

## Hexacontahedral assembly of hexagonal face icosidodecahedra

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

### References

**1. Octahedron1stEd.pdf** by Robert William Whitby

The octahedral periodicity of the atomic elements and its implications, 500 pages

<http://homepage.mac.com/whitby/FileSharing103.html>

**2. Hexicosidec.pdf** by Robert William Whitby

The file shows how identical icosahedral assemblies of twenty carbon atoms each (C<sub>20</sub>-fullerene) can join as hexagonal face icosidodecahedra.

<http://homepage.mac.com/whitby/BiologicalViruses/FileSharing98.html>

**3. HexicosidecCube.pdf** by Robert William Whitby

The file shows how hexagonal face icosidodecahedra can assemble as cubes

<http://homepage.mac.com/whitby/BiologicalViruses/FileSharing196.html>

**4. Studies into Polyhedra** by Anthony Thyssen

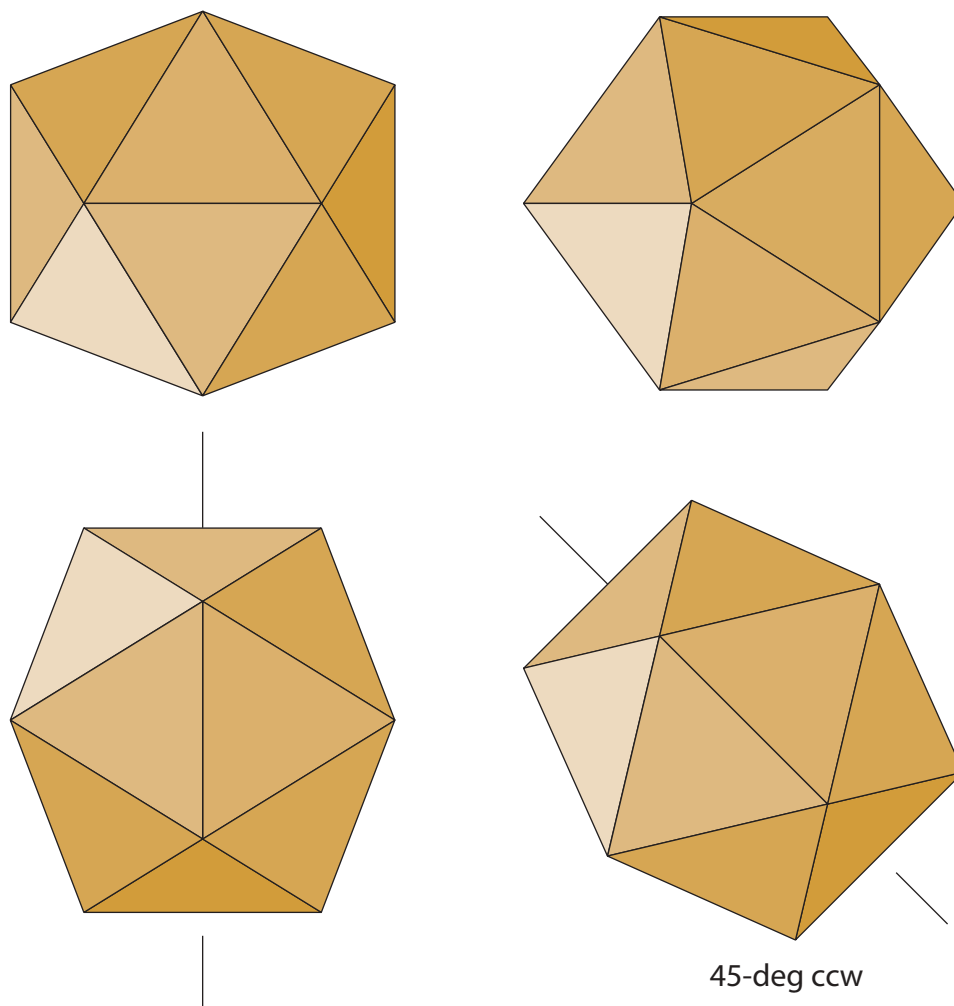
<http://www.cit.gu.edu.au/~anthony/graphics/polyhedra/>

**5. Artistic depiction of a kite hexacontahedron** by Anthony Thyssen

[http://www.cit.gu.edu.au/~anthony/graphics/polyhedra/archimedean\\_duals/kite\\_hexecontahedron.jpg](http://www.cit.gu.edu.au/~anthony/graphics/polyhedra/archimedean_duals/kite_hexecontahedron.jpg)

### Introduction

This file shows how hexagonal face icosidodecahedra form a hexacontahedron having identical quadrilateral faces.



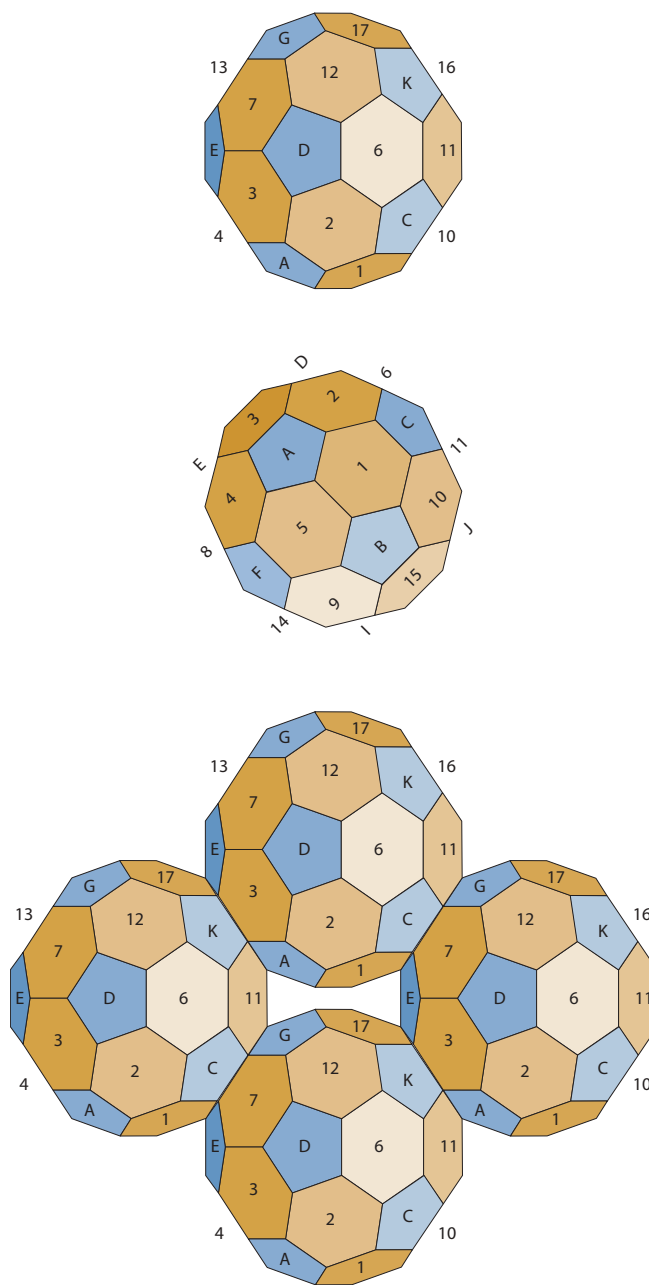
**Fig. 1 Hexacontahedron–geometric relationship to the icosahedron**

The figure shows four views of a regular icosahedron.

The icosahedron in the bottom left is parallel to an edgial diameter. An axis of symmetry has been constructed through its centroid that is perpendicular to the viewing direction. It emerges from the top and bottom of the figure. The same icosahedron is shown in a top view in the upper left of the figure.

The icosahedron in the bottom right is rotated 45° counterclockwise about a perpendicular to the page.

A top down view of this icosahedron is shown in the upper right. Each face of the hexacontahedron is in the same relationship to a regular icosahedron as the projection plane is to this view of a regular icosahedron.



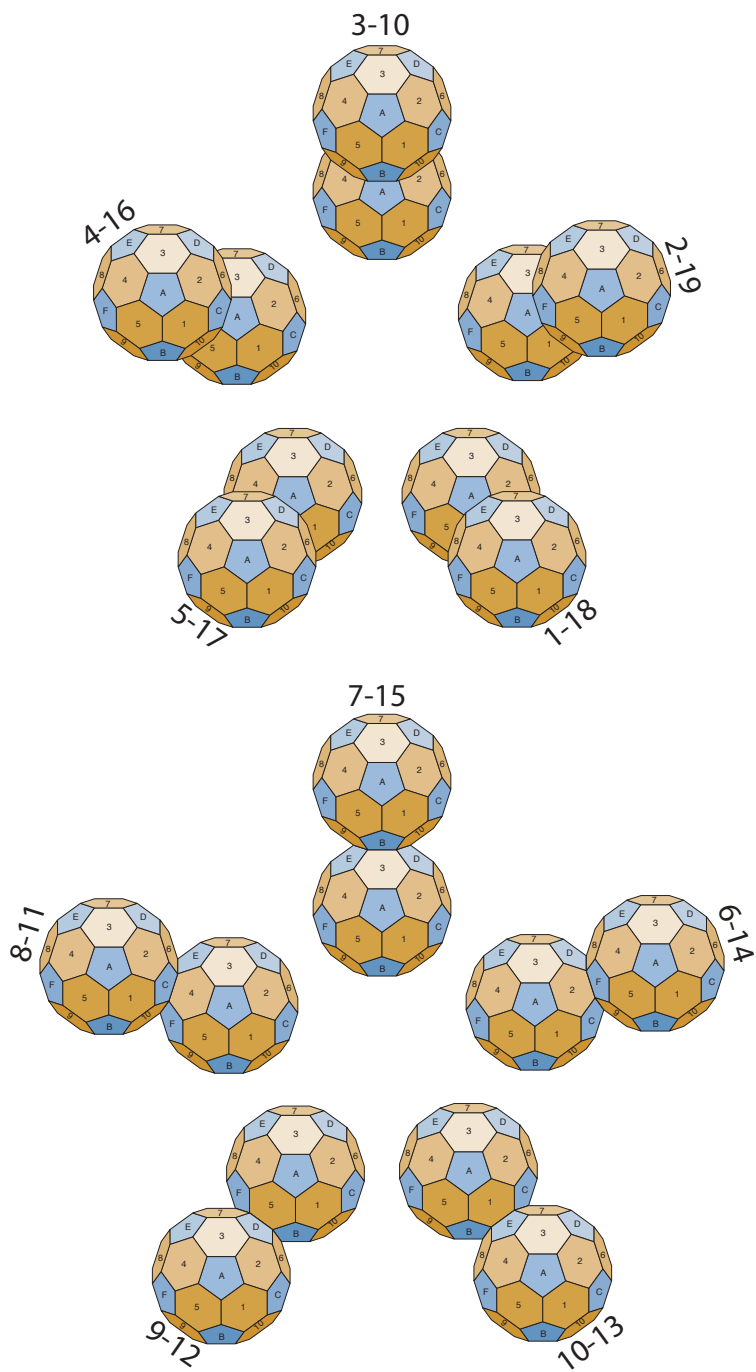
**Fig. 2 Hexacontahedral plane 4-16 10-13**

The figure shows how hexagonal face icosidodecahedra joined hexagonal face to hexagonal face define a pair of facial planes of a hexacontahedron.

At top, an icosidodecahedron is shown in a view which is normal to a pair of hexacontahedral facial planes.

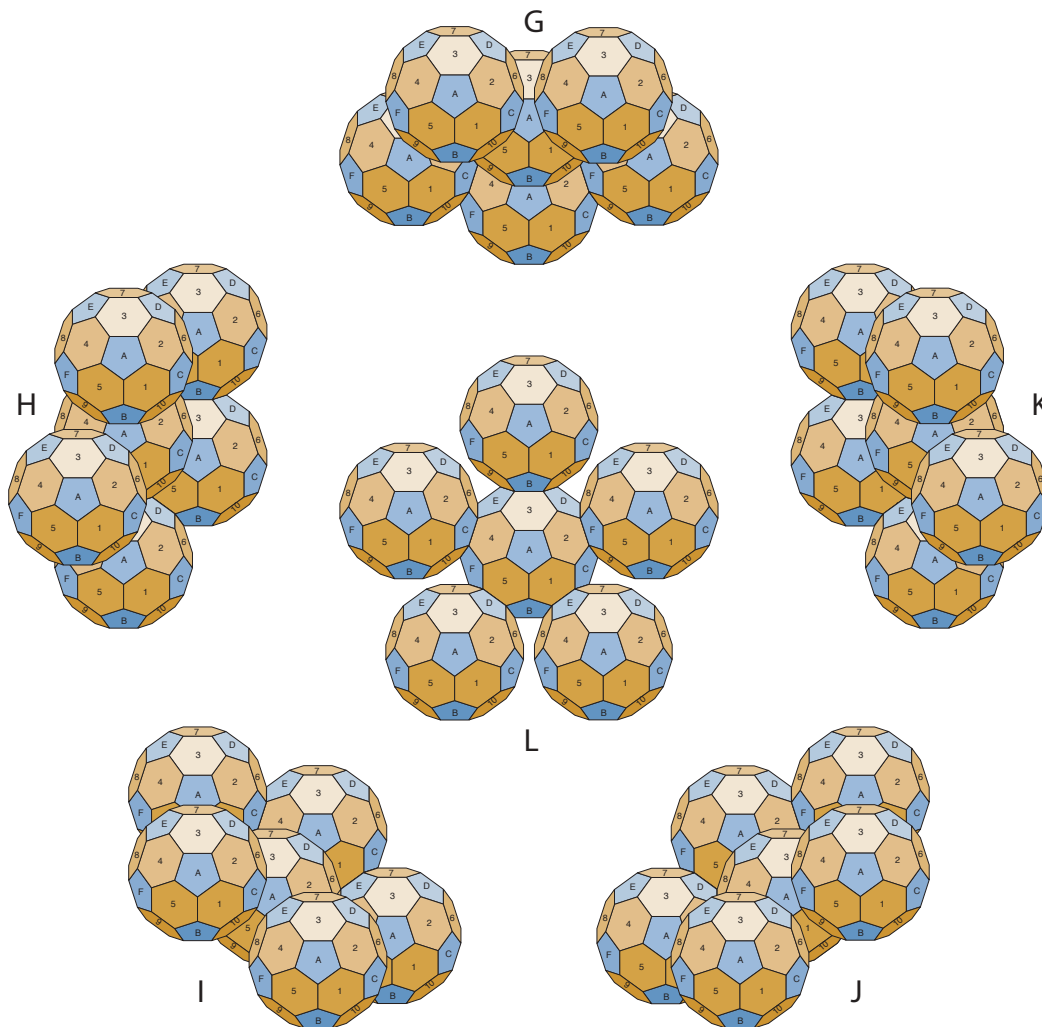
In middle, the same icosidodecahedron is shown from the side. This view is equivalent to the edgial view of the icosahedron that is rotated 45° counterclockwise.

At bottom, four icosidodecahedra are joined face to face in a planar assembly that is parallel to a pair of hexacontahedral faces.



**Fig. 3 Hexagonal face joins between icosidodecahedra**

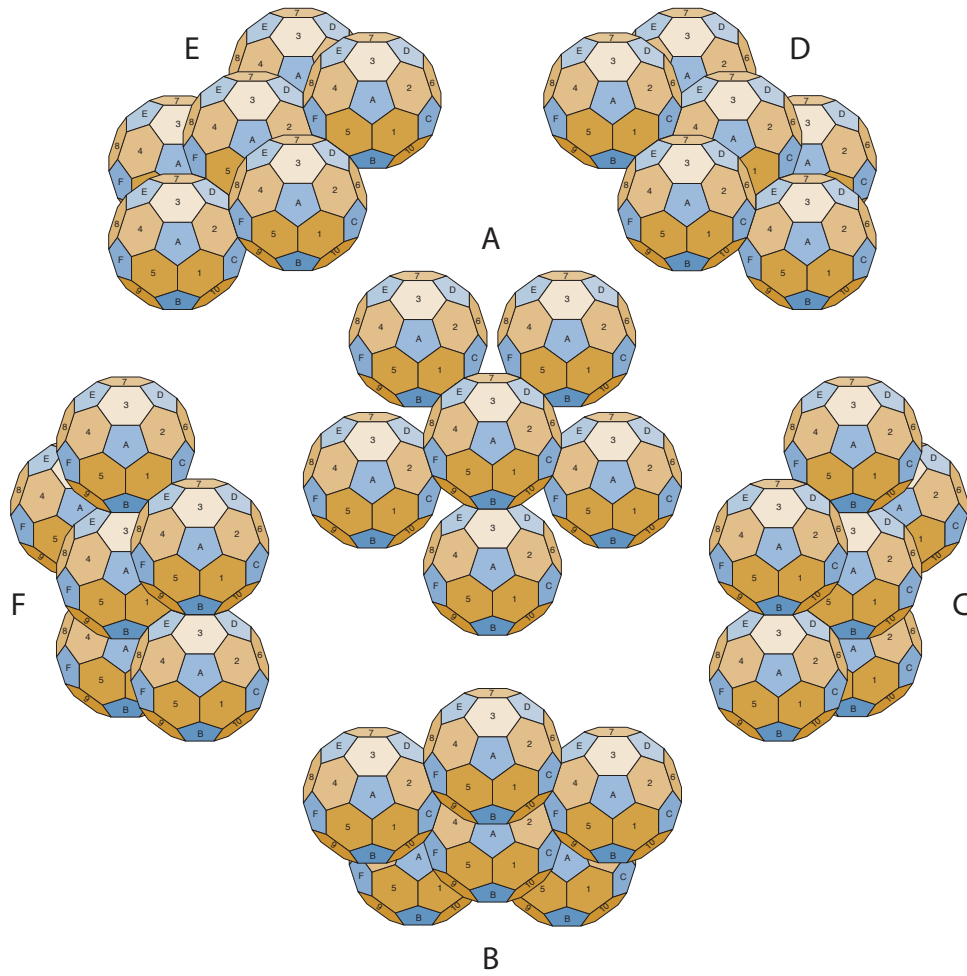
The figure shows the ten hexagonal facial joins that can be effected between a pair of icosidodecahedra. Each join is between diametrically opposite faces.



**Fig. 4 Hexacontahedral hubs–lower**

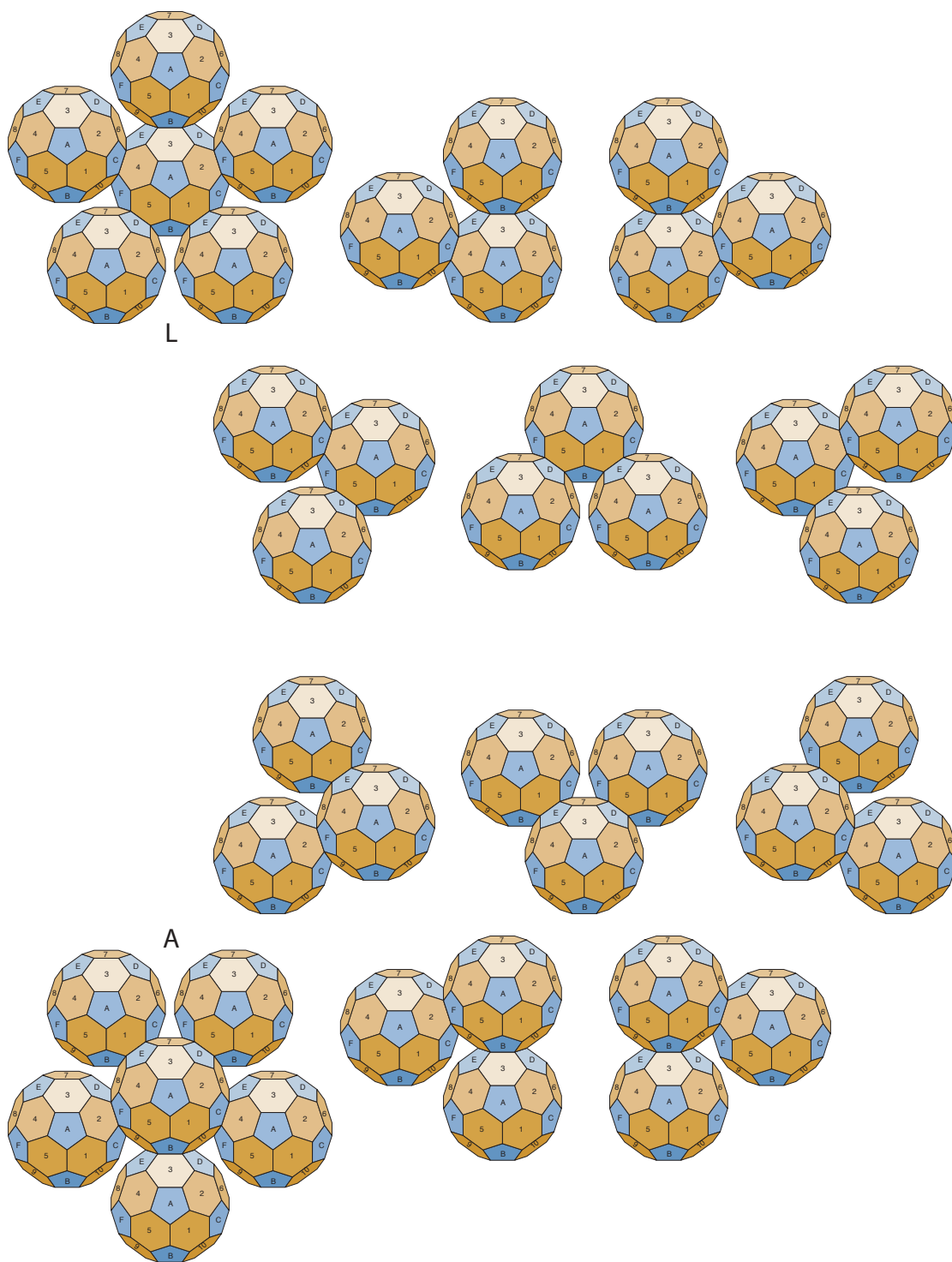
The sixty faces of the hexacontahedron can be viewed as twelve groups of five faces each. Each group of five faces is symmetrically arrayed about a vertexial diameter of a regular icosahedron.

The figure shows six assemblies of six icosidodecahedra each. The central icosidodecahedron and two adjacent icosidodecahedra define a face of the hexacontahedron. Each assembly defines five faces of the hexacontahedron. Each assembly is oriented so that it is symmetrical to one of the vertexial diameters of an icosahedron. Each assembly of the figure is showing its concave inner side.



**Fig. 5 Hexacontahedral hubs–upper**

The figure shows the remaining six assemblies which define the faces of the hexacontahedron. Here, each assembly is showing its convex outer side.

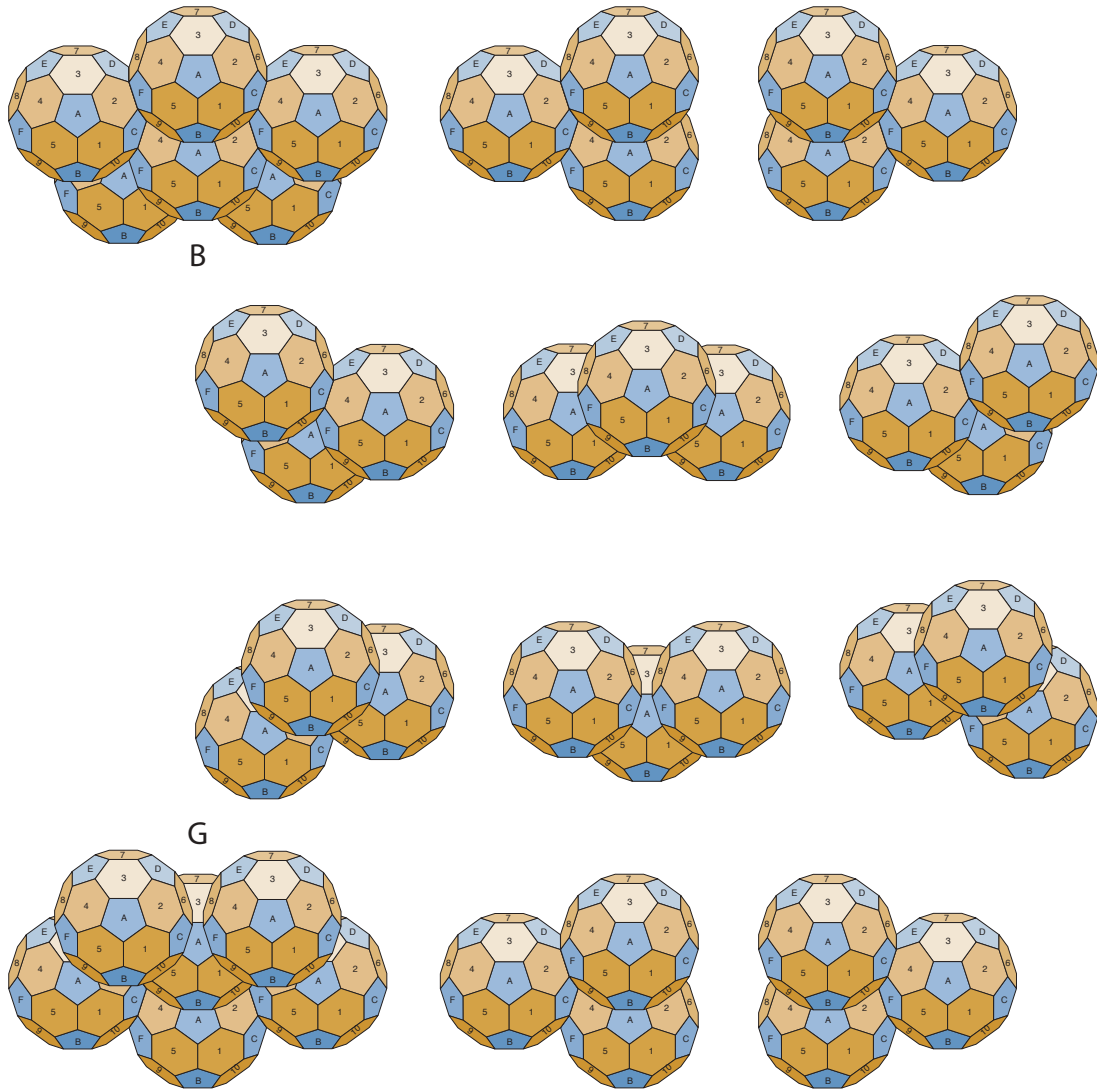


**Fig. 6 Hexacontahedral faces–hubs A and L**

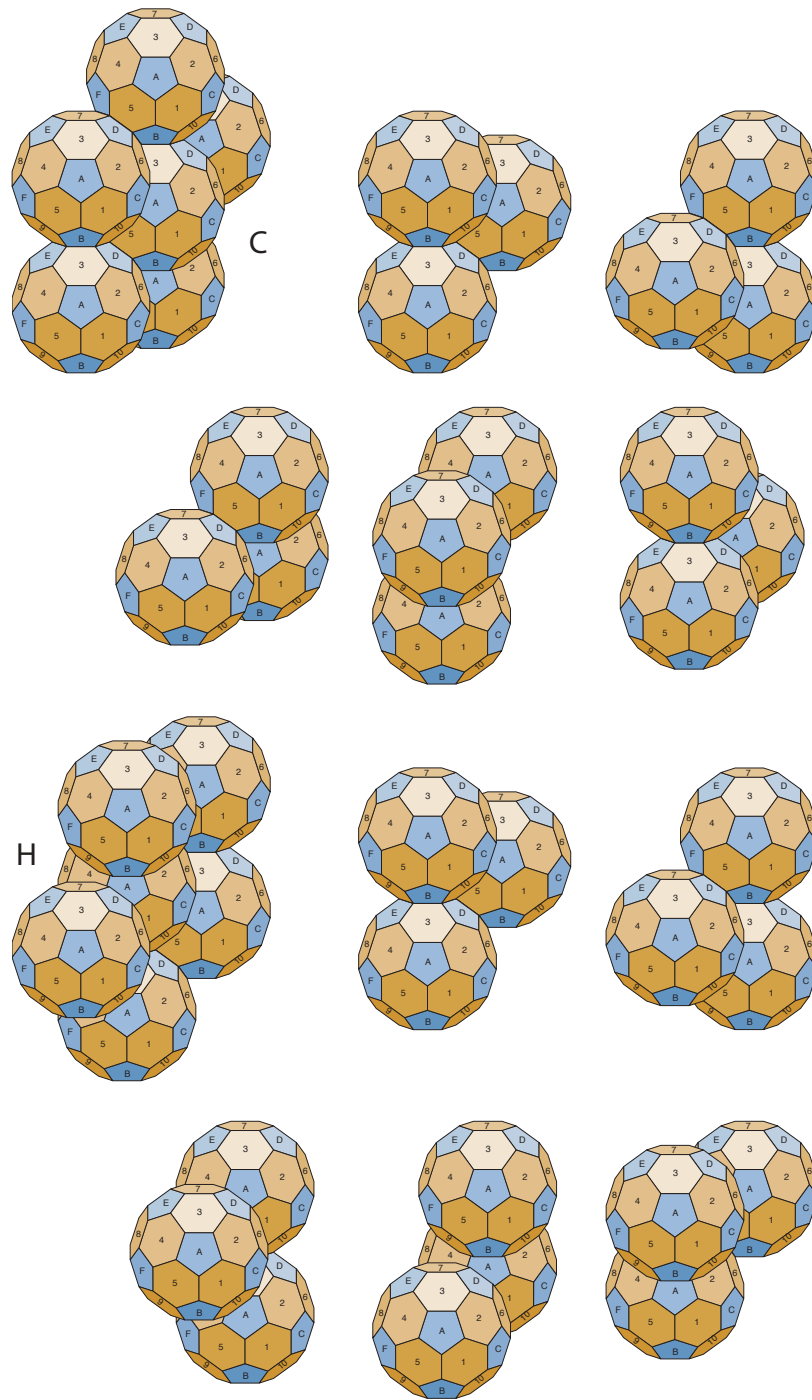
At top, the L hub is shown with each of its five faces defined by an assembly of three icosidodecahedra.

At bottom, the A hub is shown with each of its five faces defined separately.

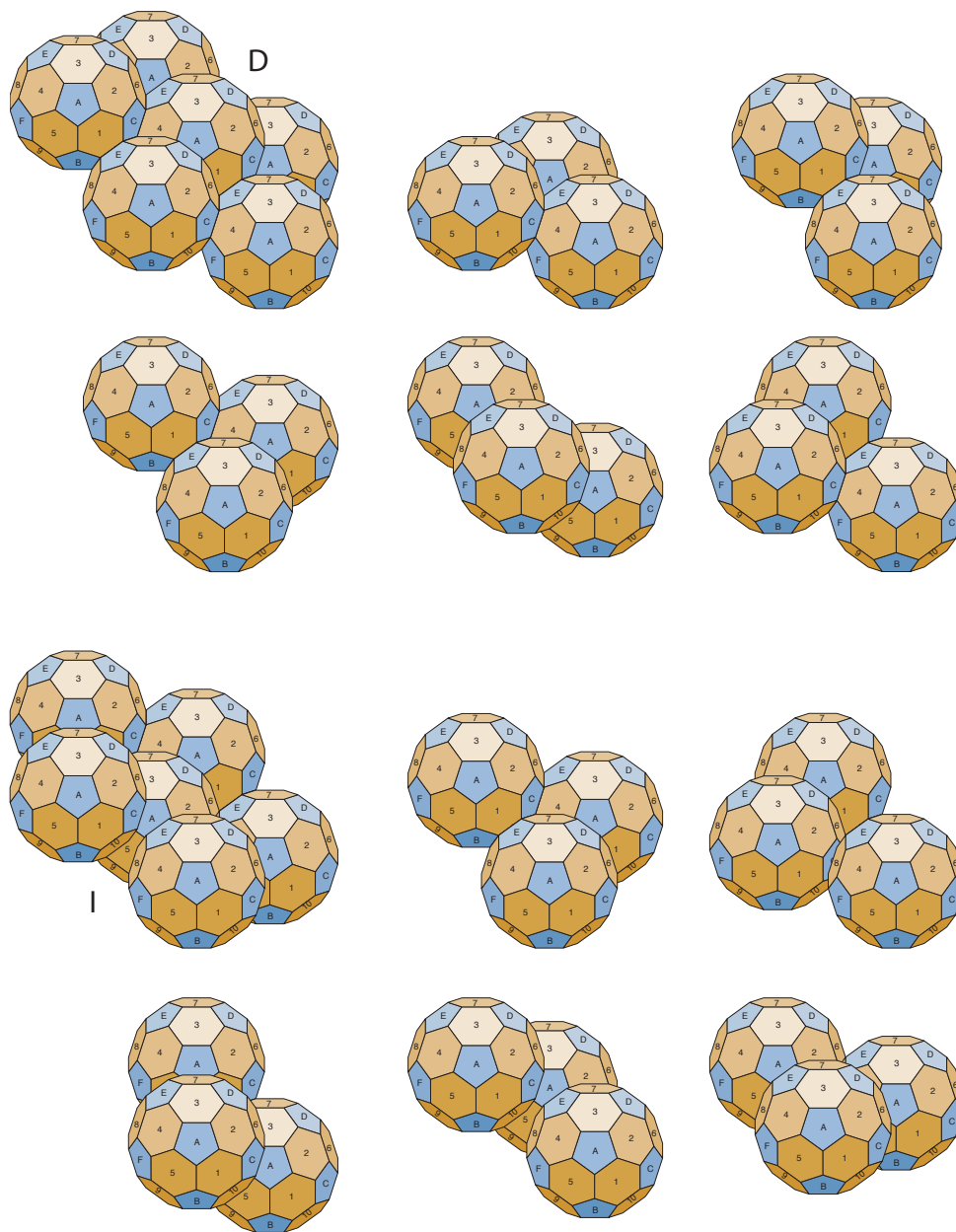
The two hubs are diametrically opposite.



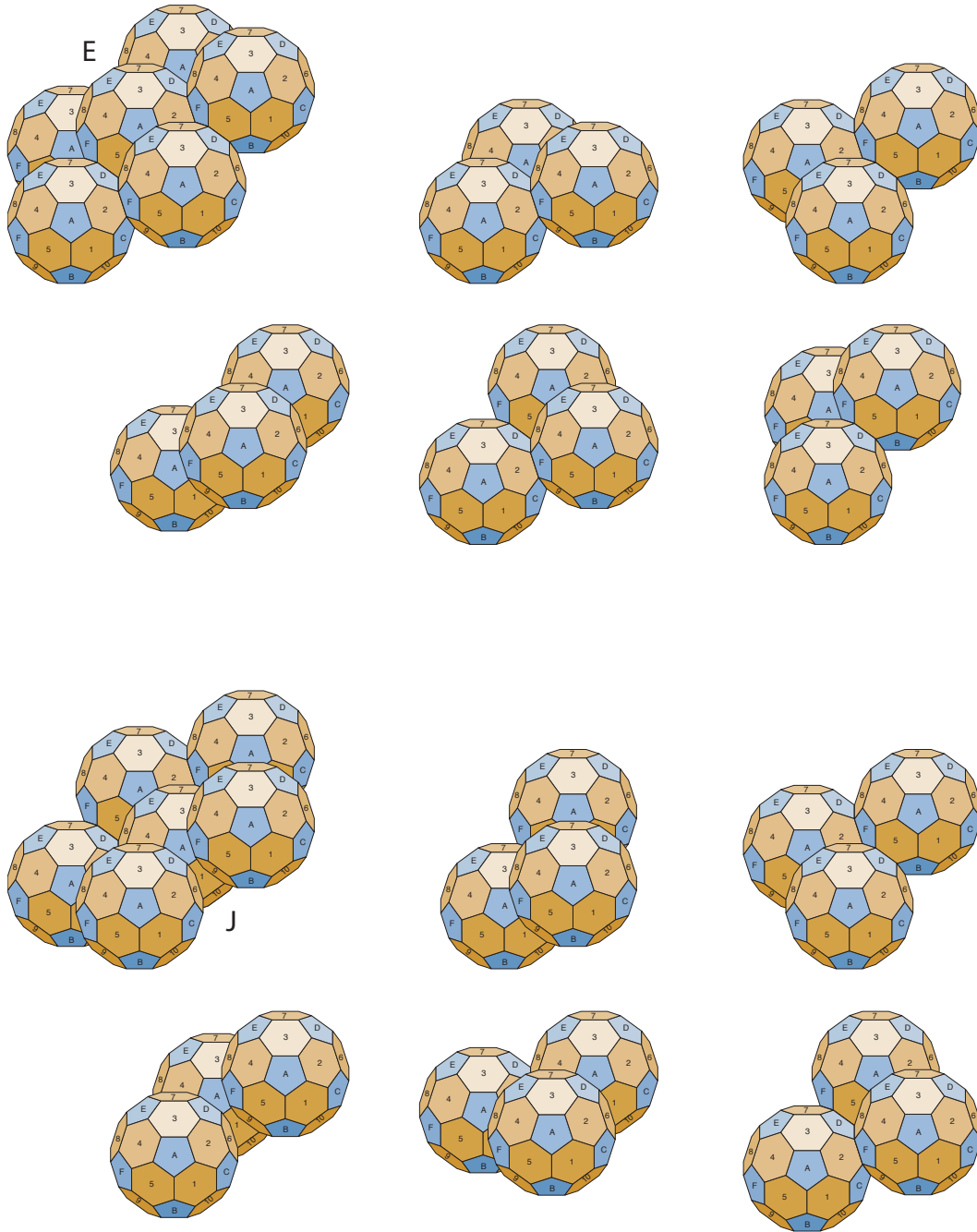
**Fig. 7 Hexacontahedral faces–hubs B and G**  
 The figure shows the two hubs B and G each with its five faces defined by an assembly of three icosidodecahedra.



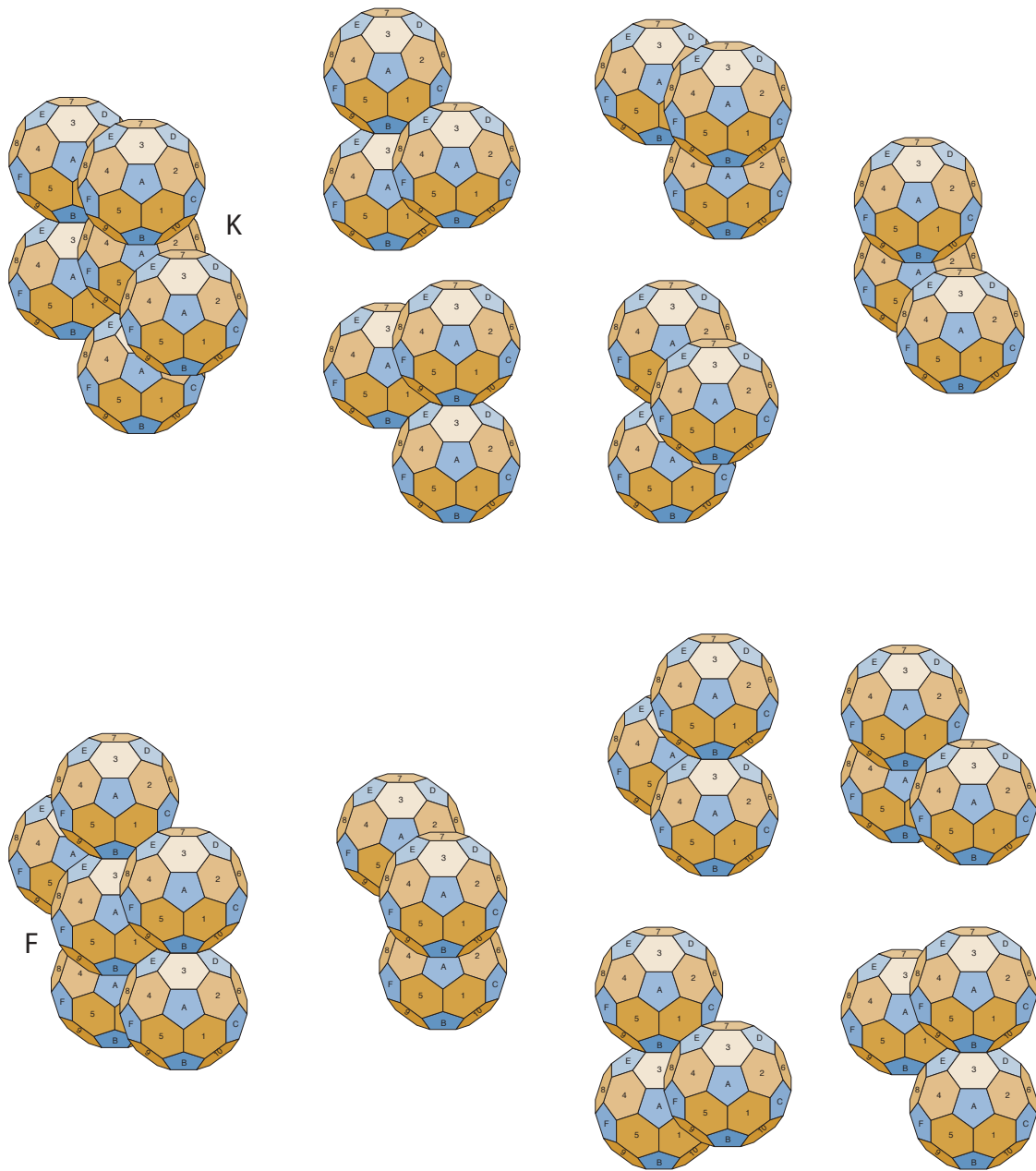
**Fig. 8 Hexacontahedral faces–hubs C and H**  
 The figure shows the hubs C and H each with its five faces defined by an assembly of three icosidodecahedra.



**Fig. 9 Hexacontahedral faces–hubs D and I**  
 The figure shows the two hubs D and I each with its five faces defined by an assembly of three icosidodecahedra.

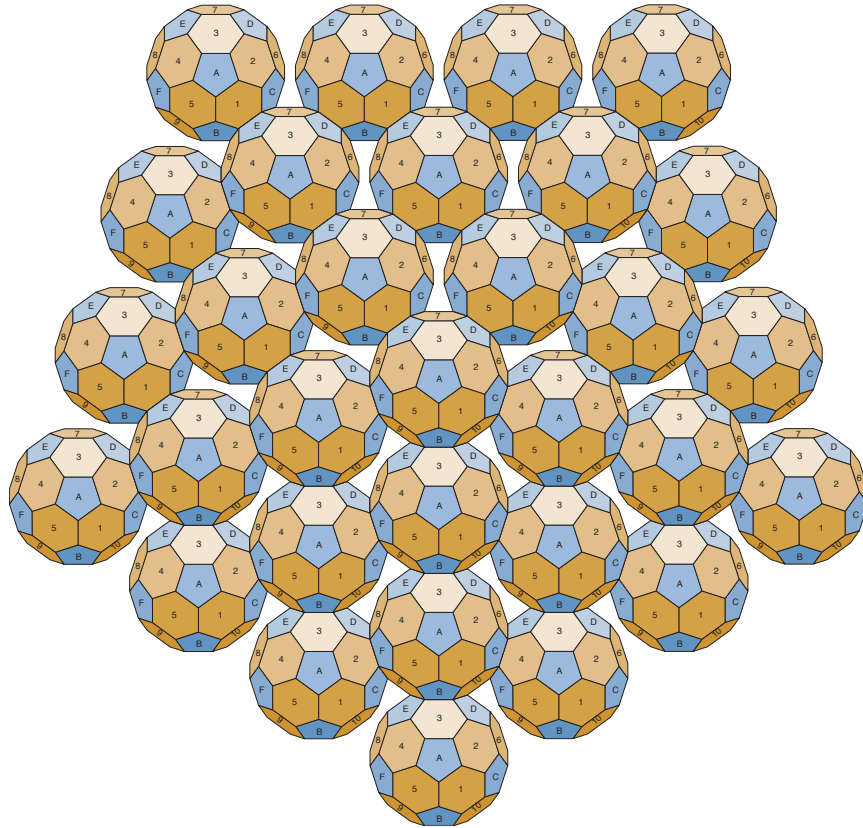


**Fig. 10 Hexacontahedral faces–hubs E and J**  
 The figure shows the two hubs E and J each with its five faces defined by an assembly of three icosidodecahedra.



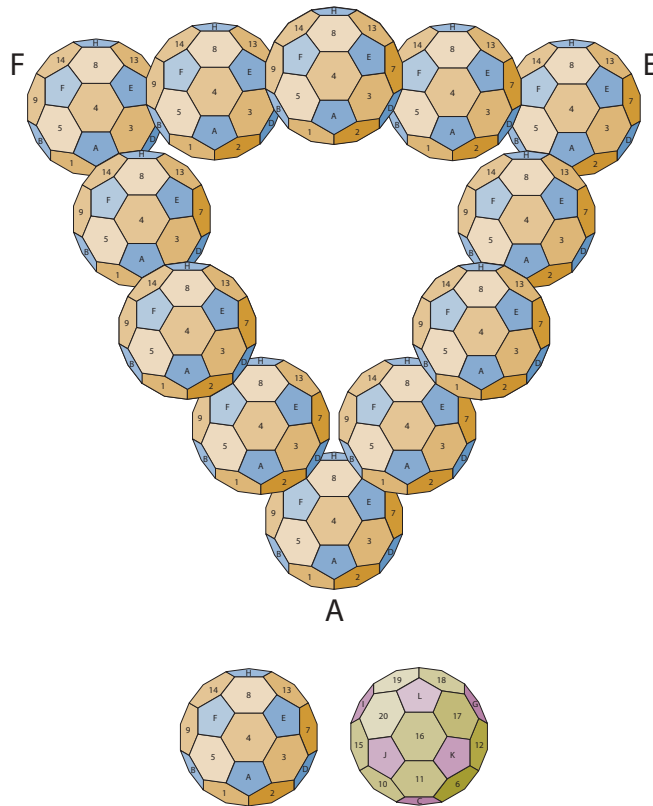
**Fig. 11 Hexacontahedral faces–hubs F and K**

The figure shows the two hubs F and K each with its five faces defined by an assembly of three icosidodecahedra.



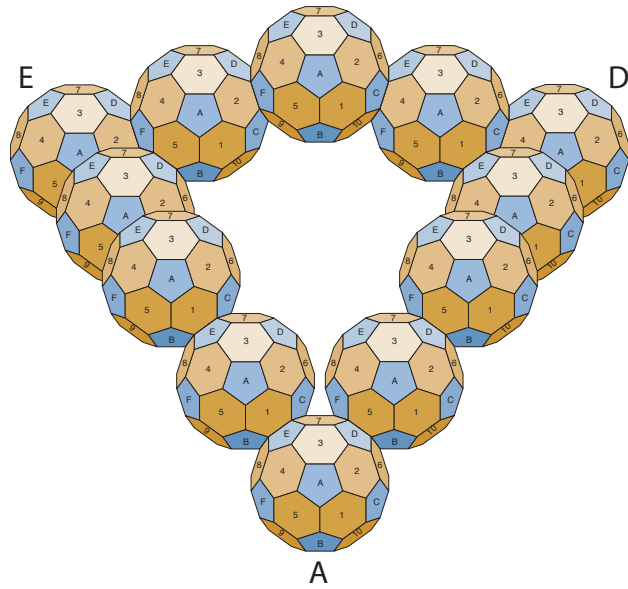
**Fig. 12 Hexacontahedron 5-vertex**

Each of the five edges is defined by a single join. Each of the five faces is defined by the joins which define two of its edges.



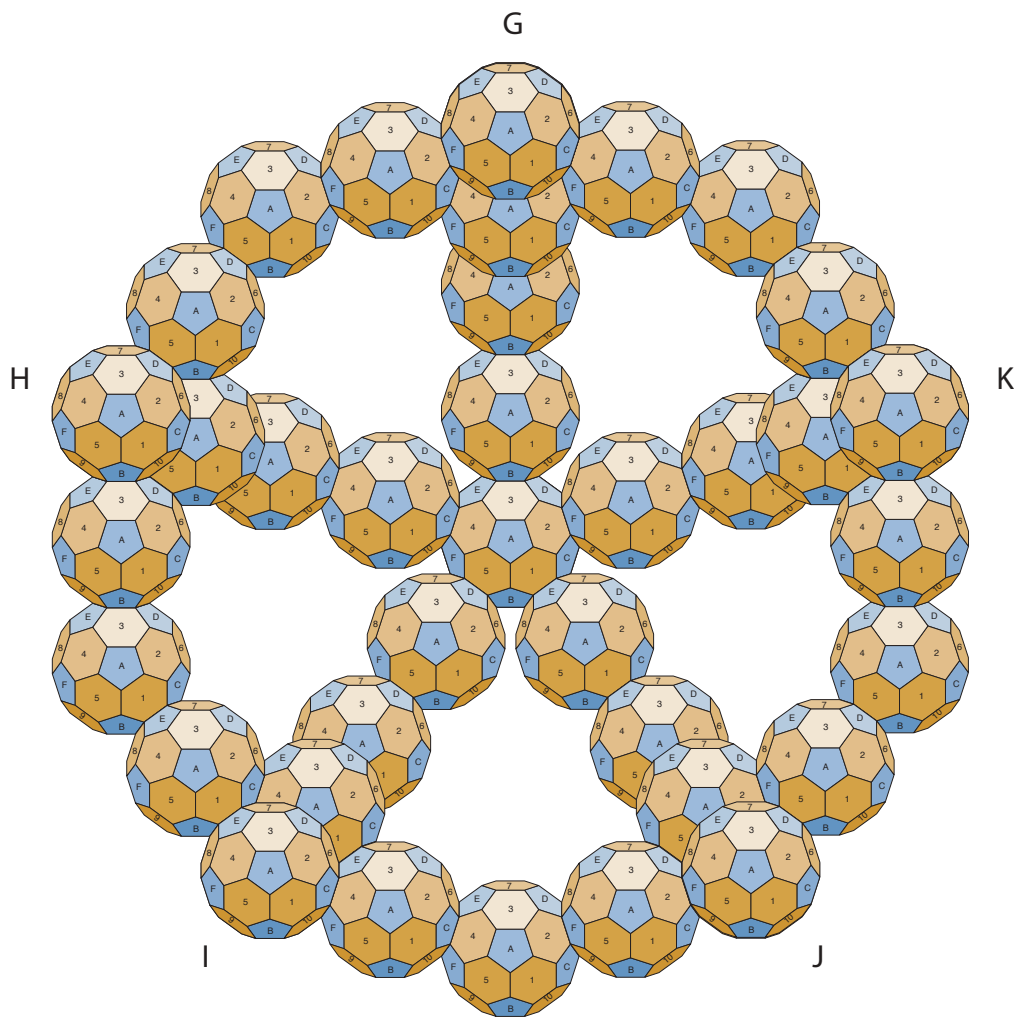
**Fig. 13 Hub to hub linkages-AFE**

Each hub is connected to five other hubs to form the hexacontahedral assembly. The connections between three hubs is shown in the figure. The viewing direction is perpendicular to hexagonal face number 4. There are twenty of these threefold views, one for each of the hexagonal faces.



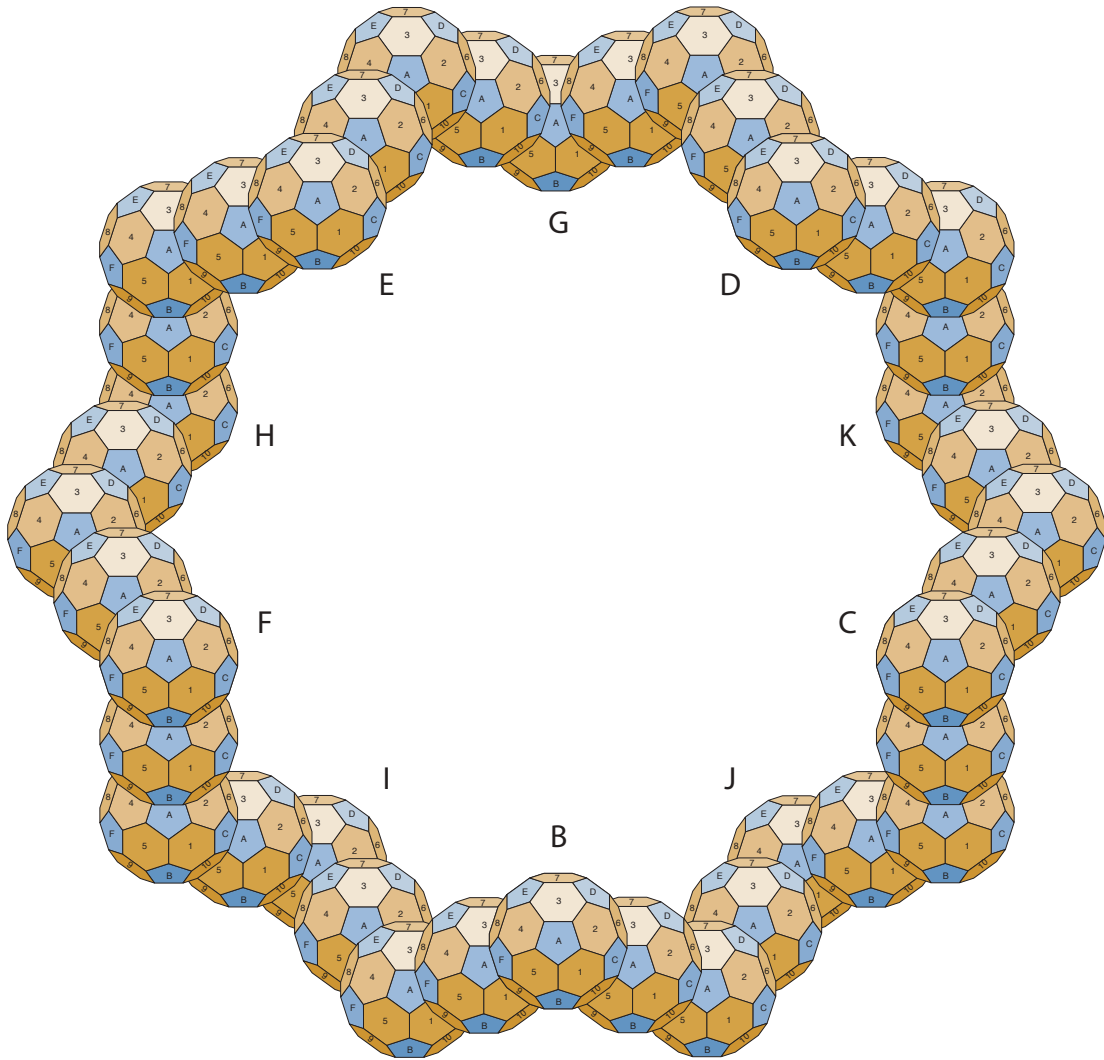
**Fig. 14 Hub to hub linkages–AED**

The figure shows the linkages between the hub units at the pentagonal vertexes A, E, and D in a view which is parallel to the pentagonal facial diameter AL.



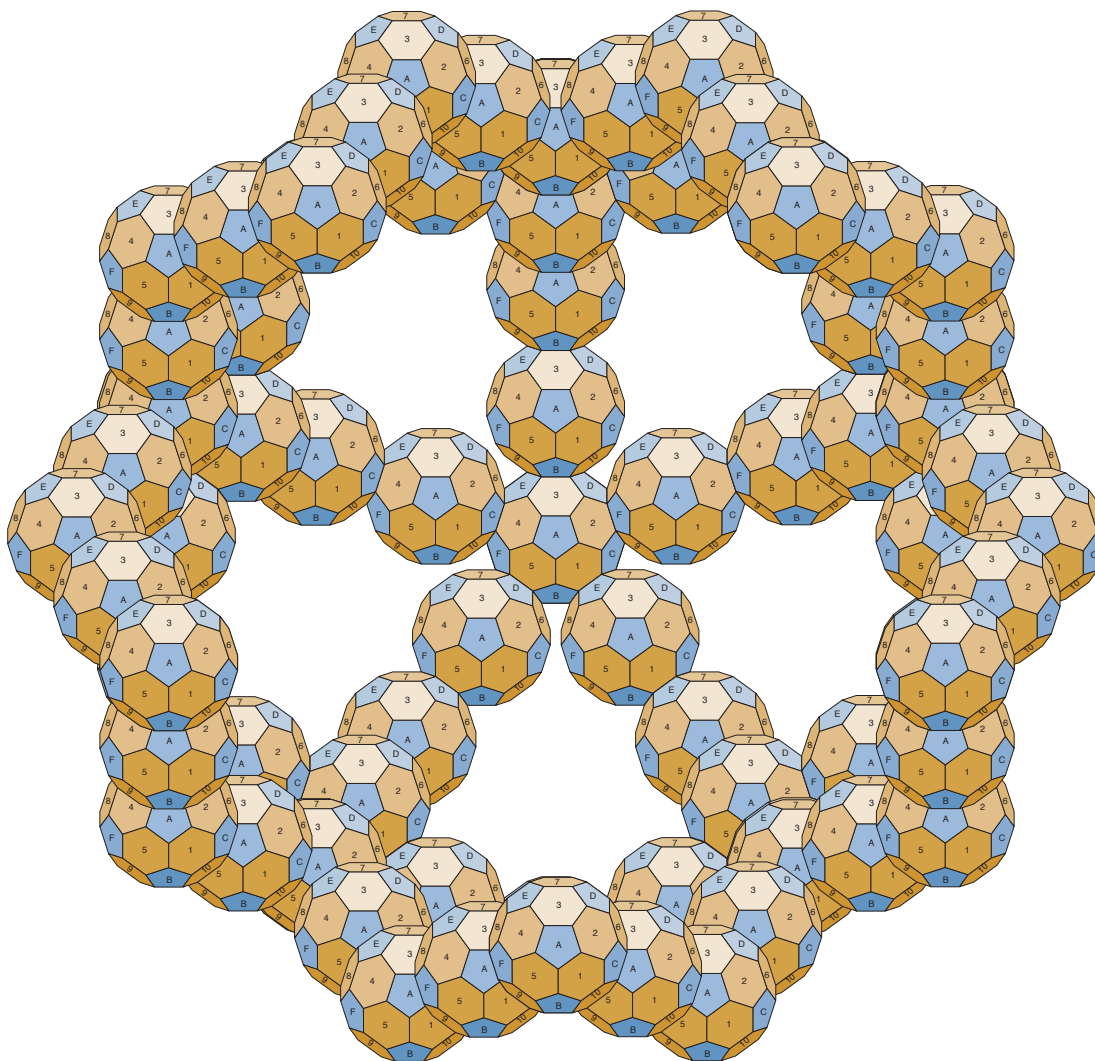
**Fig. 15 Hub to hub linkages—lower**

The figure shows how each of the hubs G, H, I, J, and K is linked to the hub L. It shows, also, the linkages between G and H, H and I, I and J, J and K, and K and G.



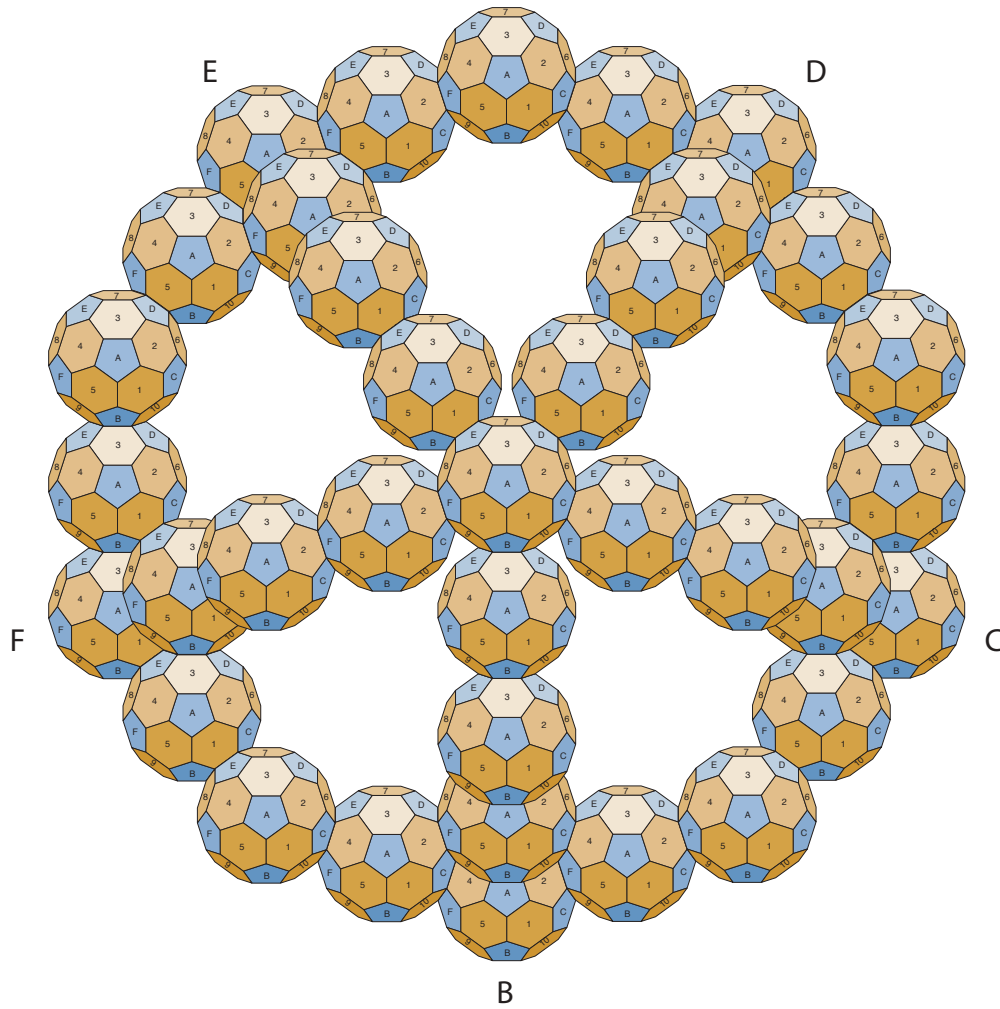
**Fig. 16 Hub to hub linkages–intermediate**

The figure shows how the links between the intermediate hubs form a ring. Hub B is joined to hub J, J to C, C to K, K to D, D to G, G to E, E to H, H to F, F to I, and I to B.



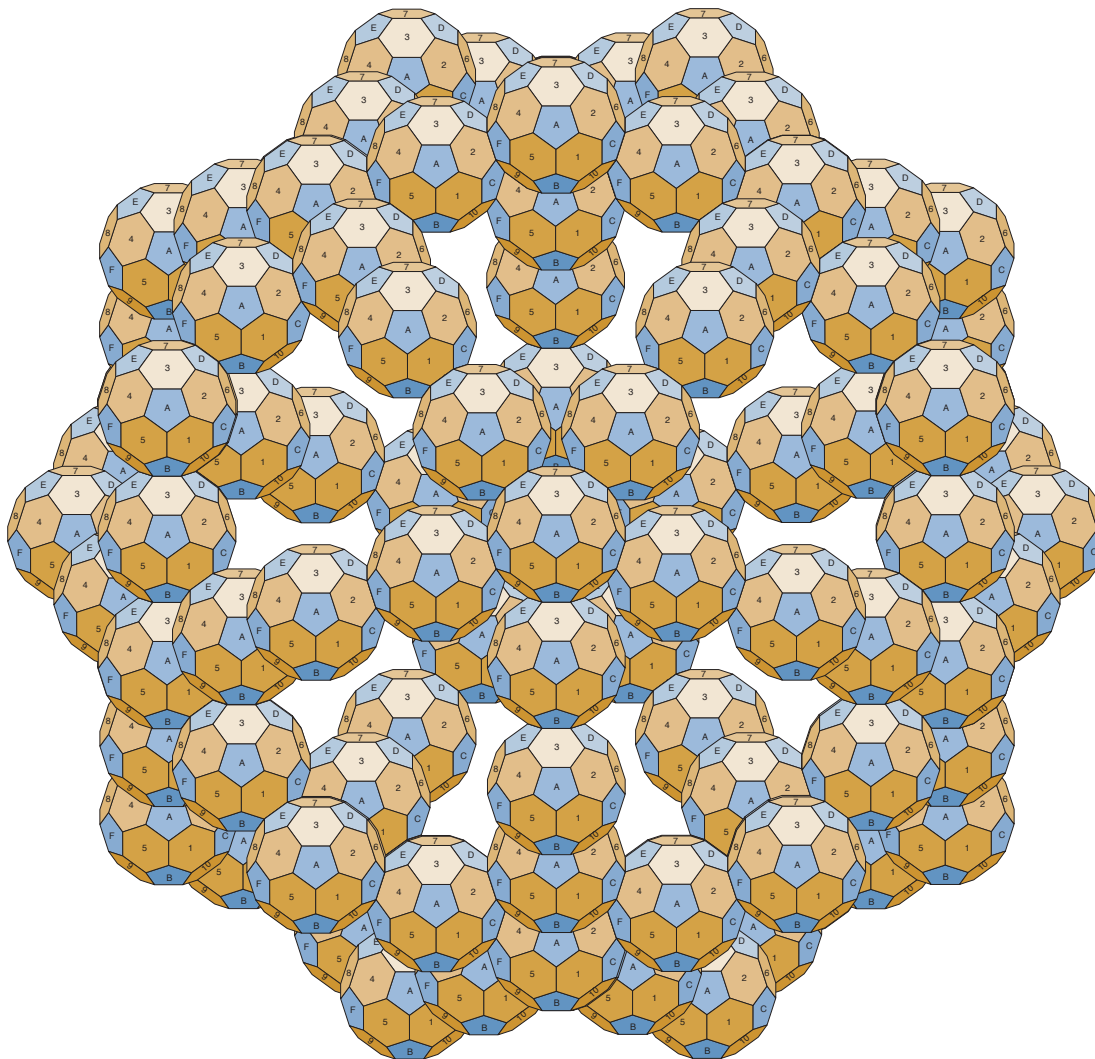
**Fig. 17 Lower hubs merged with intermediate hubs**

The figure shows an assembly in which the linked lower hubs are joined with the linked intermediate hubs. Hubs G, H, I, J, and K which are common to both the lower and intermediate hub assemblies have been merged.



**Fig. 18 Hub to hub linkages–upper**

The figure shows how the hubs B, C, D, E, and F are linked to hub A. Also shown are the links between hub B and hub C, C and D, D and E, E and F, and F and B.



**Fig. 19 Hexacontahedral assembly of hexagonal face icosidodecahedra**

The figure shows the complete hexacontahedral assembly in which each pentagonal hub unit is linked to five other hub units by an angled assembly of three units. The assembly of linked upper hubs has been merged with the previously merged lower and intermediate assemblies. Hubs B, C, D, E, and F which are common to both the intermediate and upper assemblies have been merged.