

Great rhombicuboctahedral assembly of regular octahedra

Robert William Whitby

24 December 2003

<http://homepage.mac.com/whitby/>

Copyright 2004 by Robert William Whitby

<http://web.me.com/whitby/Octahedron/Welcome.html>

Reference

Octahedron1stEd.pdf–bookmarks: QUASICRYSTAL Eightfold forms–pages 134-138

Introduction

A great rhombicuboctahedral assembly of regular octahedra consists of eight octahedral triplets and twelve octahedra acting singly. Each triplet defines an hexagonal face; an edgial equator of each lone octahedron defines a square face. The perimeter of each octagonal face is defined by an edge of four lone octahedra plus the vertexial spacing between two octahedra of each of four triplets. Facial views of the great rhombicuboctahedron are shown in Fig. 1. The definition of the three facial types by the octahedra of the assembly is shown in Fig. 2. The construction of the assembly is shown from the three facial directions in Figs. 3, 4, and 5. A rhombicuboctahedral assembly of octahedra is shown in Fig. 6. It differs from the great rhombicuboctahedral assembly in having a lone octahedron in place of each triplet. A second kind of rhombicuboctahedral assembly of octahedra is shown in Fig. 7. This arrangement has been covered in the reference. Eight great rhombicuboctahedral assemblies of octahedra have been joined in a regular cubic structure which would be quite porous if it could be realized atomically [Fig. 8]. Layouts are provided in Figs. 9 and 10.

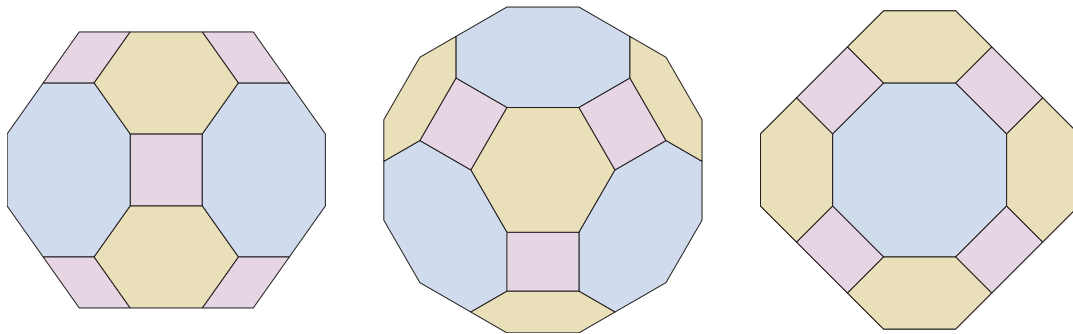


Fig. 1 Great rhombicuboctahedron–facial views

Three facial views of the great rhombicuboctahedron are shown in the figure. At left, the view is normal to a square face; in the middle, the view is normal to an hexagonal face; at right, the view is normal to an octagonal face.

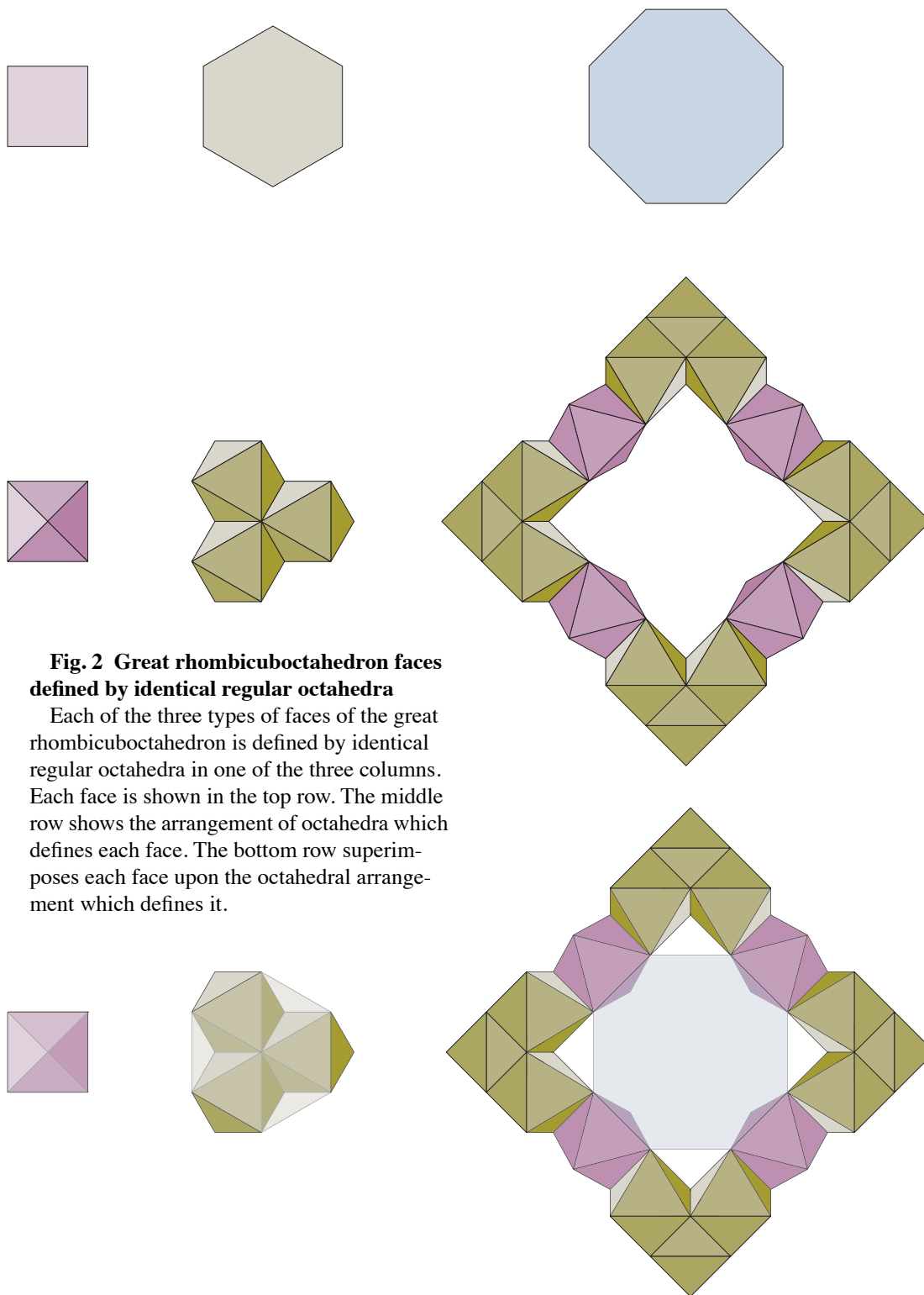
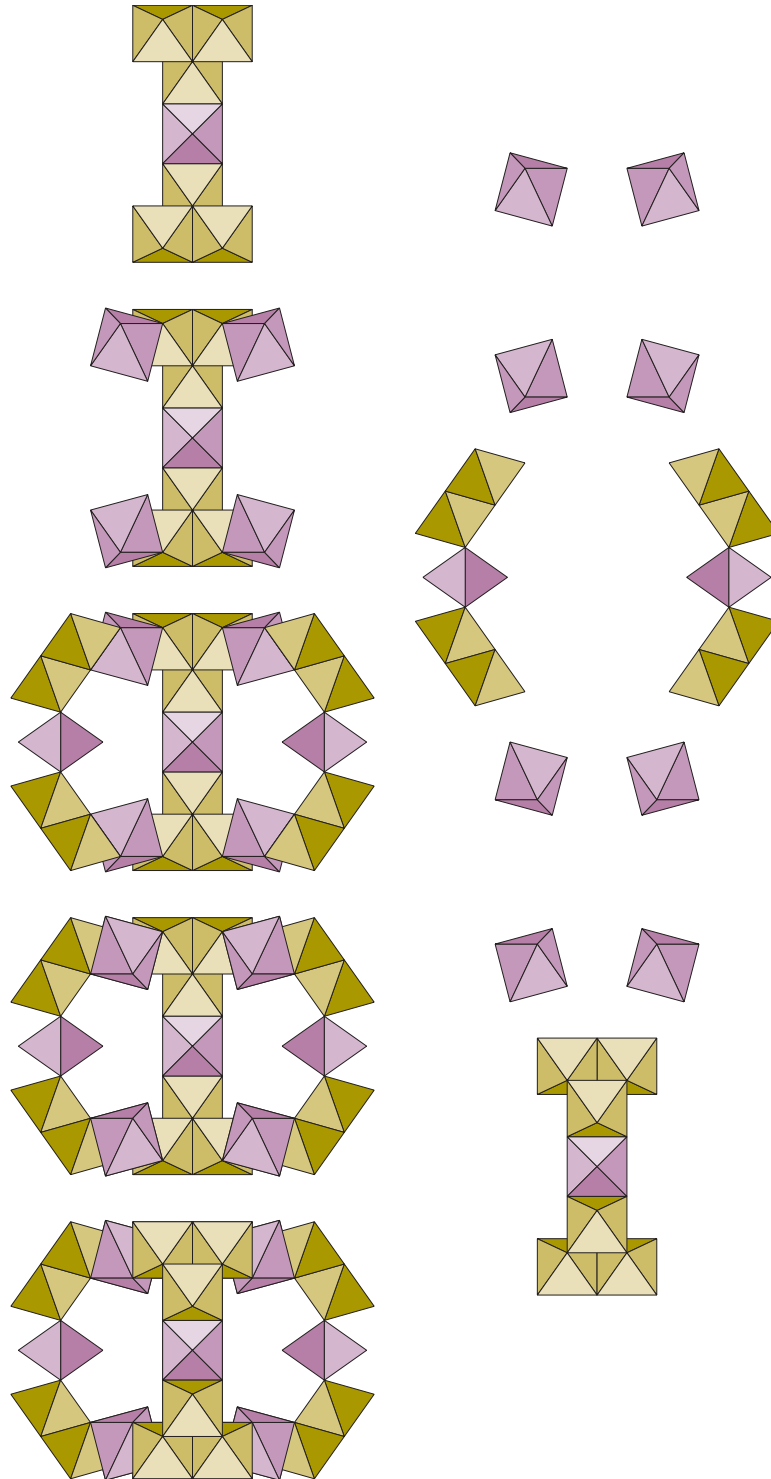


Fig. 2 Great rhombicuboctahedron faces defined by identical regular octahedra

Each of the three types of faces of the great rhombicuboctahedron is defined by identical regular octahedra in one of the three columns. Each face is shown in the top row. The middle row shows the arrangement of octahedra which defines each face. The bottom row superimposes each face upon the octahedral arrangement which defines it.

Fig. 3 Great rhombicuboctahedral assembly of regular octahedra—4-facial view

The assembly is depicted in five layers which proceed from the farthest to the nearest. The assembly progresses from top to bottom using the layers shown in the right column to build the assembly in the left column.



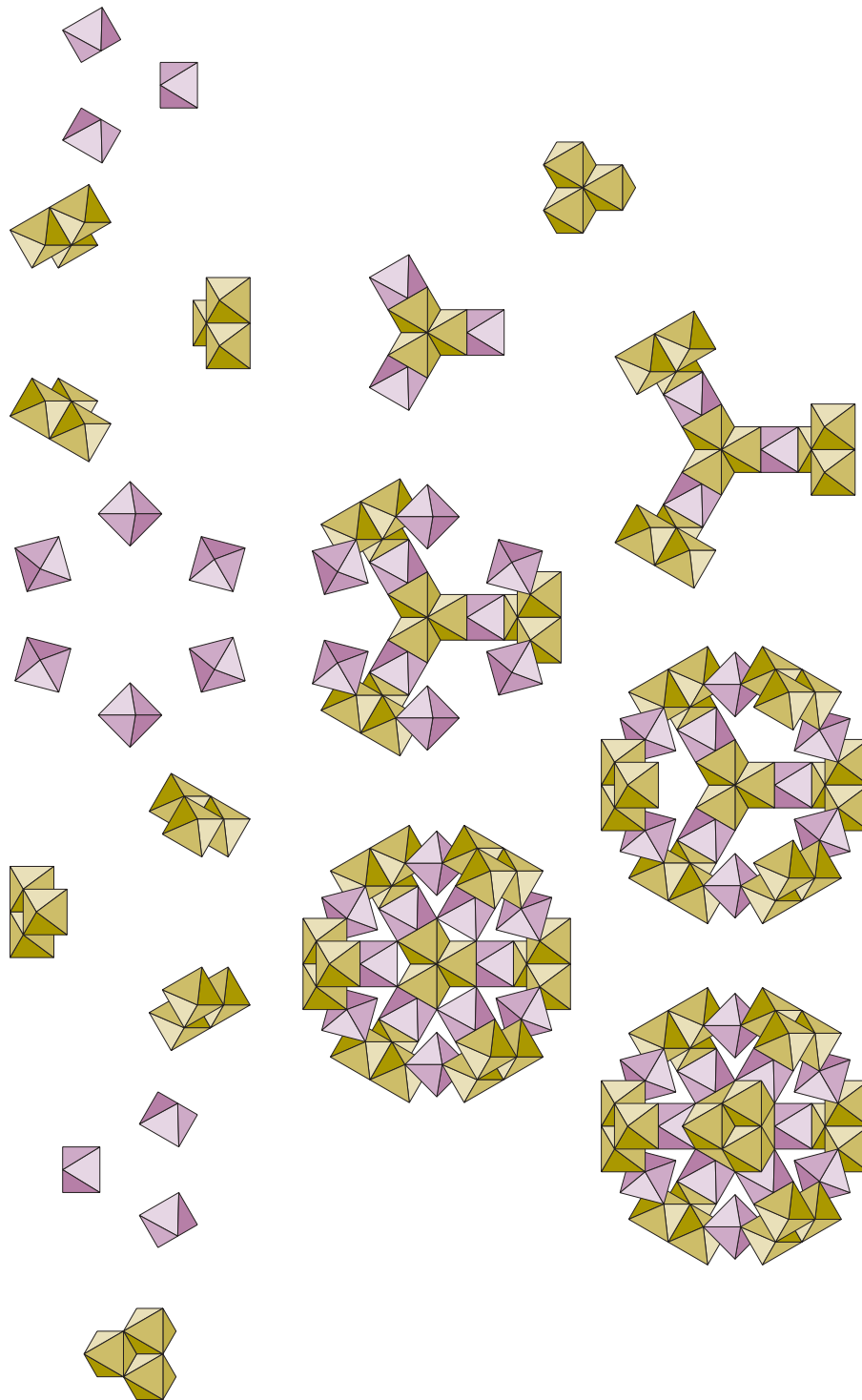


Fig. 4 Great rhombicuboctahedron–6-facial view

The assembly begins with an octahedral triplet which is shown at the top on the right. The six layers shown in the left column are added one by one to produce the growing assembly on the right.

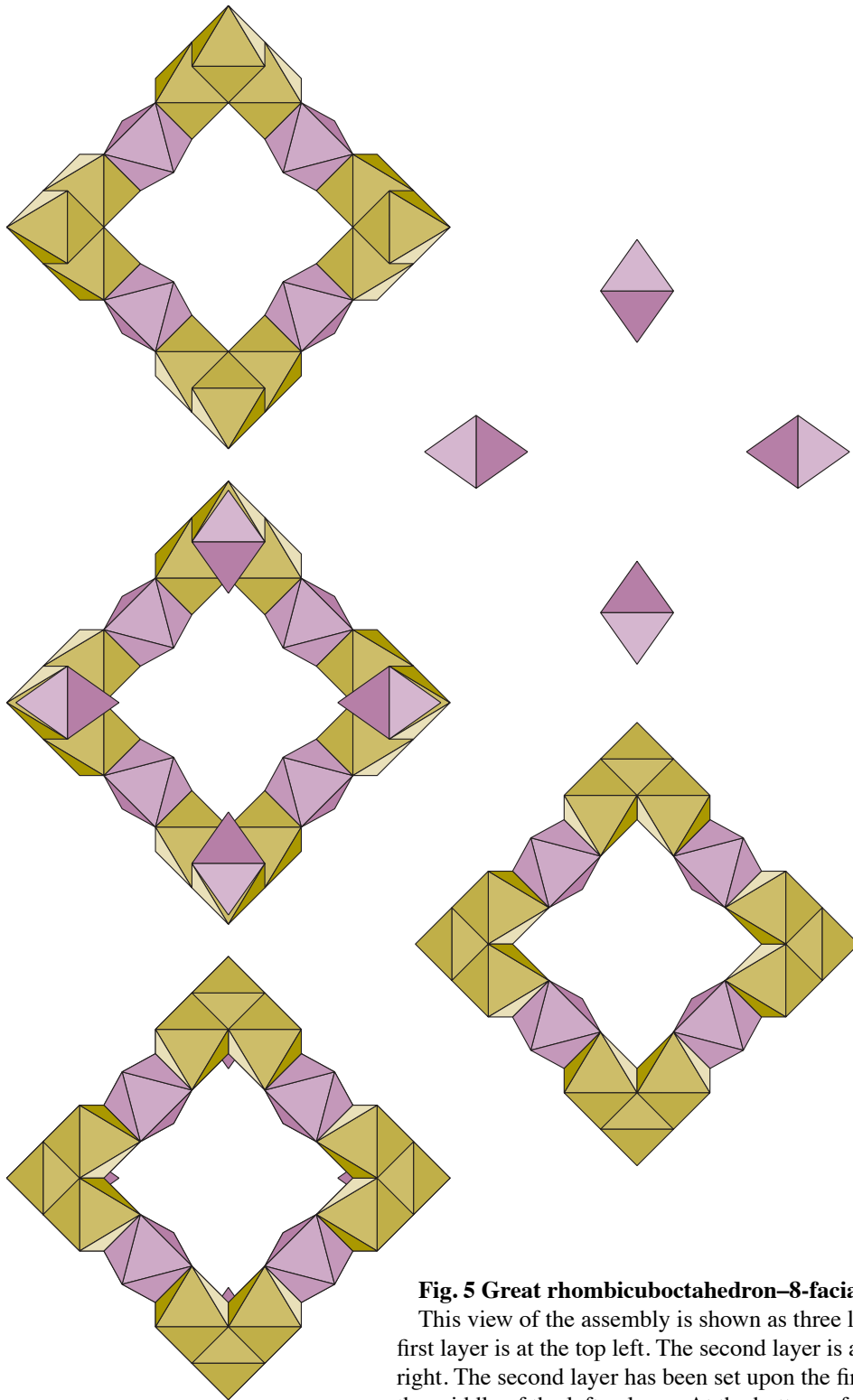


Fig. 5 Great rhombicuboctahedron–8-facial view

This view of the assembly is shown as three layers. The first layer is at the top left. The second layer is at the top right. The second layer has been set upon the first layer in the middle of the left column. At the bottom of the left hand column, the final layer from the bottom of the right column has been placed to complete the assembly.

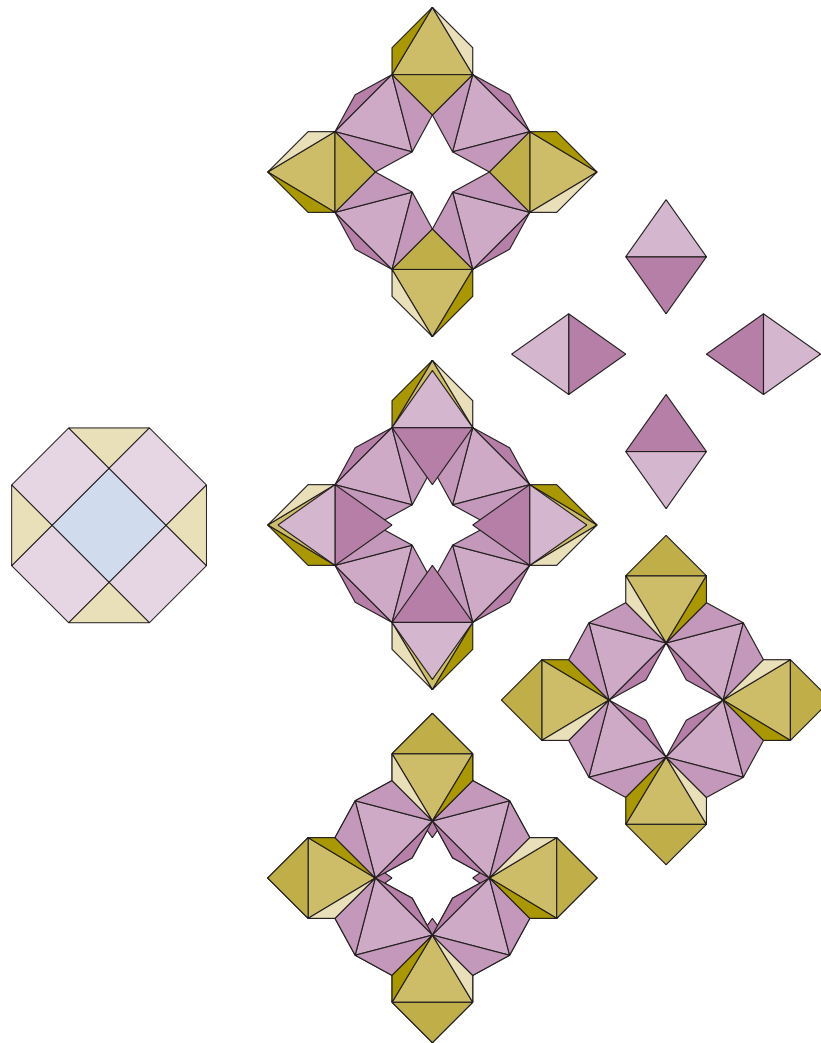


Fig. 6 Rhombicuboctahedral assembly of octahedra.

This assembly uses the same violet colored octahedra as the great rhombicuboctahedral assembly, but a single yellow octahedron is used in place of the yellow triplet. Just three layers are used in the assembly. The layer at the top left is furthest away. The layer on the top right is added next to produce the growing assembly in the middle of the left column. The bottom layer on the right completes the assembly at bottom left. A projection of a rhombicuboctahedron is shown to the left of the assembly. It has the same size and orientation as the one defined by the topological features of the assembly—each violet face is defined by an edgial equator of a violet octahedron; each yellow face is defined by a face of a yellow octahedron; each blue face is defined by an edge from each of four violet octahedra.

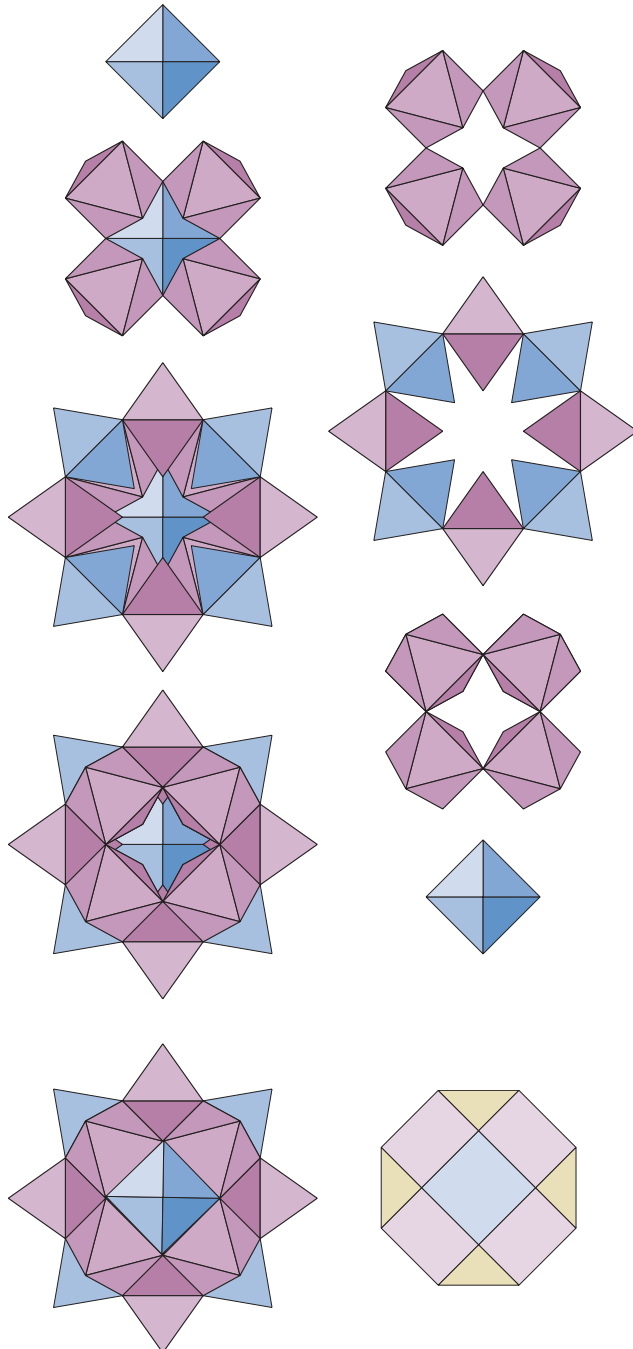


Fig. 7 Rhombicuboctahedral assembly of octahedra

This assembly uses the same violet octahedra as the previous figure, but there are no yellow octahedra. Six blue octahedra complete the assembly. The assembly commences with the blue octahedron at the top left. The four layers are added one by one to form the steps of the assembly shown on the left. The completed assembly as at bottom left. A projection of the rhombicuboctahedron defined by the assembly is shown at bottom right. Its violet faces are defined by edgial equators of the violet octahedra; its blue faces are defined by edgial equators of the blue octahedra; each of its yellow faces is defined by an edge from each of three violet octahedra

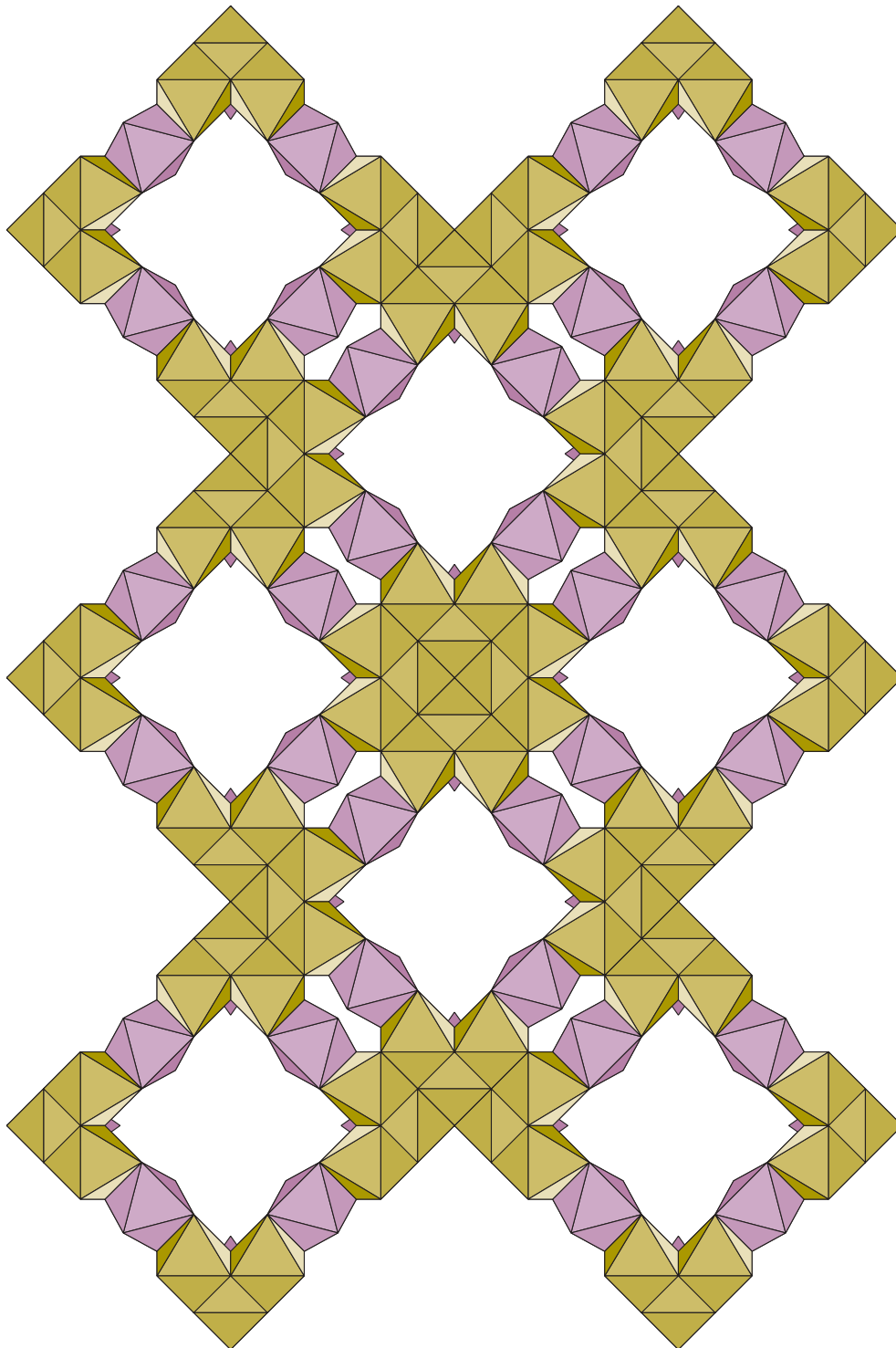


Fig. 8 An assembly of eight great rhombicuboctahedral assemblies of regular octahedra
Each assembly is joined to an identical assembly by two edges each of four yellow triplets.
This structure can be extended in the direction perpendicular to the plane of the paper.

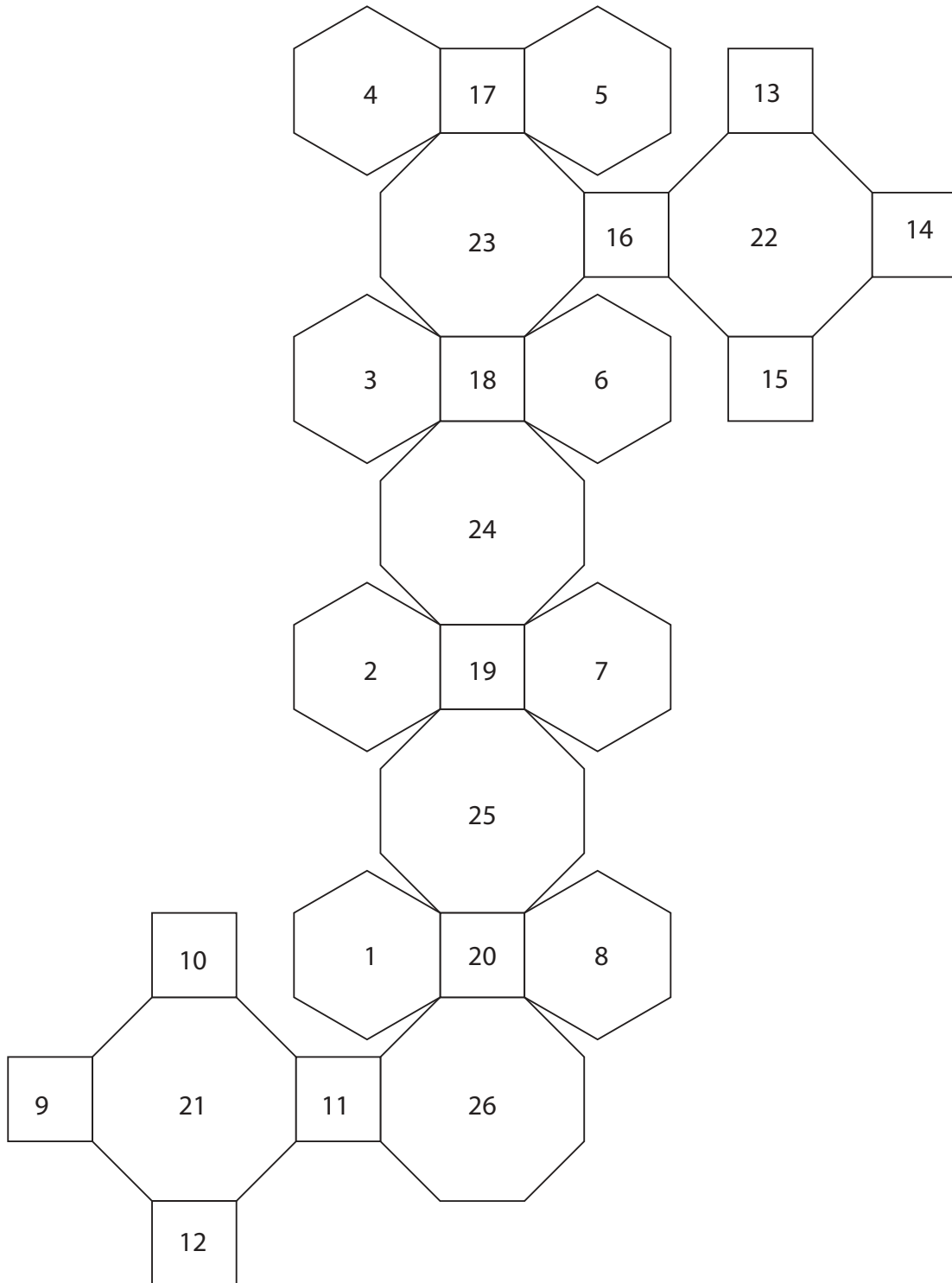


Fig. 9 Layout of a great rhombicuboctahedron.

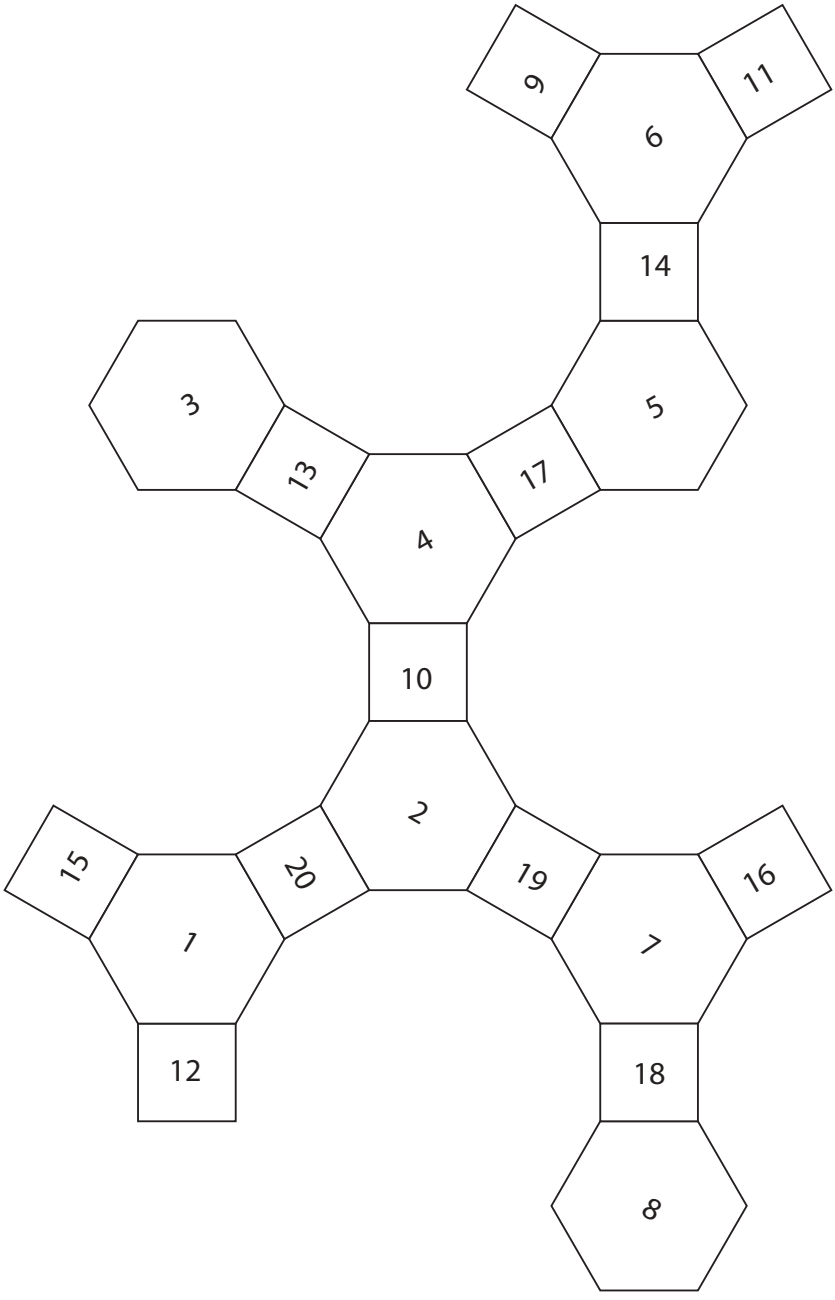


Fig. 10 Layout of a great rhombicuboctahedron without octagonal panels.