maximum occurs in June or July at all stations except those of western Sweden, where it occurs as early as May. The mean of June is 13°. A curious fact is that in Norrland, especially in the interior, a secondary maximum occurs in March, which some­times even exceeds the summer maximum.

The non-periodic daily range of temperature, or the difference between the monthly means of daily maximum and minimum of temperature, is as usual considerably greater than the periodic. The difference is almost constant for all stations, especially during the warmer part of the year. We have, for the whole country—

|  |  |  |  |
| --- | --- | --- | --- |
|  | Non-periodic. | Periodic. | Difference. |
| Winter | 10°·0 | 3°·0 | 7°·0 |
| Spring | 16°·0 | 11°·2 | 4°·8 |
| Summer | 19°·1 | 13°·0 | 6°·1 |
| Autumn | 11°·7 | 6°·3 | 5°·4 |
|  |

The mean direction of the winds shows little variation during different seasons. During the summer it is west or west-south­west in the south of Sweden, changes to soutli-west in the middle part of the country, and due south along the coast of the Gulf of Bothnia. In winter north-north-east winds become comparatively frequent in the north part of the country. This is explained by the difference in barometric pressure in summer and in winter. In July the mean height of the barometer indicates a gradual fall along the coast of the Baltic, from 29·828 inches in Calmar to 29·675 in Haparanda. In January, on the other hand, there is a gradual fall from 29·853 in Calmar to 29·718 in Hemosand, but thereafter a gradual rise to 29·834 in Haparanda. Unfortunately the isobarometric lines for Sweden have not yet been calculated with due precision.

The rainfall is greatest on the coast of the Cattegat. The annual amount is greatest at Gothenburg, where it is 32·56 inches. At Halmstad it is 28·26, and at Venersborg, where Göta Elf issues from Lake Vener, it is 30·33. These are the rainiest stations of Sweden. Generally speaking, the amount of rain diminishes afterwards as well towards north and north-west as towards south­east. The least rain falls on the one hand in northern Lapland, where the annual amount is only 15·52 inches, and on the other hand in the south-eastern corner of Sweden, where (at Calmar) we have the lowest known rainfall for the whole country (1275 inches). Between these two tracts there runs a belt of greater pre­cipitation from Gothenburg towards the north-east to Upsala, where the annual amount is 23·28. Even along this belt the amount of rainfall diminishes towards the north-east, but at every point the amount is greater than to the north-west and south-east of it. The greatest amount of rain falls in July and August and the least in February and March. Thus, for instance, there fall in Upsala during August 2·86 inches and during March 0·99 inches. As the temperature varies, so does the rainfall for different years.

The number of thunderstorms is small in Sweden compared with the countries of the south. Their number diminishes as does the precipitation from soutli-west towards north and east. From 1871 to 1880 the mean annual number of thunderstorms at each station was 9·5 in Götaland, 8·4 in Svealand, and only 6·3 in Norrland. In the south their number diminishes rapidly from west to east, from 11 on the coast of the Cattegat to 8·3 on the coast of the Baltic, and only 6·6 on the isle of Gotland. The thunderstorms have a distinctly marked annual and daily period. They occur almost always during the warmest time of the year and of the day. During the above-mentioned ten years the least number occurred during the month of February, only 3, whereas there occurred in May 1194, in June 3724, in July 4419, in August 3306, and in September 1461. As regards the daily period, the least number, 147, occurred between 1 and 2 A.M., and the greatest, 1704, between 3 and 4 p.m. In Götalandaud Svealand most of the thunderstorms come with a south-westerly wind, in Norrland with a southerly ; for the whole country, the least number come with a northerly wind.

If the number of thunderstorms is small in Sweden, the same is in a still higher degree to be said of their intensity. Hail, which on the Continent causes such immense damage to the growing crops, is rare in Sweden, and often quite harmless. In the south of Germany about 2 per cent. of the crops are annually destroyed by hail. At Magdeburg the damage is 0·9 per cent., at Berlin 0·6 to 0·7 per cent., but in Sweden only 0·06 per cent. (H. H. H.)

*Geology.—*The fundamental rocks of Sweden belong to the Azoic or Pre-Cambrian formation, and consist of crystalline rocks. Three great divisions of this formation may be distinguished,—the grey gneiss, the red iron gneiss, and the granulite.

The grey gneiss rules in the northern and western parts of the country, from West Norrland down to the province of Calmar. The rock has a prevalent grey colour, and contains as characteristic minerals garnet and in some parts graphite.

The red iron gneiss prevails in western Sweden in the provinces of Vermland, Skaraborg, Elfsborg, and down to the province of

Christianstad. The formation is very uniform in its character, the gneiss having a red colour and containing small granules of magnetite, but, nevertheless, not a single iron-mine belongs to this region. The red gneiss contains in many places beds or masses of hyperite.

The granulite, also called eurite and hälleflinta, is the most important of the Pre-Cambrian formation, as it contains all the metalliferous deposits of Sweden. It prevails in the middle part of the country, in the provinces of Vermland, Kopparberg, Vestmanland, and Upsala. It occurs also in some parts of the pro­vinces of Ostergötland, Calmar, aud Kronoherg. The main rock in this region consists of hälleflinta, a kind of very compact and fine­grained mixture of feldspar, quartz, and mica, often graduating to mica schists, quartzite, and gneiss. With these rocks are often associated limestones, dolomites, and marbles containing serpentine (Kolmården). The metalliferous deposits have generally the form of beds or layers between the strata of granulite and limestones. They are often highly contorted aud dislocated.

The iron-mines occur imbedded in more or less fine-grained gneiss or granulite (Gellivaara, Grängesberg, Norberg, Striberg), or separated from the granulite by masses of augitic and amphibolous minerals (*grönskarn),* as in Persberg and Nordmark. Sometimes they are surrounded by hälleflinta and limestone, as at Dannemora, Läugban, Pajsberg, and then carry manganiferous minerals. Argentiferous galena occurs at Sala in limestone, surrounded by granulite, and at Guldsmedshytta (province of Örebro) in dark hälleflinta. Copper pyrites occurs at Falun in mica-schists, surrounded by hälleflinta. Zinc blende occurs in large masses at Ammeberg, near the northern end of Lake Vetter. The cobalt ore consists of cobalt-glance (Tuuaberg in the province of Södermanland) and of linneite (at Gladhammar, near Vestervik). The nickel ore of Sweden is magnetic pyrites, containing only a very small percentage of nickel. The magnetic pyrites occurs generally imbedded in diorite and greenstones. In the evidently most recent division of the granulite occurs clay-slate (at Grythytta in the province of Örebro).

Large masses of granite are found in many parts of Sweden, and form extensive massiffs as in the provinces of Kronoberg, Örebro, Göteborg, Stockholm, &c. Sometimes the granite gradu­ates into gneiss ; sometimes (as north of Stockholm) it encloses large angular pieces of gneiss. In many parts of Sweden occur greenstones, as hyperite, gabbro (anorthite-gabbro at Rådmanso in the province of Stockholm), and diorite, the last often forming beds between the strata of the gneiss.

The Cambrian formation occurs generally associated with the Lower Silurian, and consists of many divisions. The oldest is a sandstone, in which are found traces of worms, impressions of *Medusæ,* and shells of *Lingula.* The upper divisions consist of bituminous limestones, clay-slates, alum-slate, and contain numer­ous species of trilobites of the genera *Paradoxides, Conocoryphe, Agnostics, Sphærophthalmus, Peltura,* &c. In Öland and north of Siljan are found beds with *Obolus.*

The Lower Silurian consists of the following divisions :—(1) beds with *Ceratopyge* ; (2) schists with Graptolites ; (3) large beds of red and grey limestone (200 feet in thickness) containing *Megalaspis* and *Orthoceratites.* This limestone is largely used as building material ; (4) slates with *Trinucleus ; (5)* slates with Brachiopods ; (6) slates with Graptolites. The Cambrian and Lower Silurian strata occur scattered in several places from Vesterbotten down to Jemtland (around Storsjön), and in the provinces of Skaraborg, Elfsborg, Örebro, Ostergötland, and Christianstad. The whole of the island of Öland cousists of these strata. The strata are in most places very little disturbed, and form horizontal or slightly inclined layers. They are, south of Lake Vener, capped by thick beds of eruptive diabase (called *trapp).* North of Lake Siljan (province of Kopparberg) occur Lower Silurian but not Cambrian strata, which have been very much dislocated. The Upper Silurian has in Sweden almost the same character as the Wenlock and Ludlow formation of England. The island of Gotland con­sists entirely of this formation, which occurs also in some parts of the province of Christianstad. In the western part of the province of Kopparberg are extensive deposits of sandstone, separated by beds of diabase, and seemingly of the same age,—the Middle Silurian,—but no fossils have been found in them. In the vicinity of this sandstone region are large beds and massiffs of porphyries. There are still two sets of stratified, not fossiliferous, deposits, viz., in the province of Elfsborg (formation of Daisland) and around Lake Vetter (formation of Visingsö). The Daisland formation, which attains the thickness of 6000 to 7000 feet, consists of con­glomerates, chlorite schists, quartzites, and mica schists. The Visingsö formation, 800 to 1000 feet in thickness, consists of sand­stones, clay-slate, &c. In the western and northern alpine part of Sweden, near the boundaries of Norway, the Silurian strata are covered by crystalline rocks, mica schists, quartzites, &c., of an enormous thickness. These rocks form the mass oi the high mountain of Åreskutan, &c.

The Triassic formation (Rhætic division) occurs in the northern