Class 24: Frieze Patterns

Definition: **Frieze Pattern**
Each **frieze pattern** (or strip pattern) is formed by repeating copies of one small bit of a pattern (called the fundamental region or *motif*) by translation, rotation and/or reflection. Some examples of strip patterns might be: a tire tread mark, a border on a room wall, artistic border on a Grecian urn, or a border around a sheet of paper.

Translations: Every frieze must have translational symmetry. (Why?)

Reflections: Horizontal reflections need to be through the midline of the strip. (Why?)

Vertical reflections must be done through an infinite number of vertical lines of reflection. (Why?)

Glide Reflections reflect the motif along the horizontal midline and combine that with a translation.

Rotations: Rotations around a point on the midline of the strip (although there may be many centers of possible rotation) at an angle of 180^o. (Why?)

GroupWork

Let's classify the symmetries of the frieze patterns on the last sheet and put our results in our table below. Put a Y if the given frieze has that symmetry, and an N if not.

	a	b	c	d	e	f	g
Translation							
Horizontal Reflection							
Vertical Reflection							
180^o Rotation							
Glide Reflection							

One can do these reflections/rotations/translations on any given motif, but is there any kind of systematic way to classify the <u>patterns</u> that emerge? YES!

There are Only Seven Distinct Frieze Patterns

One can prove (although we won't) that there are, in fact, only 7 distinct patterns for friezes. Each of the friezes above represents one of the 7 distinct patterns. (Obviously we can create an infinite number of different strips even though there are only 7 basic patterns, simply by altering the underlying motif.)

	Translation	**Horizontal Reflection**	**Vertical Reflection**	**180 Degree Rotation**	**Glide Reflection**
pma2 					
p112 					
p111 					
p1a1 					
p1m1 					
pm11 					
pmm2 					

The flowchart on the next page can also help you systematically figure out what the pattern is. (Note: The notation given at the bottom is crystallographers' notation for the 7 patterns.)

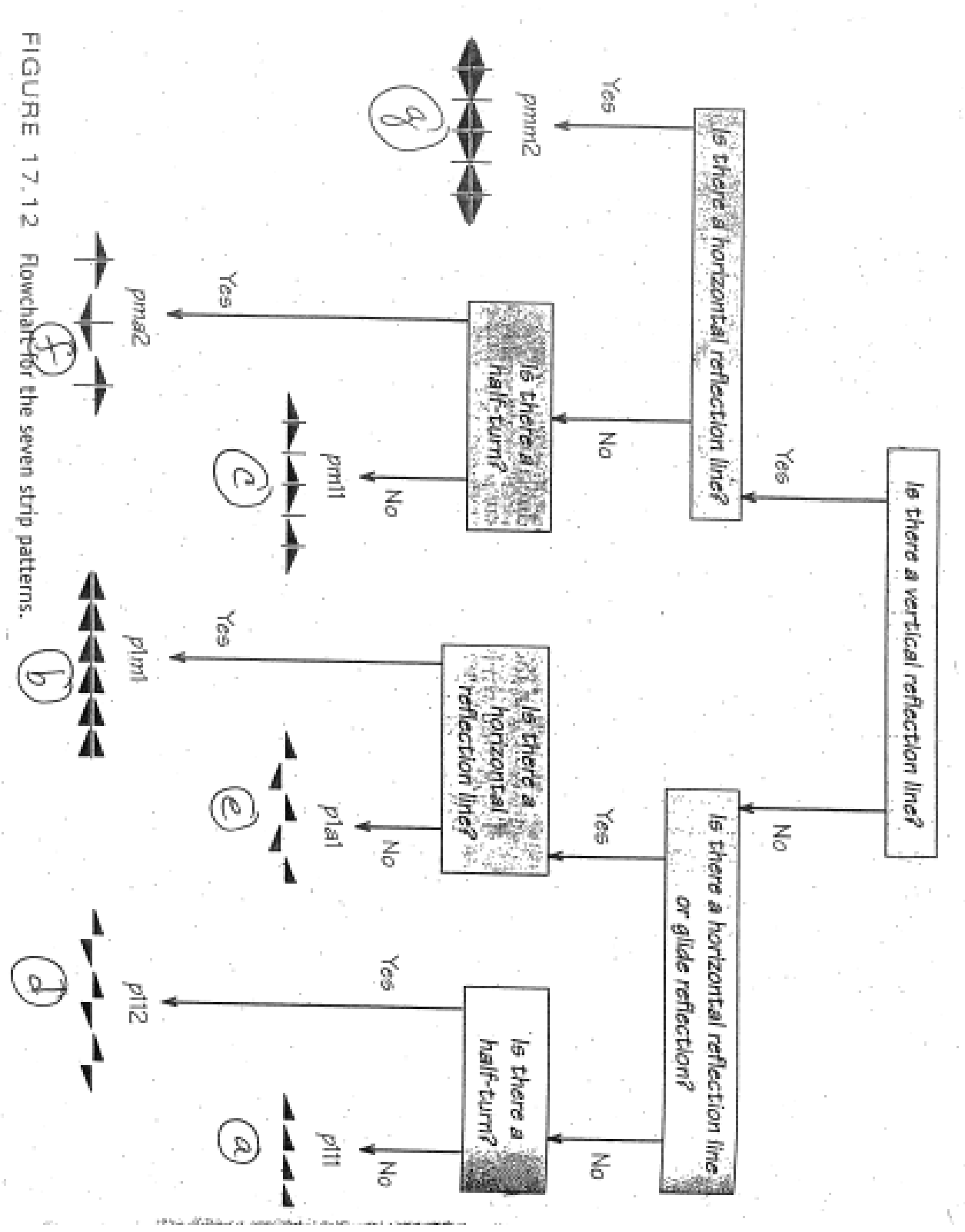

FIGURE 17.12 Flowchart for the seven strip patterns.

Match the frieze (strip pattern) below with the associated type

A = p111 **B=** p112 **C=** pm11 **D=** p1m1 **E=** p1a1 **F=** pma2