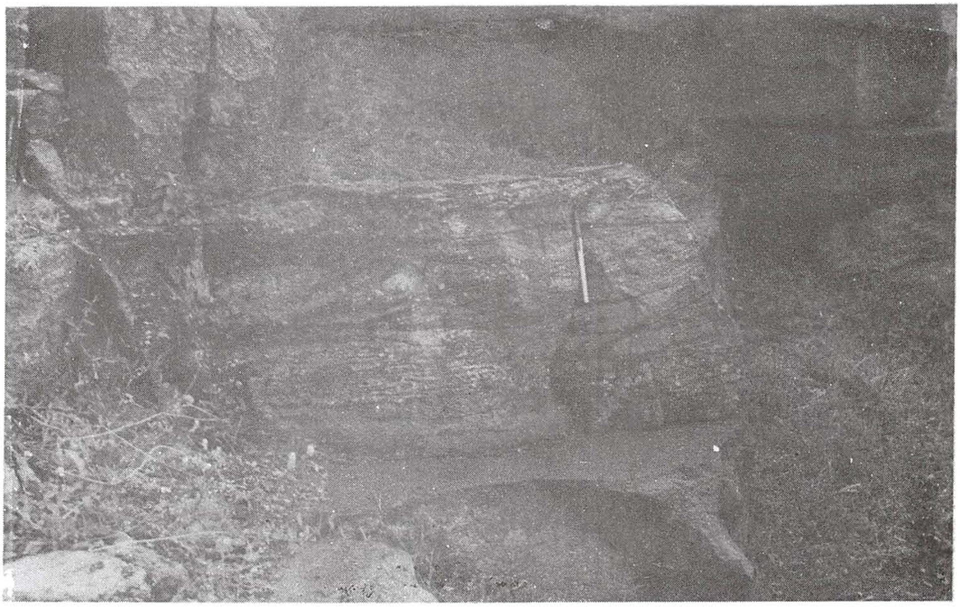

Fig. 2.13b. Field photo of pink quartzarenites traversed by darker coloured veins, in a criss-cross manner. The veins consist of purple coloured aggregated grains of quartz. Locality is Jamkhandi town, Bijapur district, Karnataka state. Photo taken by the author.

Fig. 2.13c. A large slab of light cream coloured sandstone displaying excellently developed dendritic markings. *Courtesy :* Department of Studies in Geology, Karnatak University, Dharwad.

(b) Causes of variation in thicknesses of beds

The rivers are continuously at the work of depositing the sediments into the lakes, the seas and the oceans. During the rainy season, the load carried by them is naturally and definitely more than that carried during the other seasons. Therefore probably more quantity of sediments are laid during the flood times, giving rise to thicker beds. Those deposited during the other seasons could be expected to be less in quantity, and hence thinner layers or beds might be formed. As has been said earlier, more than one river might be bringing in sediments into the basin. Therefore it is likely that one river (initiated over softer rocks) brings more sediments, while another (if it be initiated over harder rocks) brings in less quantity of sediments. Such a situation will produce beds of unequal thicknesses in the basin.

Likewise the depth of water need not be necessarily same in all parts of the basin. The floor of the basin also could be uneven, thus producing shallower and deeper stretches within it. Such a situation also could give rise to varying thicknesses of beds; thicker in the deeper stretches, and thinner in the shallower ones. Even the grain size could vary; coarser in the shallower stretches, finer in the deeper stretches, and so on. These are all interpretations, because it is not possible to demonstrate the process of sedimentation in the laboratory.

(c) Current/false/cross/torrential bedding structures

These structures are originated in the sediments that are laid in the shallower depths of water. Current, false, and cross bedding structures are one and the same i.e., these are synonymous names. The off-set beds are found to be at an angle to the top- as well as to the bottom-set beds, these latter two beds being horizontal in disposition. It is held by the sedimentologists that the water in the basin was not quiet, and the inflowing river might have generated currents in the water. Such currents appear to have upset the sediments settling vertically down. Therefore, instead of producing horizontal layers, it gives rise to inclined ones. This period is followed by the normal, quiet condition of water favouring vertical settling down of the sediments, resulting in horizontally reposing beds. Study of current bedded structure reveals that these were repeated many times giving rise to several units of current bedded structures lying one over another in a vertical succession. There is one more feature that needs a mention. The direction of inclination of the off-set beds belonging to the different units, is not the same. It is towards left hand side for one set, while it is towards the right hand side for a set found on the overlying or the underlying off-set beds (Figs. 1.6a, and 2.3). This disposition clearly indicates that there is a continuous change in the direction of the currents developed in the water of the sedimentary basin. Though the exact modus operandi of the production of the current/false/cross bedding structure is a debatable matter, it may however be said that the currents generated in the water, and the continuation of the flow of the river into the basin, together are responsible for the development of the said structures.

In the case of torrential bedding (Figs. 2.5 and 2.6), the off-set beds are inclined at high angle or are almost perpendicular to the top-set and the bottom-set beds. The origin of this structure is once again attributed to the currents produced in the water of the basin. Probably the nature and/or the intensity of the currents generated in the water was different than those responsible for the development of the current bedded structure.

composition, and (iv) the colour and the grain size. Some of the bases give rise to a classification that can be readily adopted during the field studies, like the colour and the grain size. Others can be made use of only in the laboratory, like the basis of chemical composition. Thus the classifications serve different purposes like making distinction between the several varieties, establishing origin of the rocks and so on. There is one basis which is exclusively applicable to the sedimentary rocks. It is the presence of fossils in some of them. Thus rocks are named as the foraminiferal limestones, the crinoidal limestones and so on. Classifications of the sedimentary rocks based on the above noted bases are described below.

(a) Classification based on the mineralogical composition

This is the most important basis, because, by definition, a rock is an aggregate of minerals, and therefore, minerals must be considered first, in effecting classification of any rock. As many as 51 minerals are encountered in the sedimentary rocks, and these comprise of light minerals (sp. gravity less than 2.85), and of heavy minerals (sp. gravity more than 2.85). Frequency of occurrence of them is not the same. It has been observed that only 7 minerals belong to the class of light minerals, while 44 form the category of heavy minerals. It is further interesting to note that though heavy minerals are more in number, these according to Pettijohn constitute a mere one per cent of the arenaceous sediments (Pettijohn, 1957, Table 24, p. 117). Further, only 20 heavy minerals are commonly met with, while 24 are not frequently encountered in the sedimentary rocks. Thus it is seen that though the heavy minerals are more in number, their participation in the building up of the sedimentary rocks is negligible. Classification of the sedimentary minerals on the basis of frequency of occurrence is set out in Table 3.2.

Table 3.2. Classification of sedimentary minerals based on frequency of occurrence and their sp. gravity (slightly modified from Table 24 of Pettijohn, 1957, p. 117)

Most common minerals		Heavy minerals (sp. gravity > 2.85) occasionally met with. These constitute less than one per cent of the rock
Light minerals (sp. gravity < 2.85). All occur very frequently excepting chalcedony	Not very frequently encountered (sp. gravity > 2.85)	
Quartz, felspars, calcite, dolomite, clay minerals, chalcedony (not very common)	Biotite, garnet, hornblende, hypersthene-enstatite, ilmenite, chlorite, magnetite, rutile, sphene, tourmaline, zircon, zoisite, staurolite, leucoxene, kyanite, epidote, augite, diopside, apatite, andalusite	Antinolite-tremolite, anatase, barite, brookite, casseterite, chloritoid, clinozoisite, collophane, cordierite, corumdum, dumortierite, fluorite, glaucophane, hematite, limonite, monazite, olivine, pyrite, siderite, sillimanite, spinel, topaz, xenotime, serpentine

It will be apparent from Table 3.2 that the most frequently occurring minerals in the sedimentary rocks are quartz, felspars, clay minerals, calcite and dolomite. A sandstone is made up practically entirely of quartz, a shale is composed predominantly of clay minerals, while calcite together with small quantity of dolomite, build up the limestones. The sedimentary rocks therefore could be described as

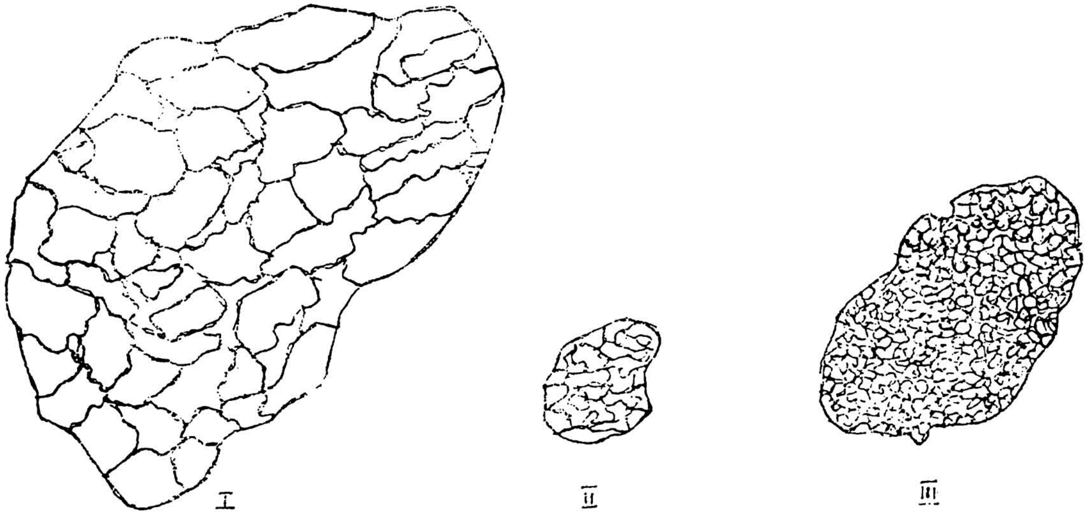

Fig. 3.14. Polycrystalline grains of quartz from quartzarenites (Camera lucida drawings ×10). *Courtesy :* G.S. Pujar (grain I); K. Bhimsen (grain II KB 139, grain III KB 115).

more than the grains of felspars. If the content of quartz be around 75 per cent, the rock is called as a sub-graywacke. If the content of quartz be between 75 and 95 per cent, it is called as a proto-quartzite. A sandstone containing more than 95 per cent of quartz, and about 5 per cent grains of chert, is called as an orthoquartzite or a quartz-arenite. In order to appreciate the subdivisions within the sandstones, a schematic diagram (Fig. 3.15) is drawn.

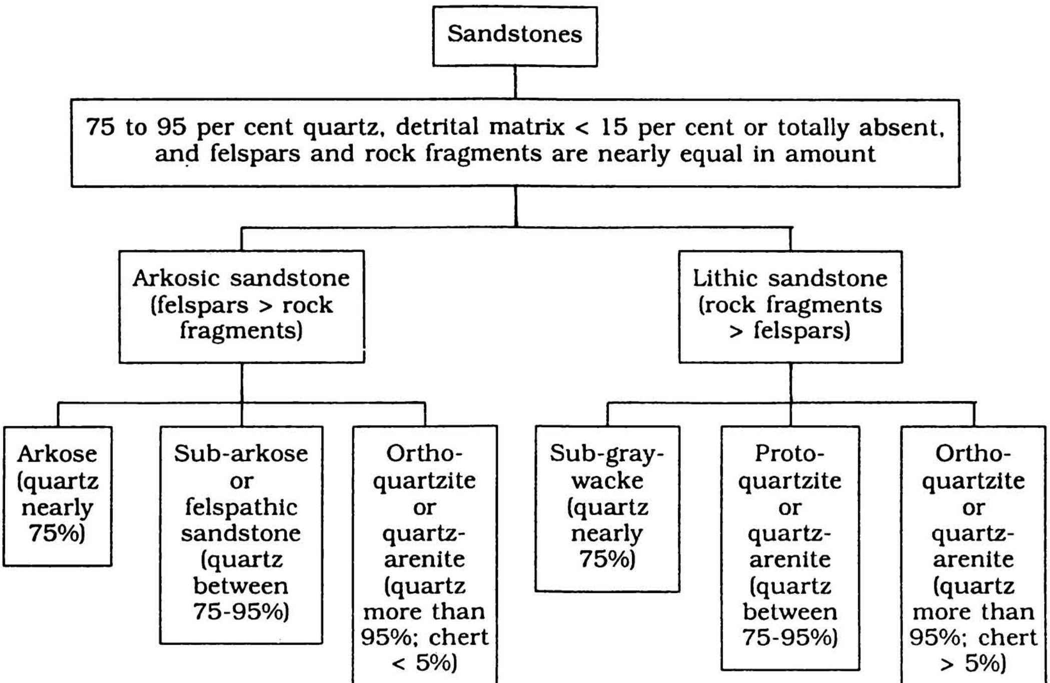

Fig. 3.15. Schematic classification of sandstones.