Chapter 23

Muqarnas: Geometrical and Stereotomic Techniques in Ancient Islamic Architectures: Ceilings and Domes of Mameluk Buildings in Old Cairo

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ABSTRACT

The topic of this chapter is the geometry and the construction of vaulted and decorative systems called ‘muqarnas’, one of the most typical elements of Islamic architecture. This way of ‘vaulting spaces’ or building roof and decorations with a system of regular staircase-elements that break down the surface covering it with simple geometrical figures, so as to make up complex patterns, spreads throughout Arabic countries, leading to the development of several styles, deriving from different generative geometries, and from building techniques and used materials. The reason which accounts for the widespread development of this type of decoration is to be found in the prohibition of the Moslem religion to portray idols or anthropomorphic figures of God, in contrast with the decorative techniques of sculpture and painting characterizing Christian art. The geometrical study which is at the basis of the Islamic art of decorating is arousing new interest and attention as regards the new systems of parametric modeling in computer art, besides opening new perspectives in standardized building techniques with new materials.

INTRODUCTION

In the new Encyclopaedia of Islam, Doris Behrens-Abouseif (Behrens-Abouseif, 2015) defines muqarnas as: “a type of decoration typical for Islamic architecture all over the central and eastern parts of the Muslim world; for its counterpart in the Muslim West, see muqarbas”.

The term derives from the Greek korwnio, Latin coronis, Fr. corniche, Italian. cornice, (Germ. Karneis), and it is a popular term, or a mason’s technical term. Wolfhart Heinrichs (Heinrichs, 1997) has

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some doubts on this accepted etymology. The fact that there is a sin-sad-variation in this word means that the written tradition of its root is not very firm. The Greek word meaning ‘everything that is curved’, can be used as an adjective meaning ‘crook-beaked’, ‘curved’ and as a noun referring to anything curved or bent. In the Lisan al-‘Arab, the architectural term *muqarnas* is nowhere to be found. Various words are listed under both the sin and the sad form of the root q-r-n-s/s: it is the geographical morphological term *qurnas* (also *qirnas*) which is defined as “something like a nose projecting in a mountain.”. Accepting this, the Arabian verb *qarnasa* would mean: ‘to furnish a structure with projecting overhanging elements’ and the past participle *muqarnas*, consequently, would originally have meant ‘(a structure) furnished with projecting overhanging elements.’ In the Persian lexicographical tradition the architectural meaning of *muqarnas* is well documented, as a structure which they used to make in the form of the *qurnas*, the latter being the nose of the mountain. It should be mentioned that in the Persian tradition the architectural term *muqarnas* often seems to have had a much meaning, covering any kind of cupola with paintings. Although the plausibility of the etymology *qurnas - muqarnas* cannot be denied, Heinrichs points out that it does have certain weaknesses. However, it also appears to have a number of advantages over its competitors.

The term *muqarna* refers to an often merely decorative element, but at times also a structural one, typical of Islamic architecture and composed of a series of niches embedded within an architectural frame, geometrically connected and forming a three-dimensional composition around a few basic axes of symmetry. This method of building vaults, developed around the middle of the 10th century in northeast Iran and later spread throughout the Arabic world.

The *muqarnas* vault is composed of three-dimensional geometrical elements with a multifaceted surface, called *blocks*, being assembled; juxtaposed in horizontal rows, projecting one on the other, so as to cover apses, domes, hackles, transitions between tambours and domes, minaret projections or wall discontinuities (gates, windows, corner solutions, etc.) mainly for aesthetic reasons, but also for structural purposes, creating, awesome spaces. They look like beehives and sometimes like a cave-like vault with stalactites (only in certain types of *muqarnas* in the Mamluk and Mozarabic areas, like the Alhambra in Granada. (see Figure 1).

The result is a three-dimensional geometric weave of complex multifaceted mesh with an ever-varying pattern strongly affecting the space of vaulted and domed settings, creating in this way extraordinary light/shade effects. At first sight *muqarnas* look more like sculpture equipment, almost inlay work in surfaces, rather than an architectural motif, although they are the result of a geometric and building process based on the standardization of blocks.

**HISTORICAL ORIGIN OF MUQARNAS**

Most research concerning the art of *muqarnas* has been carried out from a historical viewpoint, overlooking the planning and building aspects, ranging from the generative geometry of forms to the study of the patterns of space tiling according to its various three-dimensional variations, up to the building techniques used for different materials in different periods: stone, wood, raw bricks and plaster. Documentary proofs regarding *muqarnas* planning were found in 1968 by German archaeologists in the ruins of the Takht-i-Sulayman, palace near Teheran, where a few carved patterns (one quarter of a *muqarnas* vault) were found on a small clay board dating from the XIII century.