basin BUILDING PARTNERSHIPS

Wall Building
Technical Brief
Building Advisory Service and Information Network

# The Use of Natural Slabby Stone Deposits for Wall Construction

## Introduction

The most convenient stone source for building walls are layered rock outcrops. Their advantage is the unformity which is lacking in boulders and cobbles deposits. Slabby stones are also easy to extract. The quarried slabs can be shaped with simple tools. They can be handled and transported without difficulties.

The term "slab", originally any massive rectangular piece of stone, is used in this context to describe rectangular units which are units larger than the size of bricks. For flooring or paving they are known as flagstones. Stone slabs, especially if regular and parallel, are the most sought after materials for stone structures particularly in areas with limited processing facilities for stone blocks. They are used for walls as building stones and for cladding. As an instant structural building material, natural slabs require only trimming to the required size on four sides before placement.

Apart from its use for walling when cut to size, a slab could also serve as a hearth of a fireplace, as a kitchen counter, as the floor or partition of a latrine, as paving slabs, wall panels, units to clad walls (known as facing slabs). etc.

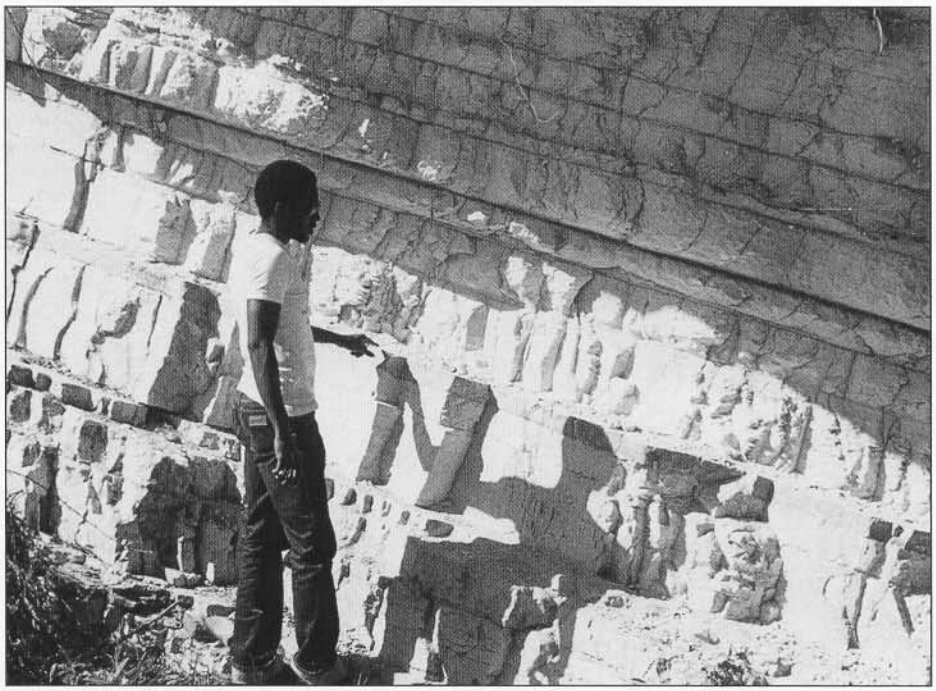

*Figure 1: "Layered rock outcrops in Haiti"*

## Identifications of deposits

Slabs occur in outcrops or layers as thin bedded deposits whether igneous, metamorphic or sedimentary. Large slab deposits can dominate the rural and urban character and environment of structures in whole regions as for example in the Verona area in Italy. Ancient structures, retention walls, paths etc.often lead to slabby outcrops covered in time by surficial vegetation.

Slabby layers are not only convenient sources, they possess a flexibility for extraction and working, provided that the

*Figure 2: "Near horizontal layers of Rodeador marble, Minas Gerais, Brazil, showing Karstic rills on well developed joints"*

*Figure 3: "Karstic features on joints and leverage with hammer leads"*

dressed product meets the required standards and specifications. Deposits near any construction site, have proved to be the most economical, locally available building material. Popular thicknesses of slabby stones are not exceeding 20 cms.

## Extraction and shaping

Any overburden, when it is present, should be cleared manually rather than with a bulldozer to avoid crushing thinner stone layers, unless a wheeled shoveldozer is available. The plane of easiest splitting is sometimes called the clift, as distinct from the direction of easiest splitting, known as the rift, which is more likely to be identified on igneous rocks than on limestone and other sedimentary rocks.

Depending on the quarry and the nature of the layers, freely parting slabs are prised loose with crowbars, as for example in La Rioja, Argentina, where oolitic sandstone slabs of 2 to 7 cms thickness are produced.

For thicker slabs crowbars are no longer sufficient. These slabs are separated by vertical wedges and manipulated to make the best use of the natural properties of the stone. Generally the break is most successful when the weight is equal on both sides of the wedge, standing up-right in the thicker beds, and pointing slightly away in thinner beds. The stone should be split into equal halves where possible. If one side is weaker, the blow will tend to run out towards the weaker side, causing an uneven break. Where drills are used, the wedge should be placed at least half of its length into the hole, but it should never reach the bottom. Delay between blows should be minimized, so that the whole row of wedges works as one. Firm and rapid blows are important, as extra hard blows will make a wedge fly out.

Where jackhammers are unavailable, holes can be made with a round steel crowbar about 1½ meters long and sharpened to a chisel edge, the barramina, or with jumper drills. Abrasives like a silica sand sludge speed up the drilling. Hole spacing and depth are dependent on how easily the material splits, and varies from quarry to quarry. To guide the line of fracture, tough or soft stones require deeper holes.

Alternatively, depending on the nature of the stone material, staggered pits or continuous grooves are preferred for straight breaks (when the drilling of holes would take more time than chasing). These are chased with a hammer and chisel. The groove tapers to the bottom, with the end finer than the edge of the breaking wedge. Wedges in many sizes are traditionally the main tool for splitting stone or detaching stone masses by insertion in induced or natural cracks of joint cavities, similarly to those made for parting slabs.

In 40 to 60 cm thick slabby layers, a v-shaped groove or pit, about 10 to 15 cms deep, is chased along the whole length of the block to be cut. The pit is lined with scales, long strips of tin. Small wedges are then inserted. These are gently tapped with light sledgehammers until the stone splits. Chasing a continuous groove takes an hour per meter, although the actual splitting blows only last a few seconds. Accurate and true chasing prevents a faulty cut. Where available, plugs, more slender than the wedge, and feathers, with a taper corresponding to the plug, have now largely replaced wedges but need insertion holes. Quarry floors require meticulous cleaning by broom or compressed air, before a next layer of stone is removed; the larger sized stone waste is cleaned and then squared by guillotine.

## Dressing Slabs and Building Stones

Slabs are shaped by dressing, that is by slicing with a saw to be smoothed with chisels, or by rubbing with abrasive or harder stones and at times by applying a polished finish. Polished marble table

tops and kitchen counters are regularly crafted by hand on the island of Romblon in the Philippines. Counters, often matched with hand carved marble kitchen sinks and wash basins, are common fittings in Greece, Turkey and the eastern Mediterranean islands. In eastern Portugal thick granite slabs constitute whole facades in large buildings and are also important components in houses and cottages.
Flooring, stairways, steps and paving consume more slab material than any other type of construction. In flooring for latrines the slabs have a hole and are often made of slate as, for example, in the foothills of the Himalayas.

*Slabs in Foundations*

As already stated above, the use of slabby stones has the geometrical advantage over the use of boulders or irregular shaped stones. Slabby stones have natural parallel faces and require less fitting time. Otherwise the technique applied for its use in foundations is similar to that used for boulders. (ref. Technical Brief on "The Boulder Concept").

*Slabs in Dry Walling*

With slabby stone material, unlike with other stone shapes, the basic technology for dry or mortared walls are akin. Dry walls are usually "monolithic" with or without a framework, whereas other types can vary from cavity walls to hybrids using various stone types and infillings together with an array of metal frameworks and anchorings. Dry walls are more intricate.

Slabs for use in dry walls are normally 30 cms wide and 7 to 20 cms thick in various lengths. The wall building technique is similar to mortared wall construction, using less wide and shorter stones.

## Wall Building

The shape and dressing of local slabby stones depends on the skill of the stone mason and the use on the skill of the builder. The two construction methods for slabby stone walls are based on filling a framework (skeleton wall), or on using massive coursing:

- Skeleton wall: this consists of wooden poles and beams which form a framework, which is then filled-in with stones.
  This is also known in the Caribbean as "Spanish Walling" (for example in Jamaica). This type of wall, braced by diagonal timber pieces, is an indigenous type of stone nogging, reputedly introduced by the Spaniards. The stones are keyed in to form a tight knit, and then mortared with sand and lime. This type of wall is more flexible than a massive wall and suitable for use in earthquake and hurricane prone areas. Skeleton frames in Haiti which are common between Miragooane and Fond des Negres in the South, use vertical uprights.
- Coursed type of wall: this is monolithic and more common in areas with high seasonal temperature difference.

Both types of wall can be of a dry-stone or built with mortar. Frequently used finishes of walls include coursed, random or snecked rubble.

The straight run of the wall is turned at a right angle by corner stones or quoins, to enclose space or to form a framework to be filled with stones. In stone rondavels, for instance at Maseru in Lesotho, the individual stones, whether slabs, ashlars, or boulders are gradually turned until a circle or oval shape is attained. To build the all stone pilot house as shown in Fig. 4 La Rioja, Argentina, slabs 2 - 10 cms thick and 30 cms wide, were cut in various length to provide building elements. With perfectly flat layers, at the top and bottom, semi-dry walling can be conside-

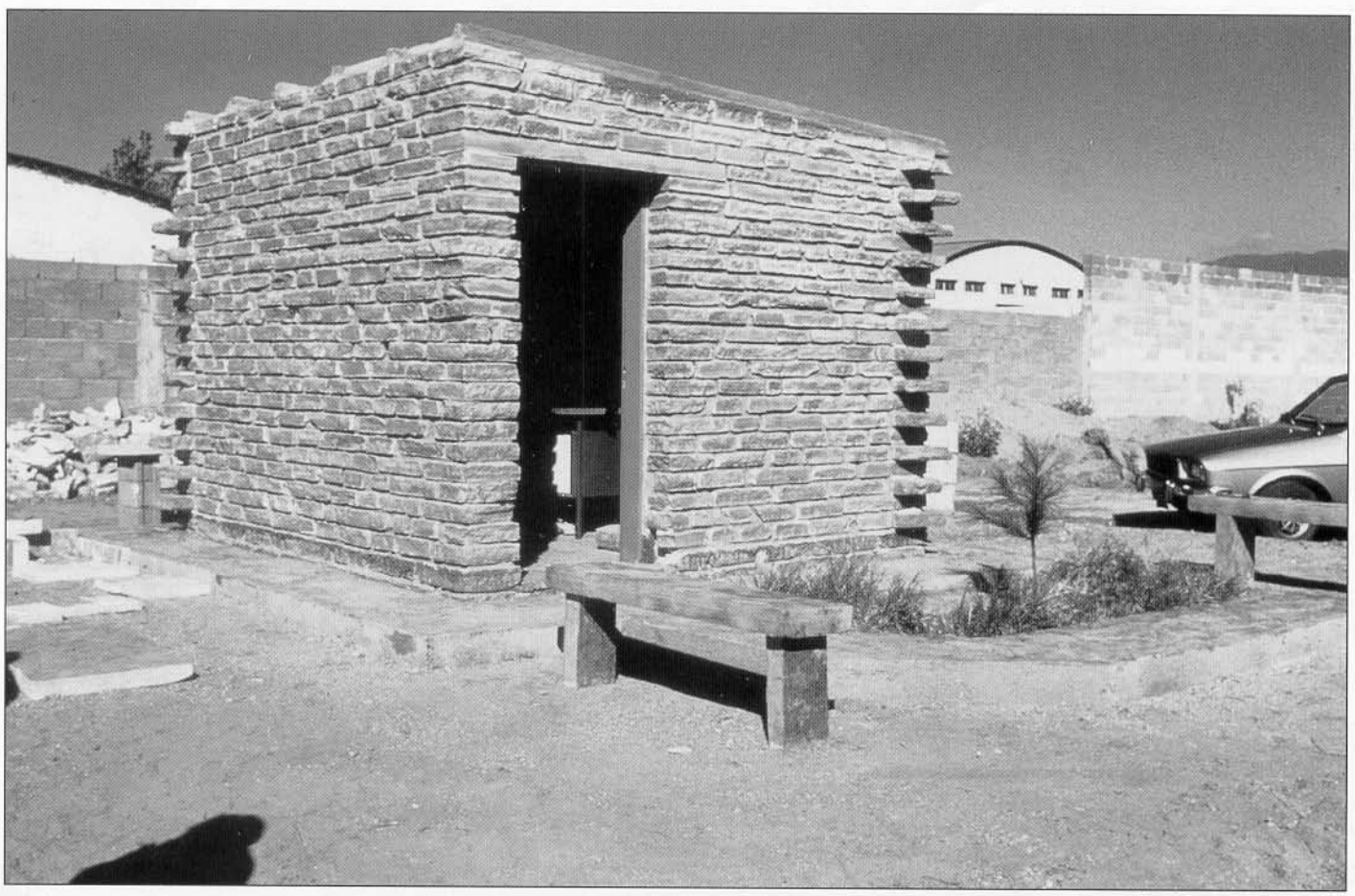

*Figure 4: "La Rioja, Argentina"*

# What is BASIN ?