

(a) (iv) *Argillaceous Sandstones* are of inferior quality and unsuitable as building stones owing to the argillaceous (clayey) cement becoming soft when wetted by rain.

(a) (v) *Micaceous Sandstones* are those in which white mica (muscovite, see p. 85) is prominent. The mica is clearly visible as glittering flakes lying with their longest faces parallel to the bedding planes. The presence of mica thus assists in indicating the direction of the natural bed of a stone. An example is Red Corsehill (see Table V).

(a) (vi) *Felspathic Sandstones* contain felspar in subsidiary amounts. Stones of this class are quarried in different parts of the country, including Herefordshire, Shropshire and Worcestershire, and are used locally.

(a) (vii) *Gritstones* or *Grits*.—These are strong, hard and durable stones. The sand grains are often coarse and angular, giving a rough texture; and the cement is siliceous. Examples are Berristall, Bramley Fall, Dungeons, Dunn House, Stanton Park, etc. (see Table V).

(a) (viii) *Flagstones* are strongly laminated and are therefore readily split along the bedding planes. They are used as paving or flagging stones, treads of steps, etc. Many quarries in Yorkshire produce sharp, annular-grained, hard-wearing and clearly laminated stone suitable for these purposes.

(a) (ix) *Tilestones*.—These are thinner-bedded stones than flagstones and are used for covering roofs, e.g., traditional in the Cotswold District (thin bedded limestone) and in Yorkshire (thin bedded sandstone). See Fig. 48, Vol. III.

(a) (x) *Liver or Knell Stones*.—These are known as "thick-bedded," and, as implied, large blocks of the stone can be obtained. Many sandstones and limestones are in this class.

(a) (xi) *Freestones* are those which are fine-grained. They have no well-defined bedding planes and can be easily dressed. Examples are Red Corsehill, Locharbriggs and Woolton (see Table V).

(a) (xii) *York Stone*.—This is a term applied to sandstones from Yorkshire, and more particularly to those from that county which are specially hard, strong and durable, and specified as being suitable for steps, sills, lintels, copings, landings, etc.

Whilst the present demand for every description of stone for building purposes is less than formerly, those of the sandstone class form one of the most valuable walling materials. The weathering properties of stones are discussed on p. 97, and reference is made to the severe test imposed on stone by sulphur acid present in smoke polluted atmospheres. It has been pointed out that the durability of sandstones depends very largely upon the cementing material (see p. 88), as the quartz is practically indestructible. Siliceous sandstones (p. 88) are therefore generally considered to be the most durable of the sedimentary rocks, as the binding material of silica is highly resistant to acid attack. The excellent state of preservation of many ancient buildings built of this stone is evidence of this. Unfortunately, city buildings constructed of sandstone often assume a drab appearance owing to the dark discoloration which results. Many sandstones are exceptionally hard, and for this reason are selected for steps, sills, etc. Some

are difficult to work, but others of the freestone (see preceding column) class are good chiselling stones and are very suitable for moulded work. Sandstone is an excellent and frequently used material for road construction and concrete aggregates.

Sandstones are very widely distributed throughout the British Isles. The distribution of some of the more important quarries producing building stone is shown in Fig. 33. This does not include the large number of small quarries which are worked, often intermittently, to supply sandstone for building purposes locally.

A selection of some of the principal quarries producing sandstones used for building purposes is listed in Table V. The chemical composition of a few building sandstones is shown in Table VII. An enlarged sketch showing approximately the structure of a sandstone such as is seen under the microscope¹ is shown at A, Fig. 34. See footnote to p. 94.

Whilst granites and certain Welsh slates are obtained from the Pre-Cambrian and Cambrian systems respectively (see Table IV), much of the stone is either inaccessible, or too difficult to work or is of unsatisfactory appearance. The Ordovician system does not provide building sandstones beyond beds of flagstones which are quarried for local use. Flagstones and grits are quarried from the Silurian system and used locally. Good building sandstones are quarried from the Old Red Sandstone series of the Devonian system and used locally in counties Gloucestershire, Herefordshire, Shropshire, Monmouthshire, Northumberland, Aberdeenshire and Kincardineshire; sandstones from the other series of this system are unimportant. Several good quality building sandstones have in the past been quarried in the North of England and in Scotland from the Carboniferous Limestone and Yoredale Beds series of the Carboniferous system and used on important buildings, but they are now chiefly used locally.

The most prolific sources of best sandstones employed for building purposes are obtained from the (i) Millstone Grit and (ii) Coal Measures series of the Carboniferous system (see Tables IV and V).

(i) *Millstone Grit*.—Whilst this series of strata, consisting of regular beds of gritstone, has a wide distribution throughout the country, it has been most extensively developed in Derbyshire, Lancashire and Yorkshire, where much excellent building stone is quarried.

(ii) *Coal Measures*.—This formation is widely distributed. The chief quarries are situated in Durham, Gloucestershire, Lancashire, Northumberland, Yorkshire (where there are many), Glamorganshire, Lanarkshire and Linlithgowshire. The stone is quarried in other counties and used locally. In general, this stone is hard, durable and of a good colour.

Sandstones for building purposes from the Permian system are quarried in Cumberland (Lazonby); local stone is also used from this system in the south-west of this country. The Bunter and Keuper series of the Triassic system yield good building sandstones in Cheshire, Cumberland, Lancashire, Shropshire, Staffordshire, Warwickshire, Worcestershire and Dumfriesshire.

Building sandstones are rare in the Jurassic system. There is none of much importance in the Cretaceous strata, and stone in the Cainozoic group is too soft for building purposes.

(b) *Limestones*.—These are called *calcareous* ("limey") rocks, as they consist mainly of carbonate of lime. They are formed either by (a) organic or (b) chemical agencies.

¹ A thin piece of the stone, approximately $\frac{1}{8}$ -in. square with smoothed faces, is mounted (secured by an adhesive,) on a piece of glass known as a *slide*. The specimen is then reduced to the required thickness, which may be not more than $\frac{1}{1000}$ -in.; this is done by rubbing it on a piece of glass on which water and an abrasive (carborundum) is applied. An examination of the slide under the microscope will show the structure of the stone.