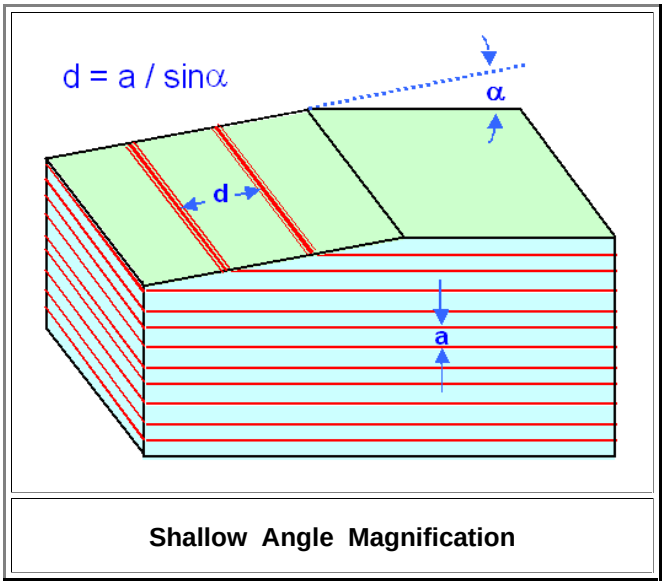
Shallow Angle Magnification Effect

Basics

- You have a layered structure and the layers have a certain distance we call ***a*** just as shown in the figure below. If you look "on" the layered stack you see only the top layer. If you look sideways at the stack you see nothing if the distance ***a*** is small, say below 50 µm or about the thickness of a hair.
  - Being smart, you take a file and cut into the layer stack at a shallow angle α. That "magnifies" the distance between the layers as shown:



Shallow Angle Magnification

  - The geometry is easy and your "magnification factor" **Mag** is simply **Mag = 1/ sin**α. You have for example:
    - **Mag = 11.5** for α **= 5°**
    - **Mag = 19.1** for α **= 3°**
    - **Mag = 57.3** for α **= 1°**
- That's why you see a grain or "hada" structure on Japanese swords blades even so the layers are just a few micrometers apart. When the sword polisher does his thing, he cuts at many small angles through the wavy surface an produces the "magnification" effect.
  Same thing, of course, for wootz blades.