of the window-frame and the stone base on which it rests— the latter being called the sill of the window, and the former that of its frame. This term is not restricted to the bases of apertures; the lower horizontal part of a framed partition is called its sill. The term is sometimes incorrectly written “ cill.” (See Masonry.)

SILL, in geology, an intrusive mass of igneous rock which consolidated beneath the surface and has a large horizontal extent in comparison with its thickness. In the north-eastern counties of England there is a great mass of this kind known as the Whin Sill. The term "whin ” is used in many parts of England and Scotland to designate hard, tough, dark coloured rocks often of igneous origin, and the Whin Sill is a mass of dolerite or, more strictly, quartz-diabase. Its most striking character is the great distance over which it can be traced. It starts not far north of Kirkby Stephen (Co. Durham) and follows a northerly course, describing a great curve with its convexity towards the west, till it ends on the sea-shore at Bamborough, not far south of Berwick-on-Tweed. The length of the outcrop is about 80 m., but in places it is covered with superficial deposits or may be actually discontinuous. Near Haltwhistle, however, it is visible for about 20 m., and as it lies among softer rocks (limestones and shales), it weathers out on a bold craggy ridge or escarpment. When it crosses the streams the resistant character of the igneous rock is indicated by waterfalls or “ forces,” *e.g.* High Force in Teesdale. The thickness varies from 20 to 150 ft., but averages 90 ft. In some places the Whin Sill splits up into two or more smaller sills which may unite, or one of them may die out and disappear, and often small attendant sills, resembling the main mass in petrographical character, appear in association with it. It is difficult to estimate the area over which it extends, as it dips downwards from its outcrop and is no longer visible, but we may conjecture that it spreads over no less than 4000 sq. m. underground.

The rocks in which it lies belong to the Carboniferous Lime­stone series, and the Sill is probably one of the manifestations of the volcanic activity which occurred during the later part of the carboniferous period. Many similar sills, often of large size, though none so great as the Whin Sill, are found in the Scottish coalfields. There are few lavas or ash beds at or above the horizons on which these intrusive rocks lie, and hence it has been concluded that towards the close of that volcanic episode in British geological history the molten magmas which were impelled upwards towards the surface found a place of rest usually within the sedimentary rocks, and rarely flowed out as lavas on the sea­bottom (the intrusive succeeding the effusive phase of volcanic action). In the Carboniferous rocks the Whin Sill lies almost like an interstratified bed, following the same horizon for many miles and hardly varying more in thickness than the sedimentary bands which accompany it. This, however, is true only on a large scale, for where the junctions are well exposed the igneous rock frequently breaks across the layers of stratification, and sometimes it departs quite suddenly from one horizon and passes to another, where again for a time it continues its apparently regular course. Its intrusive character is also shown by the emission of small veins, never very persistent, cutting the sediments above or below it. In addition, it bakes and hardens the adjacent rocks, both below and above, and this proves that the superjacent beds had already been deposited and the molten diabase forced its way along the bedding planes, as natural lines of weakness. The amount of contact alteration is not usually great, but the sandstones are hardened to quartzites, the shales become brittle and splintery, and in the impure limestones many new calc-silicates are produced.

The Whin Sill consists of a dark-green granular diabase, in which quartz or micropegmatite appears as the last product of crystallization. It is not usually vesicular and is not porphyritic, though exceptions may occasionally be noted. At both the upper and the under surface the diabase becomes much finer grained, and the finest intrusive veinlets which enter the surrounding rocks may even show remains of a glassy base. These phenomena are due to the rapid cooling where the magma was in contact with the sediments. No ash beds accompany the Whin Sill, but there are certain dikes which occur near it and probably belong to the same set of injections. In many places the diabase is quarried as a road-mending stone.

The great Palisade trap of the Hudson river, which is an almost exact parallel to the Whin Sill, is an enormous sheet of igneous rock exposed among the Triassic beds of New Jersey and New York. It has an outcrop which is about 100 m. long; its thickness is said to be in places 800 ft., though usually not above 200 to 300 ft. Like the Whin Sill the rock is a quartz-diabase occasionally passing into olivine-diabase, especially near its edges. The Palisade diabase is compact, non-vesicnlar and non-porphyritic as a rule. It follows the bedding planes of the sedimentary rocks into which it was injected, but breaks across them locally and produces a considerable amount of contact alteration. In New Jersey, however, there is also an ex­tensive development of effusive rocks which are olivine-basalts, and by their slaggy surfaces, the attendant ash-beds and their strictly conformable mode of occurrence, show that they were true lavas poured out at the surface. There can be little doubt that they belong to the same period as the Palisade trap, and they are consequently later than the Whin Sill.

These great sheets of igneous rock intruded into cold and nearly horizontal strata must have solidified very gradually. Their edges are fine grained owing to their having been rapidly chilled, and the whole mass is usually divided by joints into vertical columns, which are narrower and more numerous at top and base and broader in the centre. Where exposed by denudation the rocks, owing to this system of jointing, tend to present a nearly vertical, mural escarpment which seems to consist of polygonal pillars. The name "Palisade trap ” expresses this type of scenery, so characteristic of intrusive sills, and very fine examples of it may be seen on the banks of the Hudson river. In Britain it is no less clearly shown, as by the Sill at Stirling on which Wallace’s Monument is placed; and by the well-known escarpment of Salisbury Crags which fronts the town of Edinburgh.

In the Tertiary volcanic district of the West of Scotland and North Ireland, including Skye, Mull and Antrim, innumerable sills occur. Perhaps the best known is the Sciur of Eigg, which forms a high ridge terminating in a vertical cliff or Sciur in the island of Eigg, one of the inner Hebrides. At one time it was supposed to be a lava-flow, but A. Harker has maintained that it is of intrusive origin. This Sill occupies only a small area as compared with those above described. Its length is about two and a half miles and its breadth about a quarter of a mile. On the east side it terminates in a great cliff from 300 to 400 ft. high, rising from a steep slope below. This cliff is beautifully columnar, and shows also a horizontal banding, simulat­ing bedding. The back of the intrusive sheet is a long ridge sloping downwards to the west. The rock of which the Sciur of Eigg consists is a velvety black pitchstone, containing large shining crystals of felspar; it is dull or cryptocrystalline in places, but its glassy char­acter is one of its most remarkable peculiarities.

In the Tertiary volcanic series of Scotland and Ireland intrusive sheets build up a great part of the geological succession. They are for the most part olivine-basalts and dolerites, and while some of them are nearly horizontal, others are inclined. Among the lavas of the basaltic plateaus there is great abundance of sills, which are so numerous, so thin and so. nearly concordant to the bedding of the effusive rocks that there is great difficulty in distinguishing them. As a rule, however, they are more perfectly columnar, more coarsely crystalline and less vesicular than the igneous rocks which consoli­dated at the surface. These sills are harder and more resistant than the tuffs and vesicular lavas, and on the hill slopes their presence is often indicated by small vertical steps, while on the cliff faces their columnar jointing is often very conspicuous.

On modern volcanoes intrusive sheets are seldom visible except where erosion has cut deep valleys into the mountains and exposed their interior structure. This is the case, for example, in Ireland, Teneriffe, Somma and Etna and in the volcanic islands of the West Indies. In their origin the deep-seated injections escape notice; many of them in fact belong to a period when superficial forms of volcanic action have ceased and the orifices of the craters have been obstructed by ashes or plugged by hard crystalline rock. But in the volcanoes of the Sandwich Islands the craters are filled at times with liquid basalt which suddenly escapes, without the appearance of any lava at the surface. The molten rock, in such a case, must have found a passage underground, following some bedding plane or fissure, and giving rise to a dike or sill among the older lavas or in the sediment­ary rocks beneath. Many of the great sills, however, may have been connected with no actual volcanoes, and may represent great supplies of igneous magma which rose from beneath but never actually reached the earth’s surface.

The connexion between sills and dikes is very close ; both of them are of subterranean consolidation, but the dikes occupy vertical or highly inclined fissures, while the sills have a marked tendency to a horizontal position. Accordingly we find that sills are most common in stratified rocks, igneous or sedimentary. Very frequently sills give rise to dikes, and in other cases dikes spread out in a horizontal direction and become sills. It is often of considerable importance to