

# Planes formed of 32-strands

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

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

## References

Octahedron1stEd.pdf

32chain.pdf

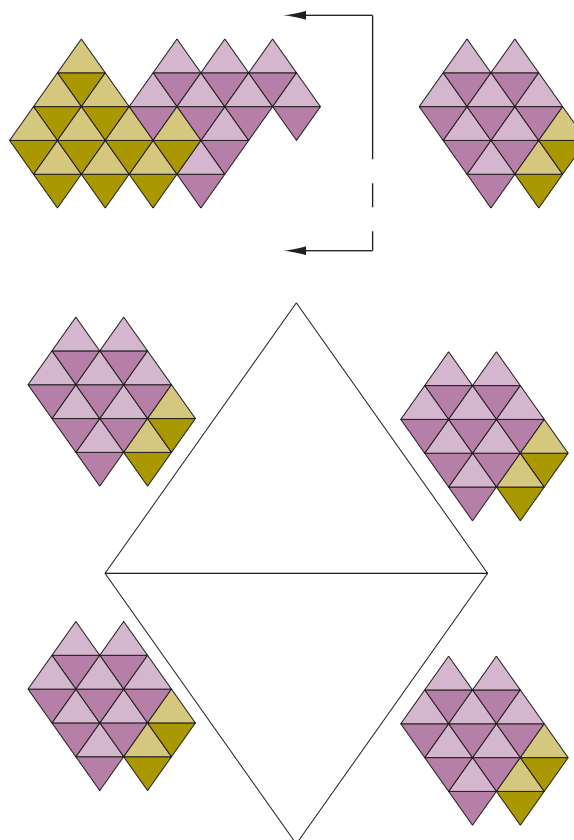
rhopsn.pdf

RhmbidecPeptide.pdf

## Introduction

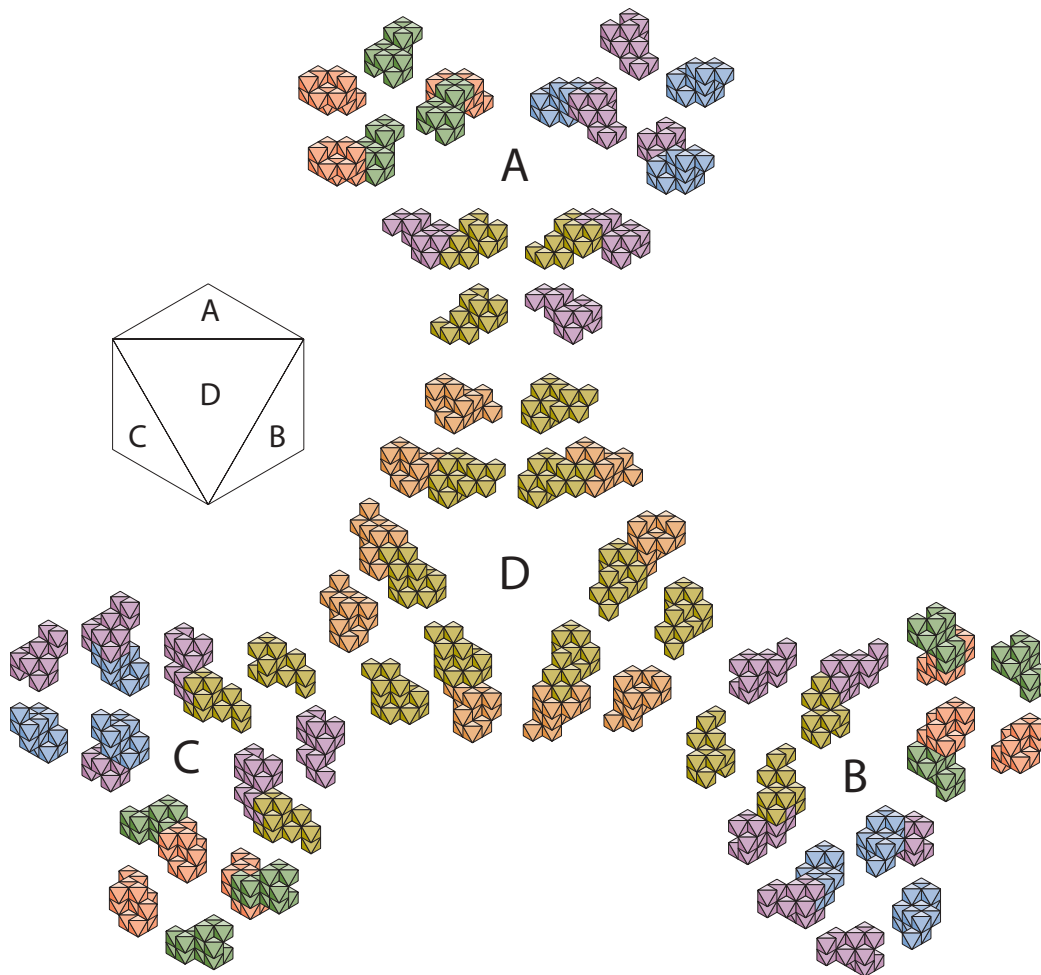
The 32-chain join produces a twofold helix which is parallel to an edge of the regular octahedron. The 32-strands can be linked with alpha helical turns to produce a planar assembly which is parallel to an octahedral face (See rhodoposi.pdf). The relationship of the 32-strands to the octahedral faces is examined herein.

Two 32-strands can be linked by a single residue. The pair of joined strands can be joined with an identical pair to produce a 32-sheet. The sheet is parallel to the face of a cube. This sheet is examined in detail herein.



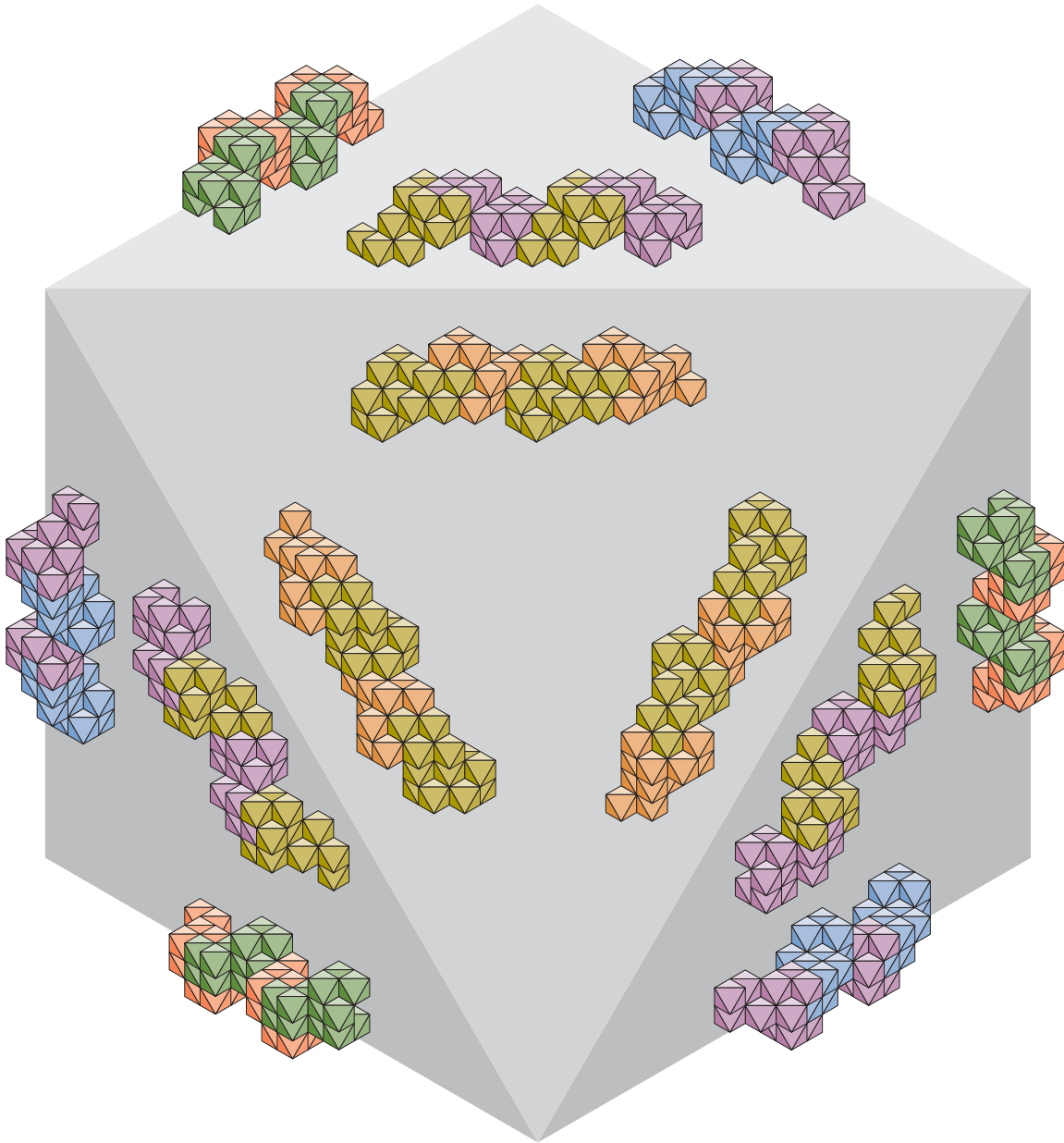
## Planes defined by a 32-chain

A pair of 32-strand residues is shown at the top left of the figure. The view is normal to the 32-strand axis. To the right is an axial view of the same pair. At the bottom of the figure, four axially viewed pairs are shown in relation to the four octahedral planes to which their strands belong. The strands represented by the pairs have axes which are parallel to one another and to the pair of edges joining the faces to which they belong.



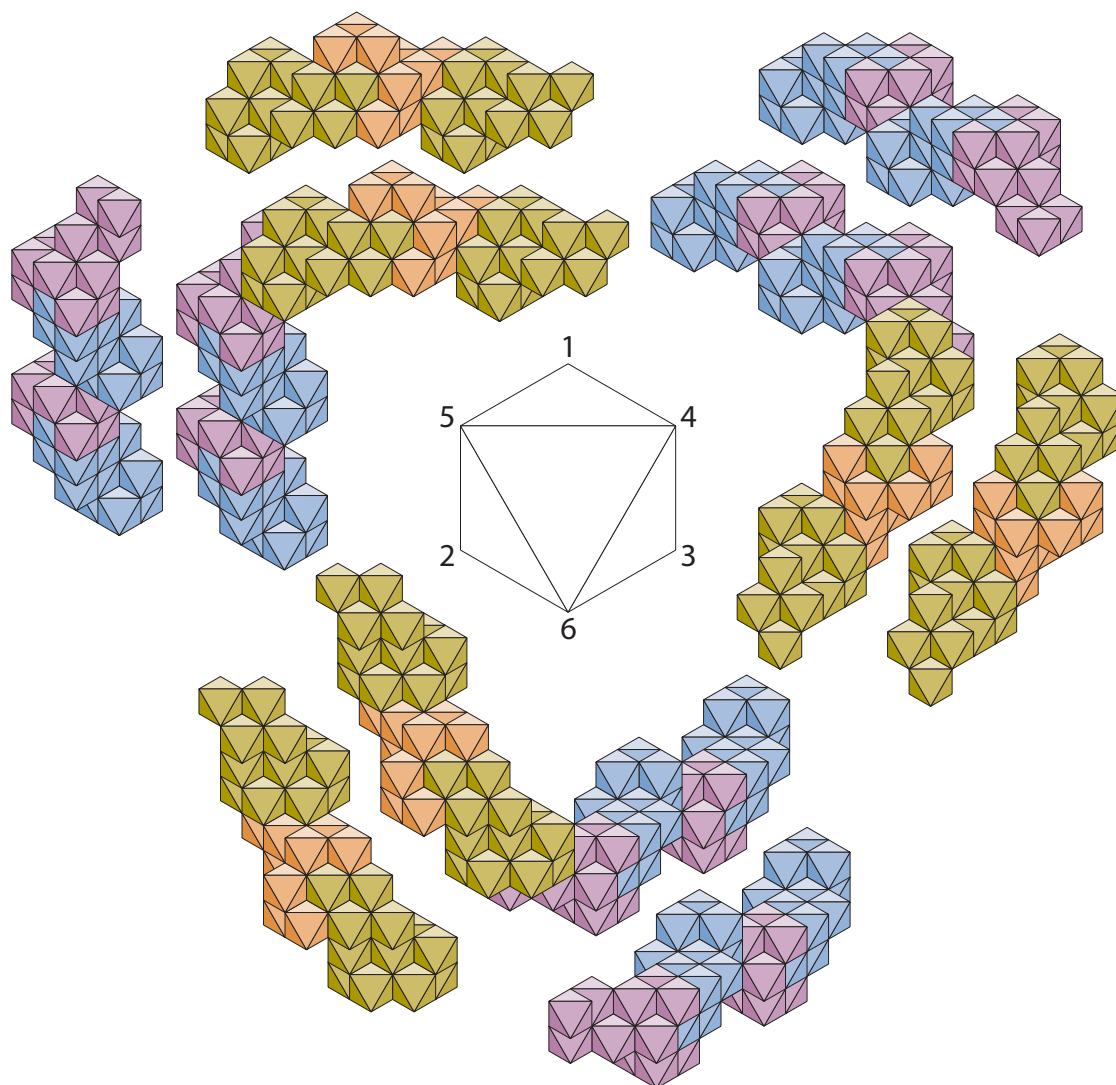
**Planar relationships of 32-strands**

The main chain units for 32-strands are grouped according to the faces which they define. The color of a unit is related to its orientation. The main chain units which form the 32-strands are shown separately. The two 32-strand joinings which they can make are adjacent to them. The axis of each strand defined by the pair is parallel to an edge of the octahedron.



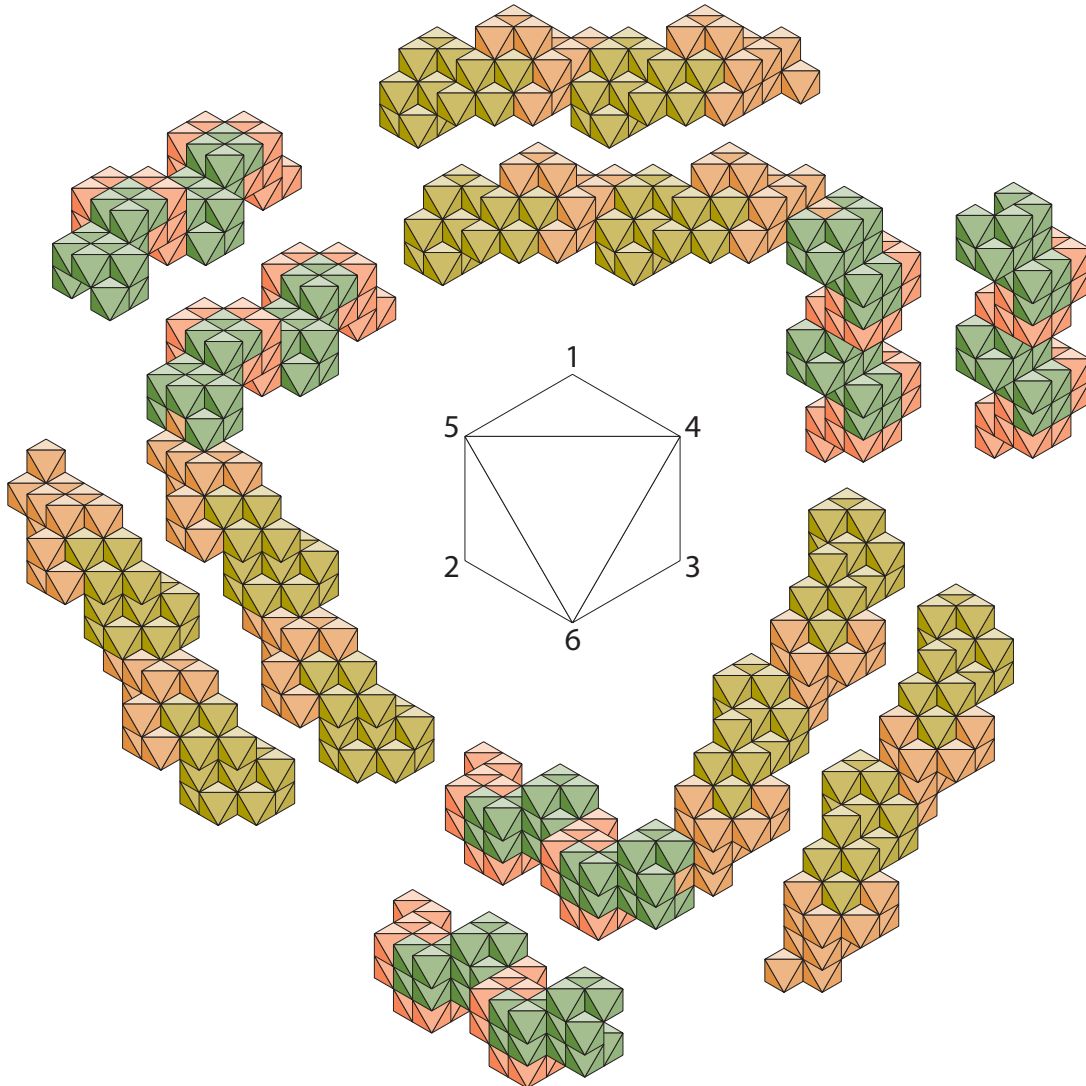
### **32-strands on octahedral faces**

The figure shows twelve identical 32-strands of five main chain units each. The strands are in four groups of three with each group mounted on the face of a regular octahedron. The He-octas of the atoms of the strands are in the same orientation as the octahedron on which the strands are mounted. Within each strand, the units have just two orientations. Thus, all twenty-four of the orientations of the main chain units are depicted. Each strand which is parallel to an edge of the octahedron is parallel to faces which meet at that edge. The 32-chain is suited to make planes which are parallel to the faces of the octahedron. The 32-strand linked alpha helixes of the rhodopsin file are octahedrally planar.



**Joining 32-strands parallel to different octahedral edges–Plate I**

Each of the 32-strands of face 456 is joined to a strand of face 451 or 463 or 562 by a beta180-join.

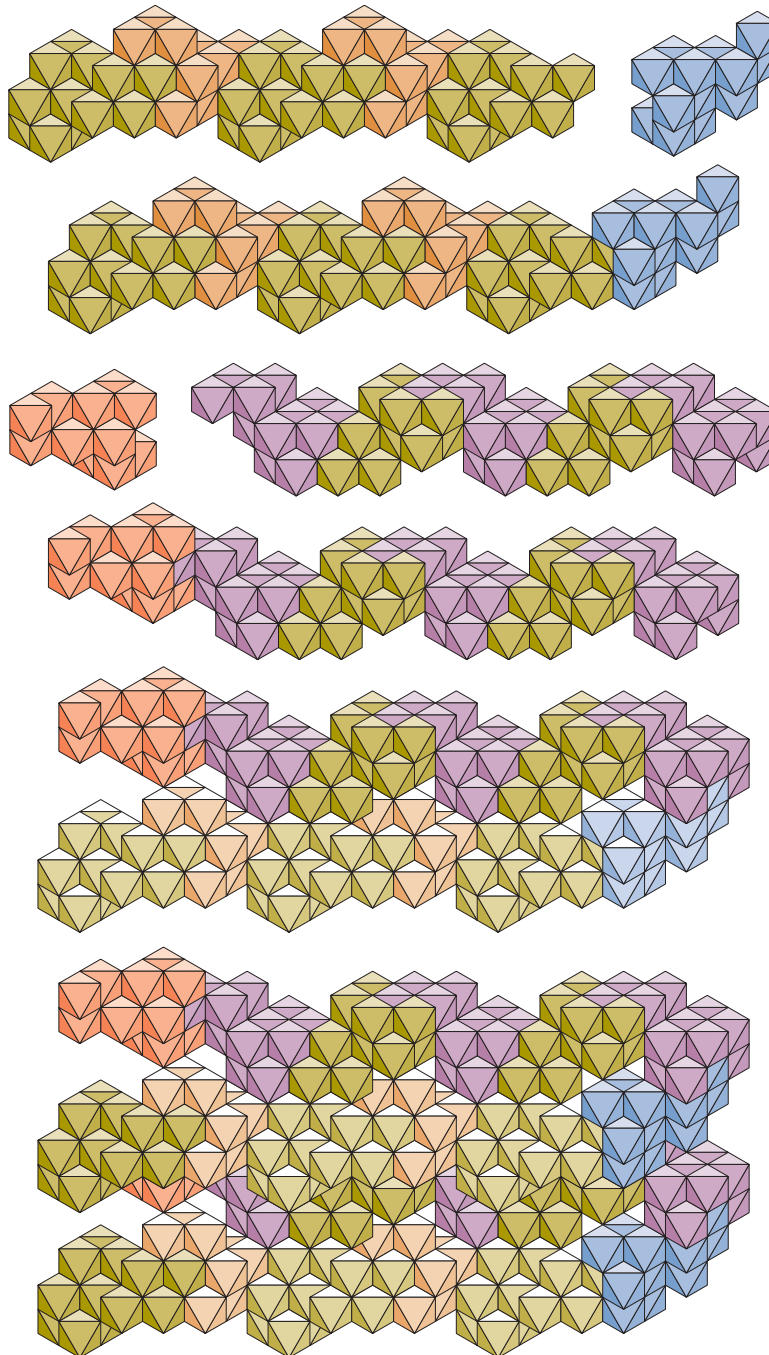


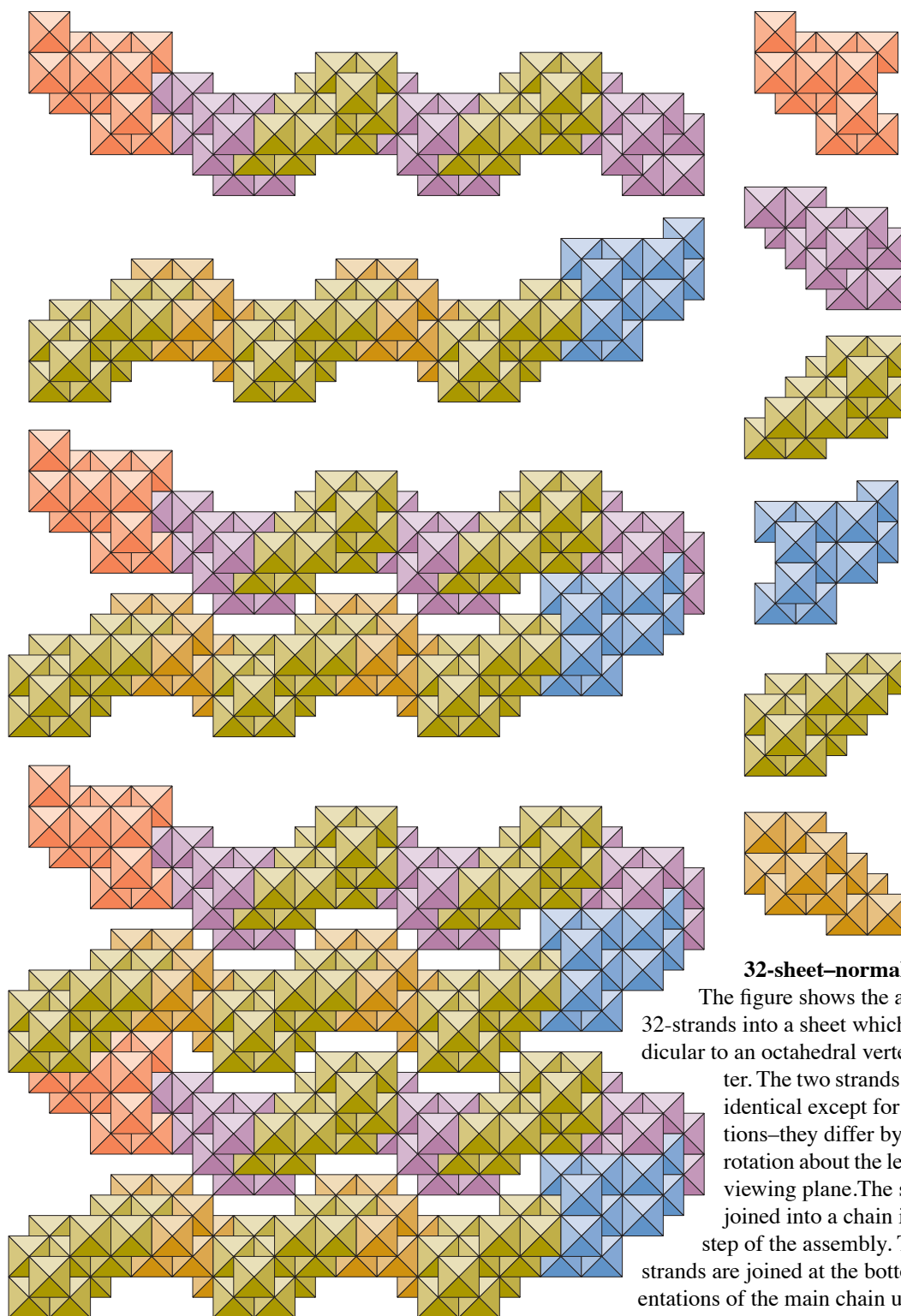
**Joining 32-strands parallel to different octahedral edges-plate II**

The joins between the 32-strands is  $\beta 180$ . Each strand of each pair is parallel to a different octahedral face.

### 32-strands linked by lone residue produce a 32-sheet

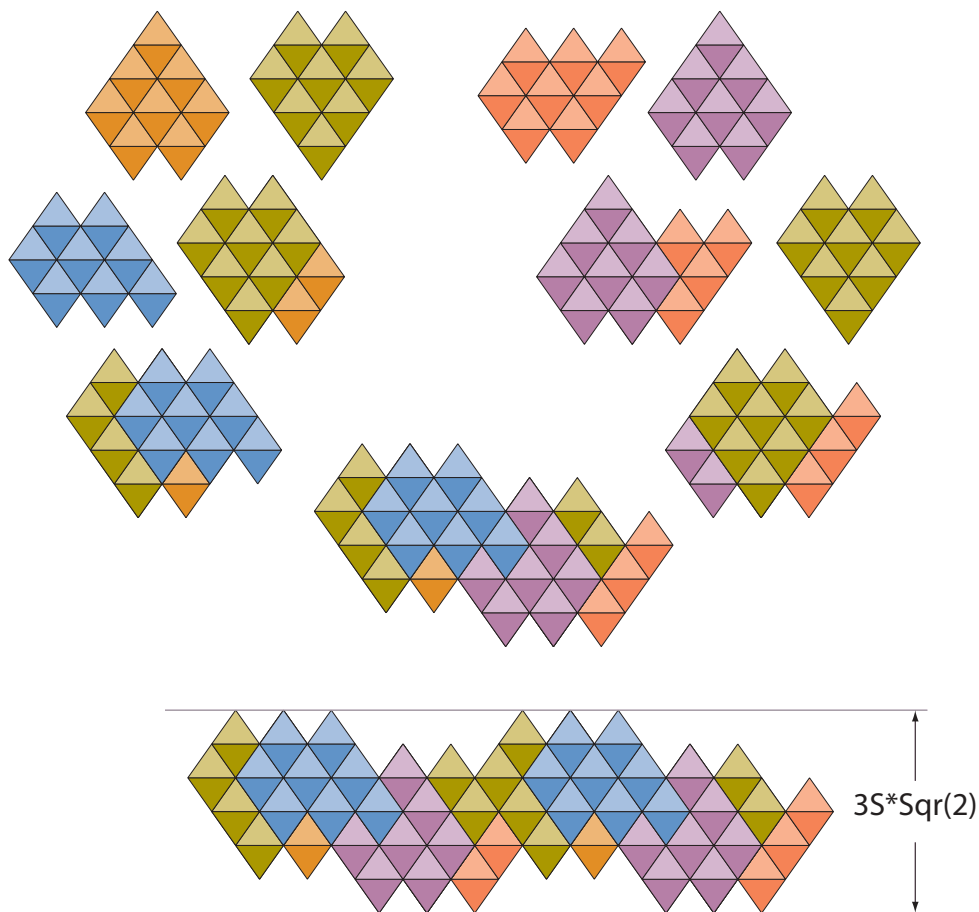
The progression from strand to sheet begins at the top of figure. First, two anti-parallel strands are joined to linking units. The strands with linking units join as a looped pair. Two looped pairs then join as a sheet. Looking at the assembly in detail, the yellow-orange strand makes a beta90-join with the blue unit. The red unit makes the same join with the violet-yellow strand. To make the pair, the violet-yellow strand makes an alpha helical join with the blue unit of the yellow-orange strand. Then, the yellow unit of one pair makes an alpha helical join with the red unit of a second pair to form a sheet.





### 32-sheet-normal view

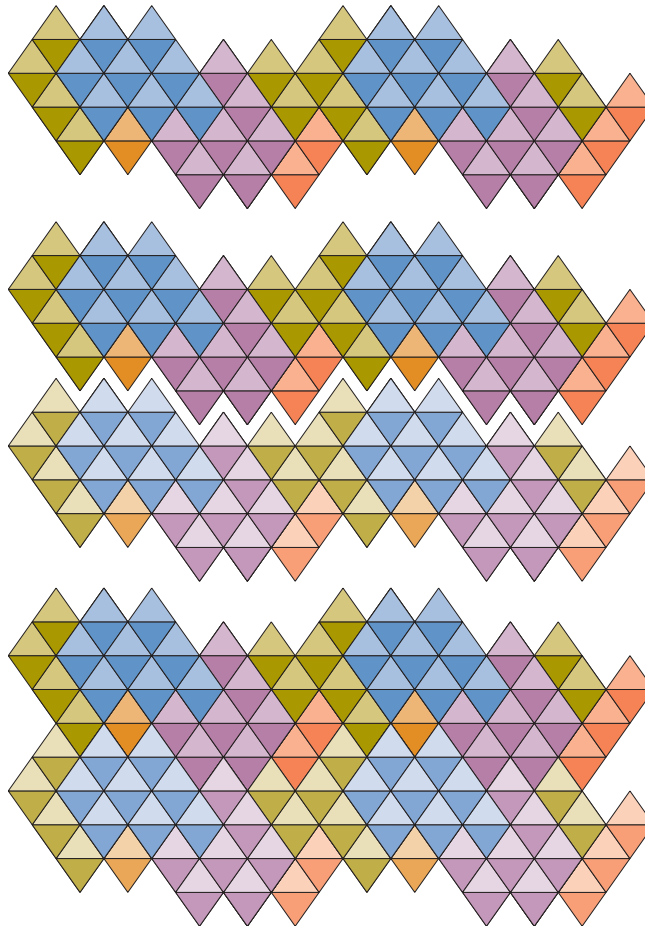
The figure shows the assembly of 32-strands into a sheet which is perpendicular to an octahedral vertexial diameter. The two strands at the top are identical except for their orientations—they differ by a  $1/2$ -turn rotation about the left edge of the viewing plane. The strands are joined into a chain in the second step of the assembly. Two paired strands are joined at the bottom. The orientations of the main chain units used in the assembly are shown on the right. The violet and yellow and the orange and second yellow are 32-strand units. The red and blue are linking units.



**Formation of a sheet of 32-strands viewed parallel to the axes of the strands.**

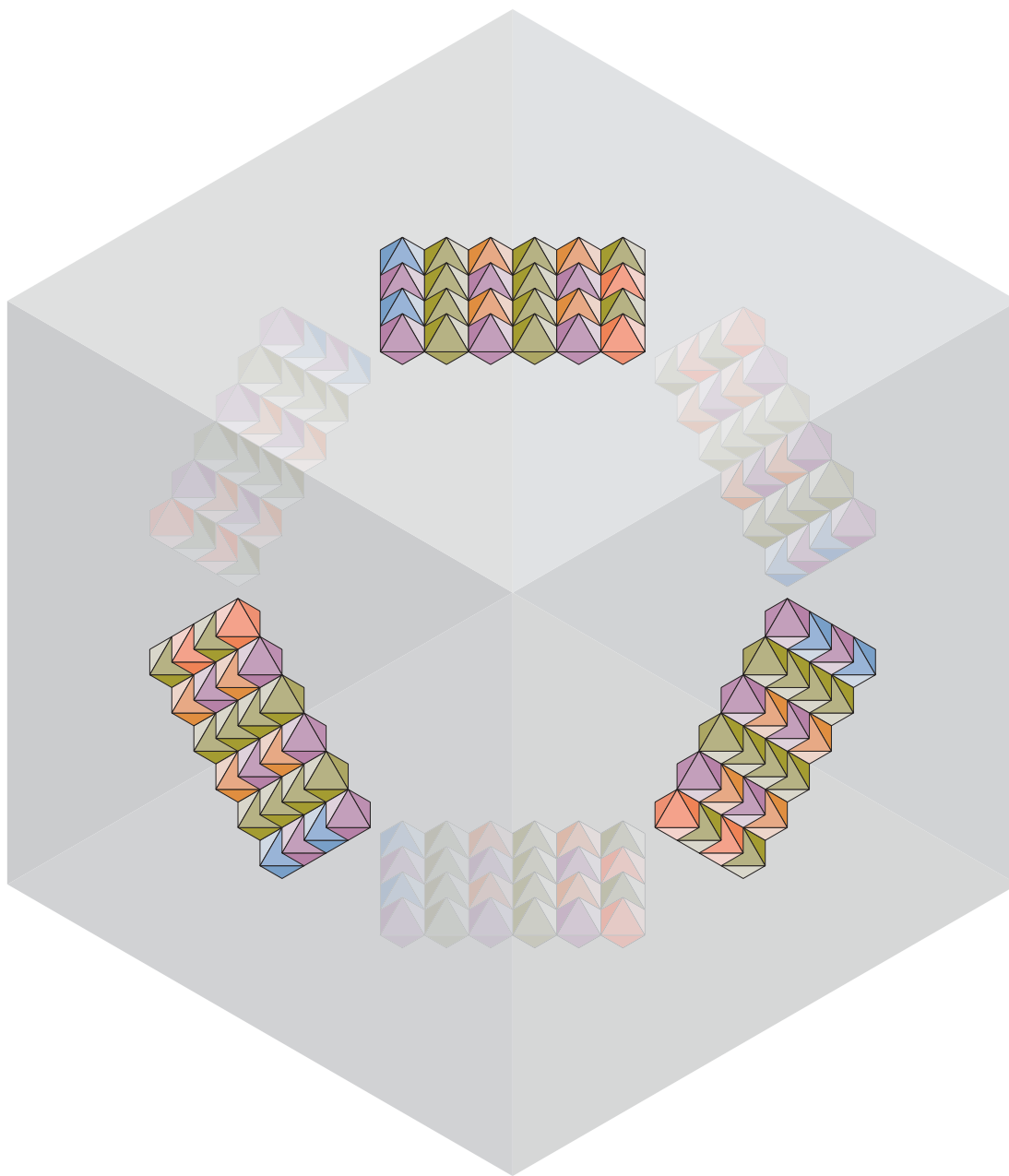
The sheet is composed of identical pairs consisting of two strands each. The figure shows the steps in the arrangement of the strands, the joining of the strands into a pair, and the joining of the pairs into a sheet. The orange-yellow strand is formed in the upper left of the figure. The violet-yellow strand is formed in the upper right. The main chain units which form each strand are in the top row. They are joined as pairs in the second row. The strand-linking units are also shown in this row. The strands with links are shown in the third row. The strands are joined as a pair in the fourth row. At the bottom, two pairs have been joined to form a sheet. The sheet thickness is three vertexial diameters of a He-octa.





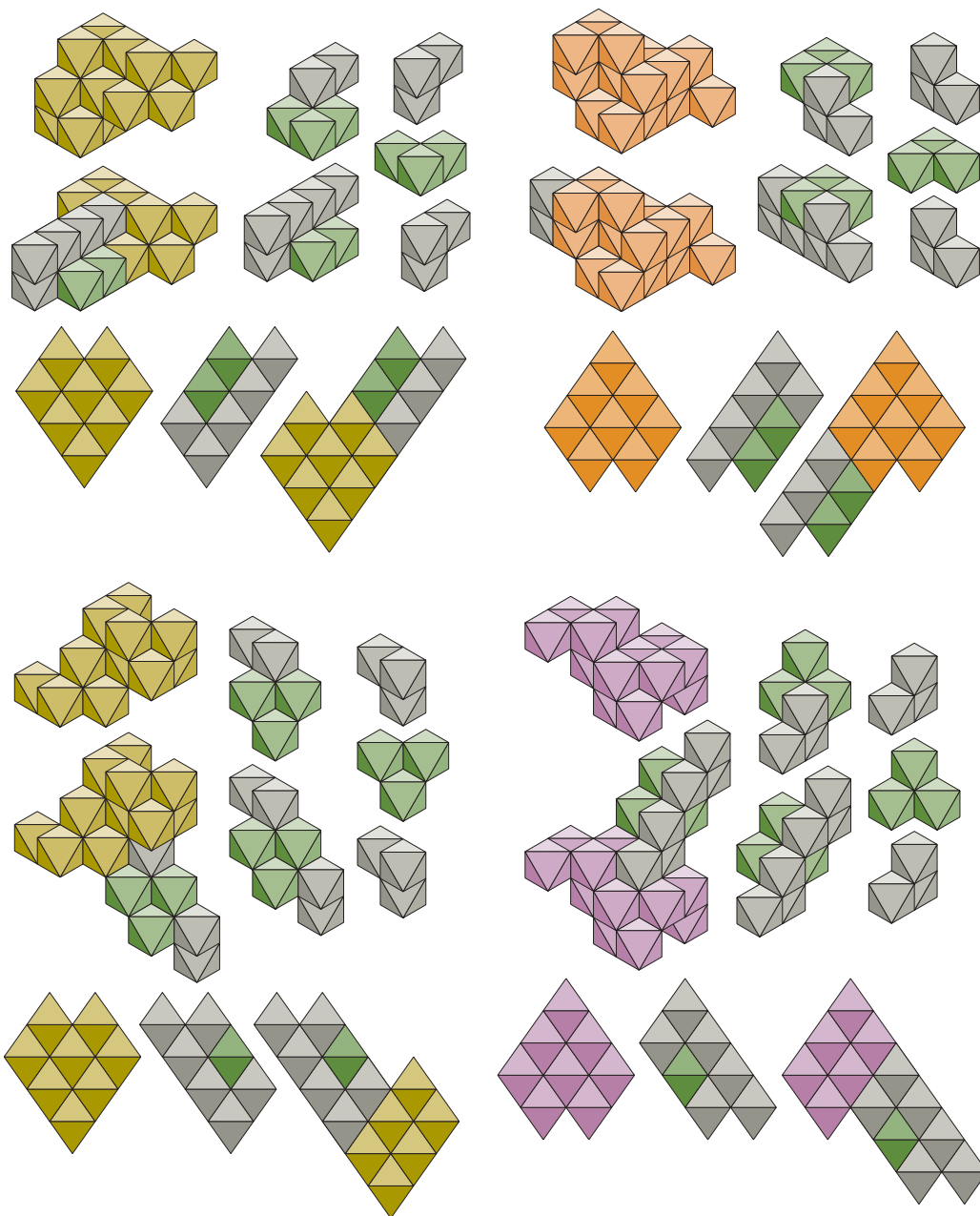
### 32-sheet stack

It is apparent from the previous figure that the profile of the upper surface of the 32-sheet viewed parallel to the axes of its strands fits exactly the profile of the lower surface. The view is reproduced at the top of this figure. Two copies of the view are shown in close proximity to emphasize the fit between them. At the bottom of the figure the two copies are joined.



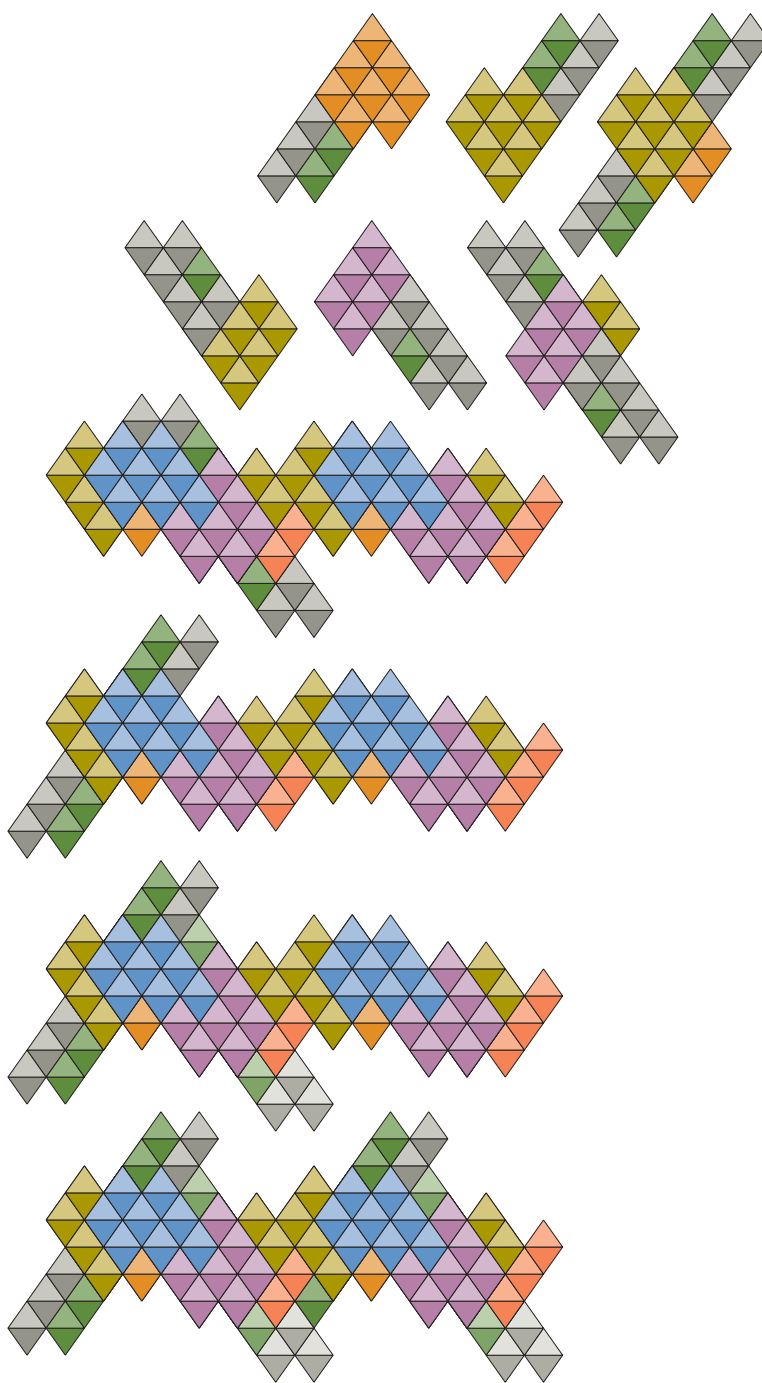
**Verticial planes on faces of cube**

The figure shows a 4x6 verticial plane of regular octahedra on each face of a cube. Each group of octahedra represents a sheet of four 32-strands linked in a chain.



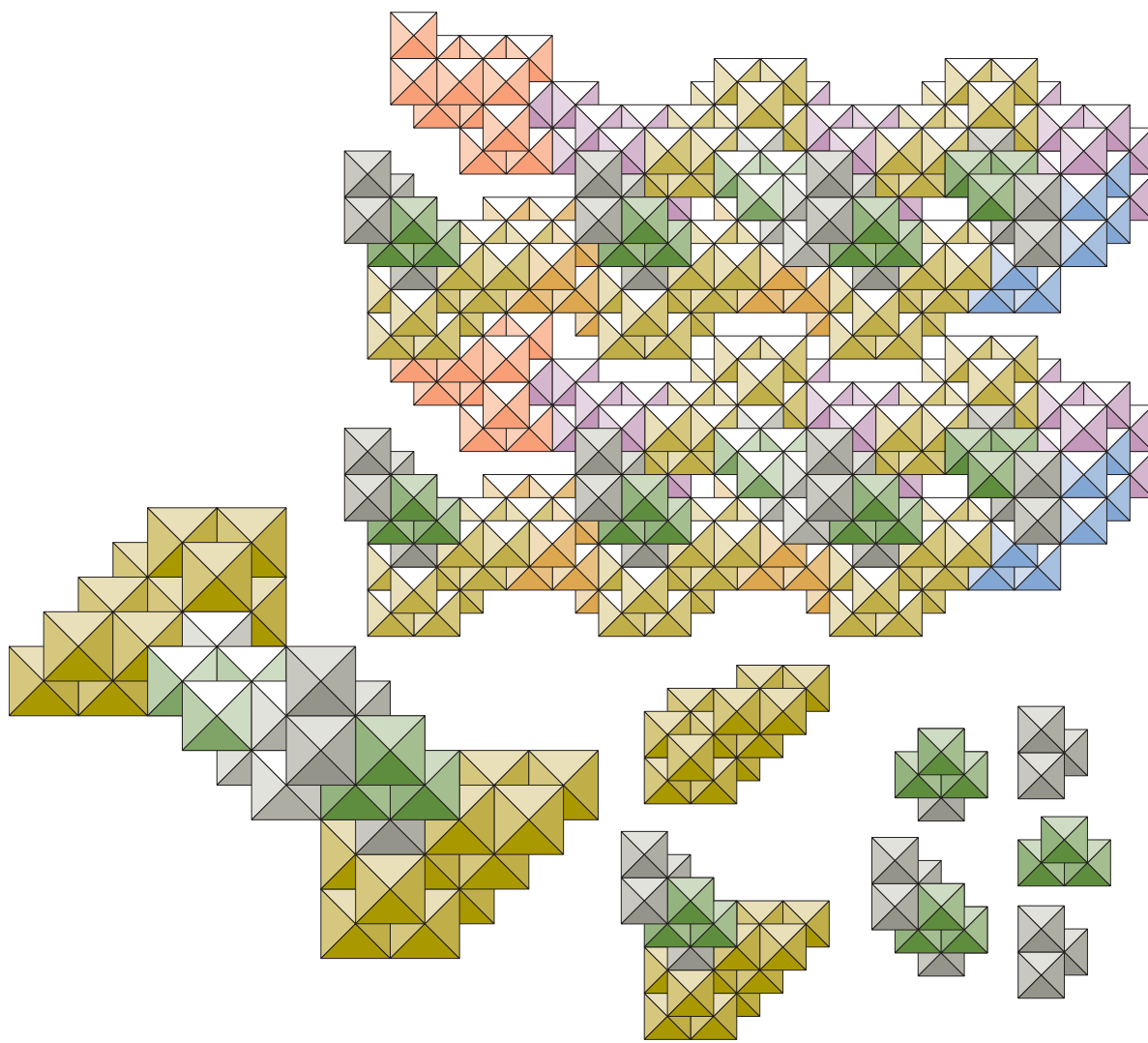
### 32-sheet units with side chains

The four units of the 32-sheet are provided here with side chains consisting of three C-atoms. The assembly of each side chain is shown. The strand unit with side chain is shown in two views—facial and edgial. The edgial view is parallel to the strand axis.



### 32-sheet side chains—axial view

On the left of the top two rows of the figure, each orientation of the 32-strand units is shown with a three C-atom side chain. The units are joined in their respective strands at the right of the rows. In the third row, side chains have been added to the leftmost violet-yellow strand of a sheet. Below that, side chains have been added to the leftmost yellow-orange strand only. The next to last row shows a sheet in which side chains have been added to the two leftmost strands. At the bottom, side chains have been added to each of the four strands of the sheet.



### 32-sheet viewed normally with side chains

A 32-sheet is shown at the top of figure in a viewing direction which is normal to the plane of the sheet. Side chains which extend towards the viewer have been added. These are joined to each of the yellow units in the manner shown on the right. The side chain of a unit of each yellow-violet strand touches the side chain of a unit of each yellow-orange strand. The arrangement is shown in an enlarged view in the middle left of the figure. The side chain of the upper unit could not be extended because the end C-atom is contacting the end C-atom of the lower unit. The side chain of the lower unit could be extended.

