between Castile and Aragon, along the Mediterranean border, in Andalusia, and likewise along the flanks of the Pyrenees. The Lias is best represented. The Cretaceous system is distributed in four great districts: the largest of these extends through the kingdoms of Murcia and Valencia ; a second stretches between the two Castiles; a third is found in the Basque Provinces and the Asturias; and a fourth spreads out along the southern slopes of the Pyrenees from Navarre to the Mediterranean. The lower members of the Cretaceous series include an important freshwater formation (sandstones and clays), which extends from the Cantabrian coast through the provinces of Santander, Burgos, Soria, and Logrono, and is supposed to represent the English Wealden series. The higher members comprise massive hippurite limestones, and in the Pyrenean district representatives of the upper subdivisions of the system, including the Danian.

Deposits of Tertiary age cover rather more than a third of Spain. They are divisible into two great series, according to their mode of origin in the sea or in fresh water. The marine Tertiary accumula­tions commence with those that are referable to the Eocene series, consisting of nummulitic limestones, marls, and siliceous sand­stones. These strata are developed in the basin of the Ebro, and in a belt which extends from Valencia through Murcia and Andalusia to Cadiz. Marine Miocene deposits occupy some small tracts, especially on the coast of Valencia. But most of the sandy Tertiary rocks of that district are Pliocene. The Tertiary masses of Andalusia have coarse conglomerates (Middle Miocene) at their base, followed by thick beds of Bryozoan molasse and younger (Pliocene) beds. These strata are specially noteworthy for con­taining an important metalliferous deposit, that of the native silver of Herrerias, which is found in a Pliocene bed in the form of flakes, needles, and crystals. But the most extensive and interesting Tertiary accumulations are those of the great lakes which in Oligocene and Miocene time spread over so large an expanse of the tableland. These sheets of fresh water covered the centre of the country, including the basins of the Ebro, Jucar, Guadalaviar, Guadalquivir, and Tagus. They have left behind them thick de­posits of clays, marls, gypsum, and limestone, in which numerous remains of the land-animals of the time have been preserved.

Quaternary deposits spread over about a tenth of the area of the country. The largest tract of them is to be seen to the south of the Cantabrian chain ; but another, of hardly inferior extent, flanks the Sierra de Guadarrama, and spreads out over the great plain from Madrid to Caceres. Some of these alluvial accumula­tions indicate a former greater extension of the snowfields that are now so restricted in the Spanish sierras. Remains of the reindeer are found in caves in the Pyrenees.

Eruptive rocks of many different ages occur in different parts of Spain. The most important tract covered by them is that which stretches from Cape Ortegal to Coria in Estremadura and spreads over a large area of Portugal. They likewise appear in Castile, forming the sierras of Gredos and Guadarrama ; farther south they rise in the mountains of Toledo, in the Sierra Morena, and across the provinces of Cordova, Seville, Huelva, and Badajoz as far as Evora in Portugal. Among the minor areas occupied by them may be especially mentioned those which occur in the Triassic districts. Of rocks included in the eruptive series the most abundant is granite. There occur also quartz-porphyry (Sierra Morena, Pyrenees, &c. ), diorite, porphyrite, diabase (well developed in the north of Andalusia, where it plays a great part in the structure of the Sierra Morena), ophite (Pyrenees, Cadiz), serpentine (forming an enormous mass in the Serrania de Ronda), trachyte, liparite, andesite, basalt. The last four rocks occur as a volcanic series distributed in three chief districts—that of Cape Gata, including the south-east of Andalusia and the south of Murcia, that of Catalonia, and that of La Mancha.

*Climate.—*In accordance with its southerly position, its differences of elevation, and the variety in its superficial configuration in other respects, Spain presents within its borders examples of every kind of climate to be found on the northern hemisphere, with the sole exception of that of the torrid zone. As regards temperature, the heart of the tableland is characterized by extremes as great as are to be met with in almost any part of central Europe. The northern and north-western maritime provinces, on the other hand, have a climate as equable, and, it may be added, as moist, as that of the west of England or Scotland.

Four zones of climate are distinguished. The first zone may be called that of the tableland, although to it also the greater part of the Ebro basin may be referred. This is the zone of the greatest extremes of temperature. Even in summer the nights are often decidedly cold, and on the high parameras it is not a rare thing to see hoar-frost in the morning. In spring cold wetting mists occasionally envelop the land for entire days, while in summer the sky is often perfectly clear for weeks together. At all seasons of the year sudden changes of temperature, to the extent of from 30° to 50° F., are not infrequent. The air is extremely dry, which is all the more keenly felt from the fact that it is almost constantly in motion. At Madrid (2150 feet above sea-level) it regularly

freezes so hard in December and January that skating is carried on on the sheet of water in the Buen Retiro ; and, as winter through­out Spain, except in the maritime provinces of the north and north-west, is the season of greatest atmospheric precipitation, snowfalls are frequent, though the snow seldom lies long except at high elevations. The summers, on the other hand, are not only extremely warm but almost rainless, the sea-winds being deprived of their moisture on the edge of the plateau. In July and August the plains of New Castile and Estremadura are sun­burnt wastes ; the roads are several inches deep with dust ; the leaves of the few trees are withered and discoloured ; the atmo­sphere is filled with a fine dust, producing a haze known as *calina,*which converts the blue of the sky into a dull grey. In the greater part of the Ebro basin the heat of summer is even more intense. The treeless mostly steppe-like valley with a bright- coloured soil acts like a concave mirror in reflecting the sun’s rays, and, moreover, the mountains and highlands by which the valley is enclosed prevent to a large extent the access of winds, and thus hinder the renewal of the air, which in the lowest parts is little disturbed.

The second zone is that of the Mediterranean provinces, exclusive of those of the extreme south. In this zone the extremes of temperature are less, though the summers here also are warm, and the winters decidedly cool, especially in the north-east.

The southern zone, to which the name of African has been given, embraces the whole of Andalusia as far as the Sierra Morena, the southern half of Murcia, and the province of Alicante. In this zone there prevails a genuine subtropical climate, with extremely warm and almost rainless summers and mild winters, the temperature hardly ever sinking below freezing-point. The hottest part of the region is not the most southerly district but the bright-coloured steppes of the coast of Granada, and the plains and hill terraces of the south-east coast from Almeria to Alicante. Snow and frost are here hardly known. It is said that at Malaga snow falls only about once in twenty-five years. The winter, in fact, is the season of the brightest vegetation : after the long drought of summer the surface gets covered once more in late autumn with a fresh green varied with bright-coloured flowers, and so it remains the whole winter through. On the other hand, the eastern part of this zone is the part of Spain which is liable to be visited from time to time by the scorching and blasting *leveche,* the name given in Spain to the sirocco, as well as by the *solano,* a moist and less noxious east wind.

The fourth zone, that of the north and north-west maritime provinces, presents a marked contrast to all the others. The temperature is mild and equable ; the rains are abundant all the year round, but fall chiefly in autumn, as in the west of Europe generally. Monthly roses bloom in the gardens at Christmas as beautifully and as plentifully as in summer. The chief drawback of the climate is an excess of rain in some parts, especially in the west. Santiago de Compostella, for example, has one of the highest rainfalls on the mainland of Europe (see table below).

The figures given in the following table (I.),@@1 although based only on data of short periods (from 31/2 to 20 years), will help to illustrate the preceding general remarks. Greenwich is added for tho sake of comparison.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  | Height | Mean Temperature, F. | | | Rain­fall in inches. |
|  | | in feet. | Jan. | July. | Year. |
| Tableland | Leon | 2600 | 37° | 73° | 53° | 19 |
| zone | Madrid | 2150 | 41 | 76  75  79  79  77  70  66 | 56  63  70  63 | 15  30 |
| Southern zone | San Fernando Malaga | 90  75 | 52  54 |
| Mediterranean | Murcia | 140 | 49 | 14 |
| zone  Northern mari­time zone | Mahon | 52 | 64 | 27  46 |
| Bilbao | 50 | 46 | 58 |
| Oviedo | 750 | 43 | 54 | 36 |
| Santiago | 750 | 45∙5 | 66 | 55 | 66 |
|  |  |
|  | Greenwich | ... | 39 | 63 | 50 | 25 |

*Vegetation.—*The vegetation of Spain exhibits a variety in keeping with the differences of climate just described. The number of endemic species is exceptionally large, the number of monotypic genera in the Peninsula greater than in any other part of the Mediterranean domain. The endemic species are naturally most numerous in the mountains, aud above all in the loftiest ranges, the Pyrenees and the Sierra Nevada ; but it is a peculiarity of the Spanish tableland, as compared with the plains and tablelands of central Europe, that it also possesses a considerable number of endemic plants and plants of extremely restricted range. This fact, however, is also in harmony with the physical conditions above described, being explained by the local varieties, not only of climate, but also of

@@@1 By conversion from Th. Fischer's Klima der Mittelmeerländer.