the temperate forest and meadow steppe. The latter has abundant grasses, which produce a large amount of root residue for humus formation. Kastanozems, in combination with Solonetz and Solonchaks, represent the soil of the dry steppe and semi-desert zones.

Gleysols occupy 16% (275 million ha) of the country. Shallow ground watertable or stagnating surface water causes a Gleyic horizon to form. Albeluvisols, formed from fine and medium textured parent rocks and showing Albic properties (E horizon) in the topsoil, cover about 15% (250 million ha) of the country. Albeluvisols are acid and are poor in plant available nutrients. These soils need organic and mineral fertilizers, liming and drainage if they are commonly wet. Podzols occupy nearly 22% (365 million ha) of the country and are formed from fluvio-glacial sands. They are acid, low in nutrients and unsatisfactory physical properties. The characteristics of Podzols make them vulnerable to any human-induced impacts, which limits their intensive use.

Chernozems, Phaeozems, Kastanozems cover less than 10% (164 million ha) of the country. These soils have a deep humus horizon and show an accumulation of secondary carbonates at different depths. The humus content in Chernozems varies from 3.5–5.5% and cation contents are high. Rich in plant available nutrients, Chernozems have few limitations for agriculture and can be intensively used.

A small area is occupied by the soil groups of a hot arid climate (i.e. Calcisols, Solonetz, Solonchaks). Together, these soils cover nearly 2% of the country but considerable improvements, including irrigation, leaching of toxic salt and drainage, are needed for productive agiculture. The land use structure of Russia comprises about 8% croplands, some 4% haylands and pastures. The rest is under forests (44%), grasses and shrubs (25%), bogs (12%), built up areas and badlands (8%). The total extent of land in Russia affected by soil degradation is estimated to be 243 million ha, which is nearly 15% of the country. About half of the degradation is caused by cultivation, which initiates a loss of organic matter and associated reduction in soil fertility. The loss of humus stimulates the destruction of soil aggregates and compaction. The latter accelerates runoff and reduces soil resistance to water and wind erosion, evident on about 25% of agricultural land. Pollution of agricultural soils is negligible due to the limited application of mineral fertilizers and pesticides.

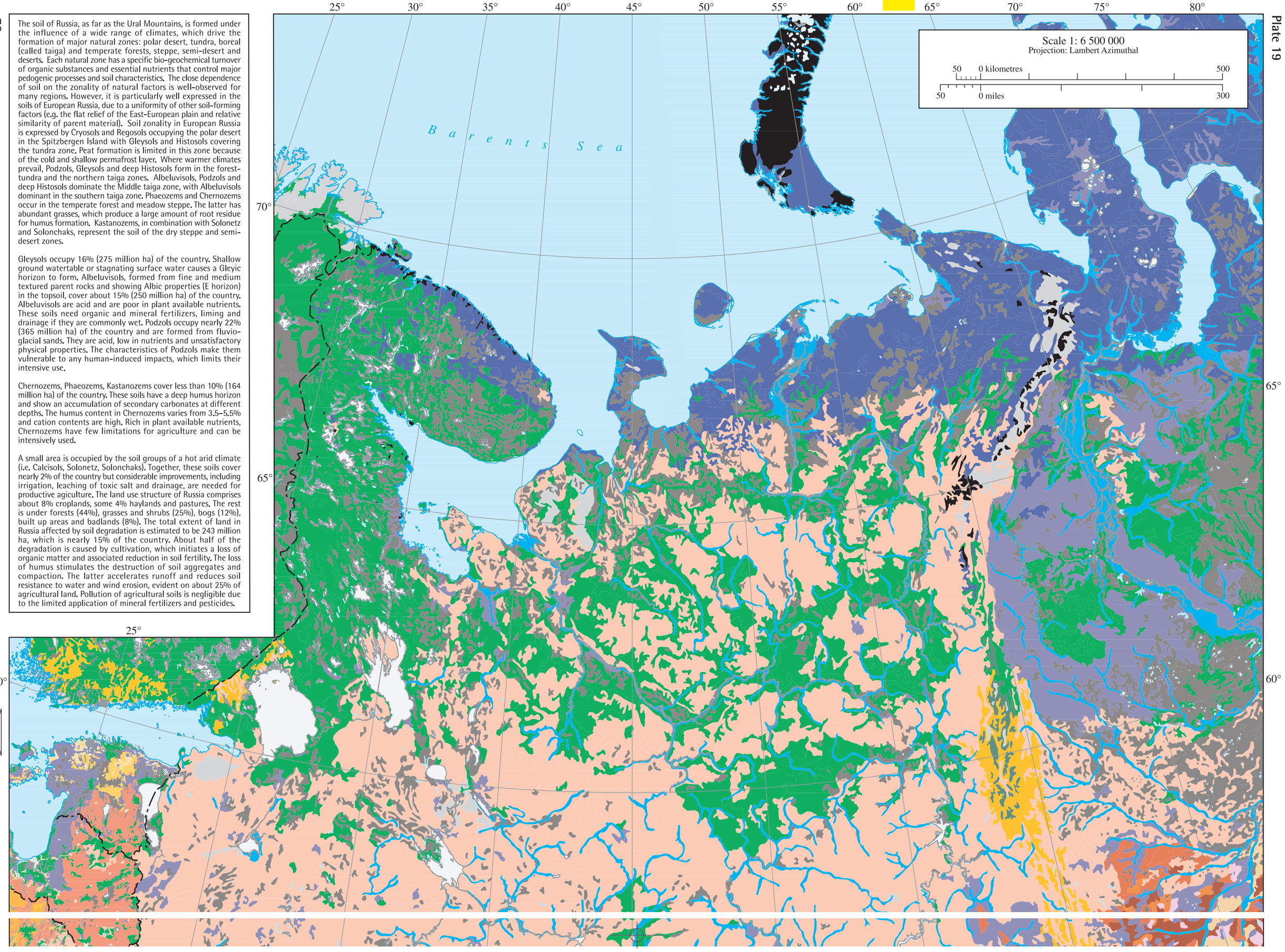
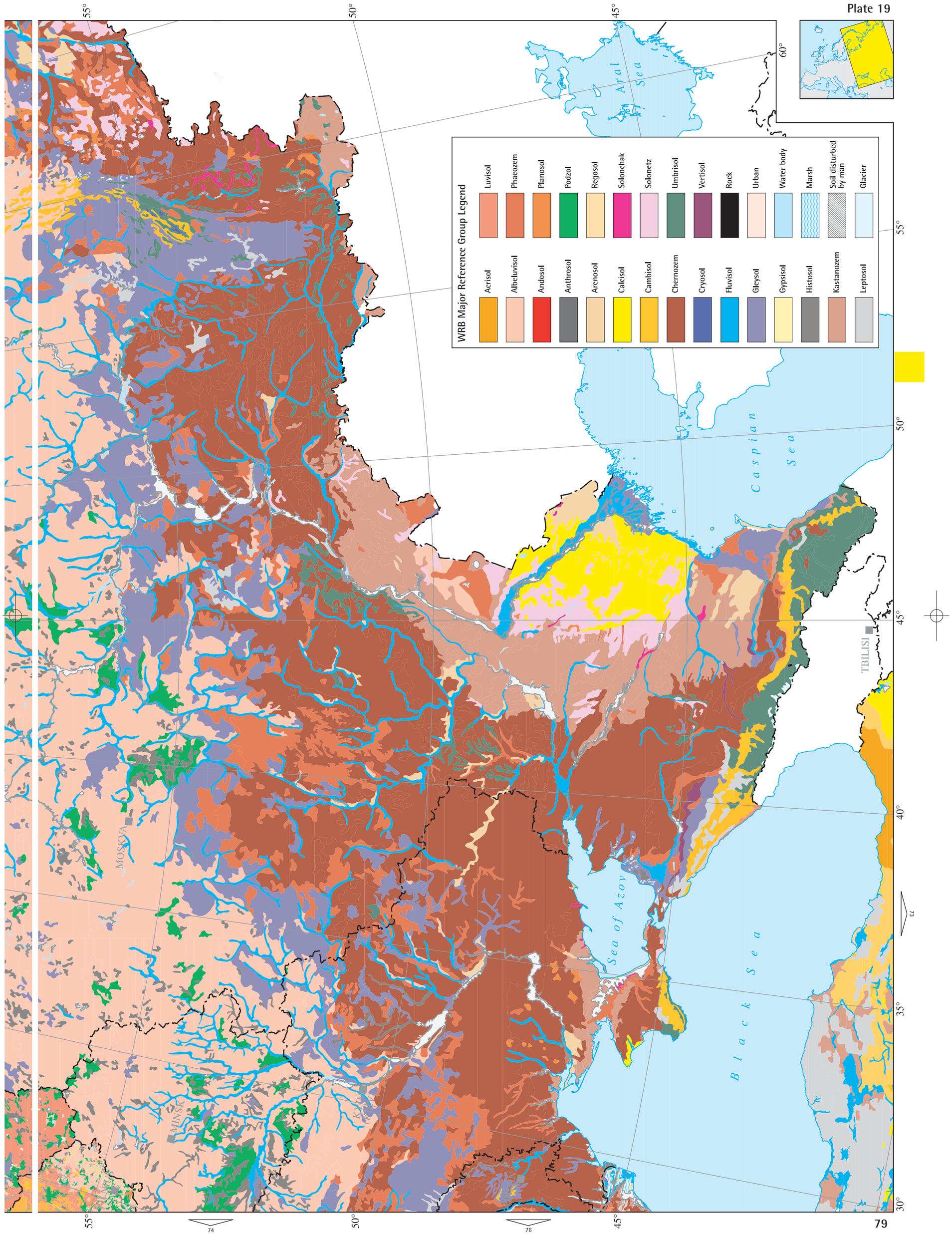


Plate 19


WRB Major Reference Group Legend
Luvisol
Phaeozem
Planosol
Podzol
Regosol
Solonchak
Solonetz
Umbrisol
Vertisol
Rock
Urban
Water body
Marsh
Soil disturbed by man
Glacier
Acrisol
Albeluvisol
Andosol
Anthrosol
Arenosol
Calcisol
Cambisol
Chernozem
Cryosol
Fluvisol
Gleysol
Gypsisol
Histosol
Kastanozem
Leptosol
Aral Sea
Caspian Sea
Sea of Azov
Black Sea
MOSKVA
MINSK
TBILISI
55°
50°
45°
60°
40°
35°
30°