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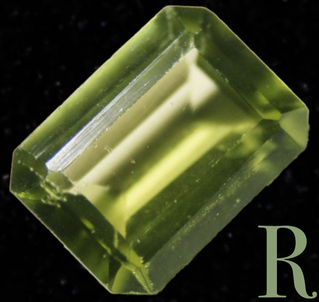
Around the World . . .

. . . in 80



Rocks, Fossils, & Formations!

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Around the World . . .

. . . in 80

Asia, Part 2


Roseann Hanson
Exploring Overland
Field Arts Institute
EXPLORATION
Quarterly
Volume 1, Issue 1
We shall not cease
~ finding Yourself in Nature ~
The Wild Workshop Series
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Quick Geology Reminders, or *What is a Rock?*

- **Rocks** are made up of ***minerals.***
- **Minerals** are made up of ***elements***: iron, magnesium, calcium, silicon, etc.
- **Minerals** become **rocks** through **formation processes** in the earth
  - *"Think of minerals as cooking ingredients and rocks as the finished dish."*
    – Geologist-artist Vojta Hybl
- There are 3 major **rock** types based on those processes:
  - **Igneous**
  - **Metamorphic**
  - **Sedimentary.**

Someone: "I hate geology puns!"

Someone: "I hate geology puns!"

Me: "My sediments exactly."


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Jadeite

$NaAlSi_2O_6$ (metamorphic)

- Most valuable form of jade, a precious stone.
- A pyroxene (group of silicate minerals accounting for 90% Earth's surface.
- Highest quality from N. Myanmar.
- Mohs hardness 6.5 to 7.0
- Jade tools found at Stone Age sites.
- Unusual lavender jade (*metaphonolite*) from NW Turkey; color = jadeite pyroxene.


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www.vsana.org/

Flower Stones, Korea
(Igneous)

- ***Hwamunseok*** **in Korean (화문석, 花紋石)**
- **48 and 50 million y.a.**
- **Molten magma filled fissures in older, overlying sedimentary rock; rhyolite was formed as magma cooled; *spherulites* formed.**
- **Rhyolite is felsic (quarts and feldspar).**
- **Highly prized because they depict chrysanthemums, symbols for autumn and for an easier life in retirement.**
- **“Sunflower Emperor” is the best-known flower stone in Korea.**


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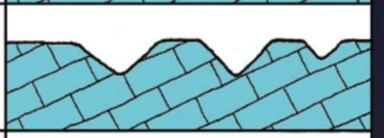
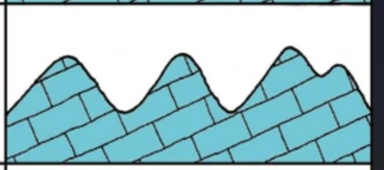
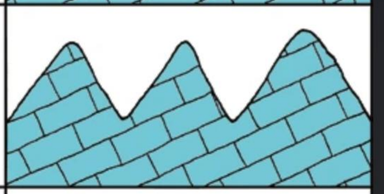
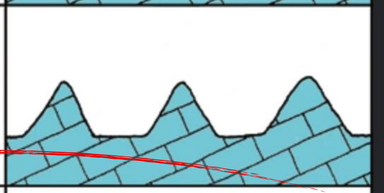
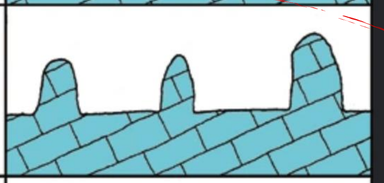
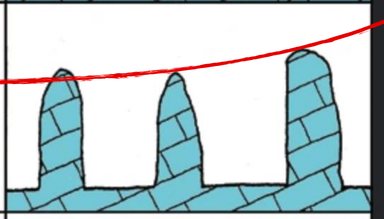
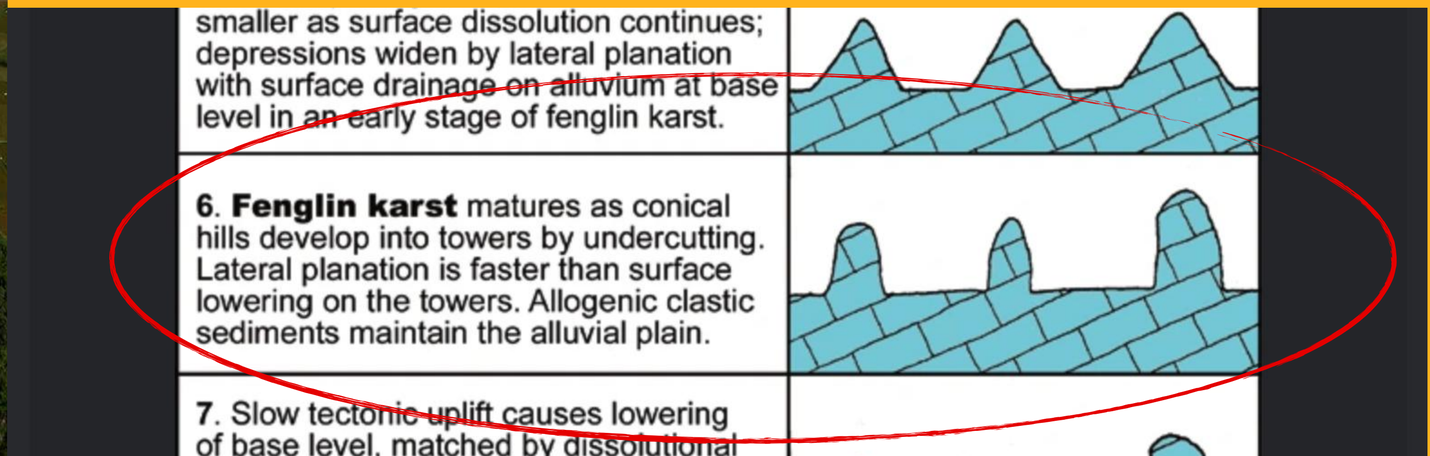
1. Initial surface, either an older plain, or a landscape with inherited relief.	
2. **Doline karst** evolves as isolated depressions form around points of drainage into cave passages.	
3. **Fengcong karst** forms as dolines coalesce to remove any remnants of initial surface; residual hills become conical with dolines on all sides.	
4. Fengcong karst matures with continuing uplift, as dolines deepen, and smaller dolines are eliminated. The karst has maximum relief, and is underlain by major caves.	
5. Base level is reached, preventing more deepening of dolines. Hills become smaller as surface dissolution continues; depressions widen by lateral planation with surface drainage on alluvium at base level in an early stage of fenglin karst.	
6. **Fenglin karst** matures as conical hills develop into towers by undercutting. Lateral planation is faster than surface lowering on the towers. Allogenic clastic sediments maintain the alluvial plain.	
7. Slow tectonic uplift causes lowering of base level, matched by dissolutional lowering of depression floors, which extend by lateral planation. Towers erode more slowly, so stand progressively higher above renewed alluviated plain, forming the finest fenglin tower karst.	
8. Without uplift, lateral planation at a stable base level undercuts margins of the towers, which become both narrower and lower by repeated cliff collapse.	
9. **Karst plain** ultimately forms at base level by lateral planation.	

Phong Nam Valley, Vietnam

Limestone karst ($CaCO_3$ + $CaMg(CO_3)_2$

- Cao Bang province
- UNESCO Global Geopark known for its significant geo-cultural sites and natural beauty.
- “Tower” or “Fenglin” karst = conical hills undercut into towers.
- Alluvial plain is “allogenic clastic sediments” (washed down from upstream).

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Natural Agate

Silicon dioxide (SiO_2)

Mongolia, Gobi Desert

- **Botryoidal chalcedony = globular formations.**
- **Est. 450 to 500 million years in desert; silica-rich solutions crystallized in cavities of host rocks, exposed by erosion.**
- **6.5-7 on Mohs scale.**
- **Natural are most desired; many are dyed (too bright).**
- **Once traded on the Silk Road.**


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Tham Si Fa, Thailand

Limestone and calcite ($CaCO_3$)

- **Calcite = stable polymorph of limestone.**
- **“Blue Cave”.**
- **Approx 100m deep.**
- **In Mae Sot, about 500km north of Bangkok.**
- **Blue is from trace organic carbon, ancient marine fossils, and light reflecting off suspended calcium carbonate.**
- **Speleothems: Natural stalactites and stalagmites.**


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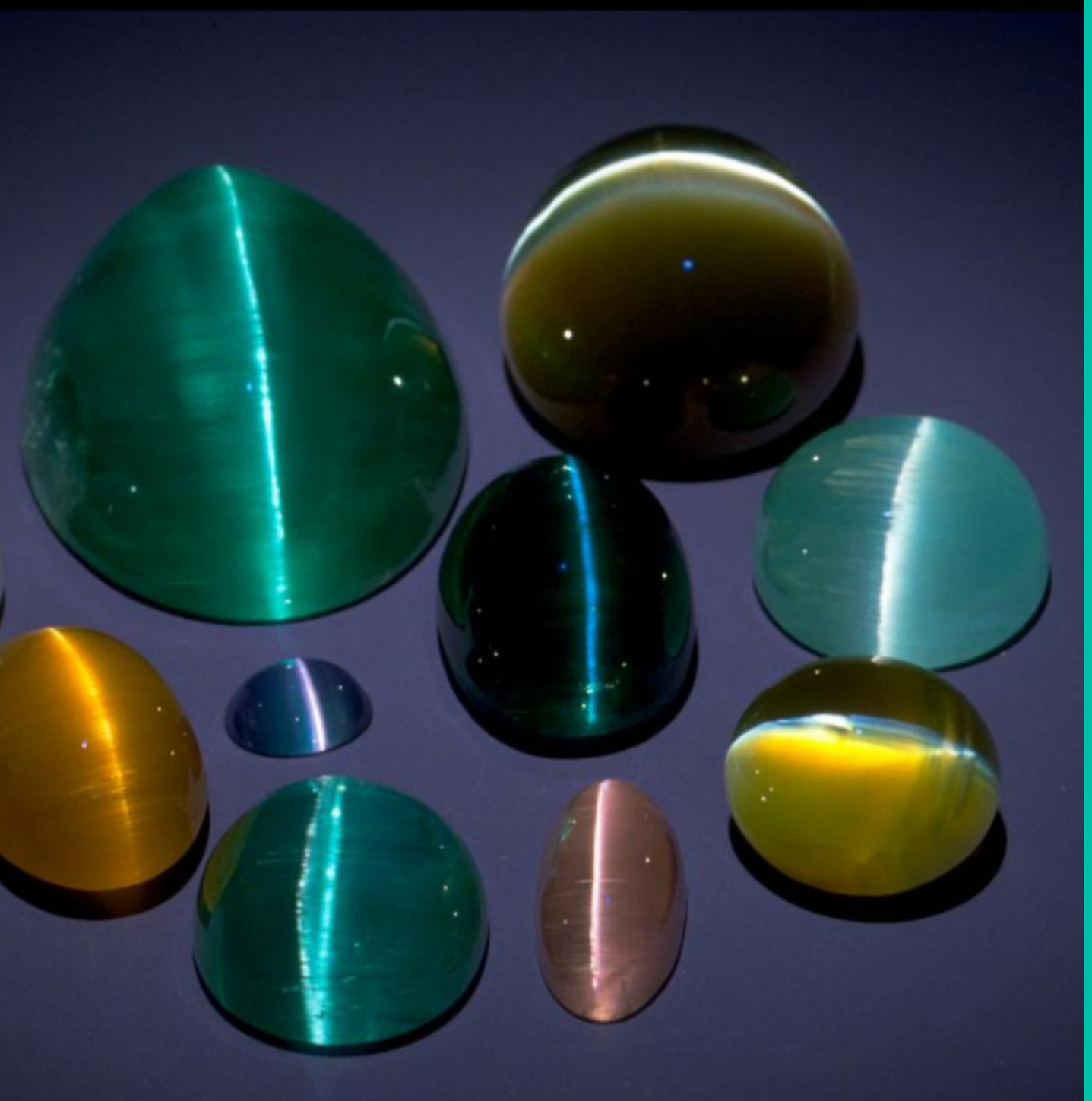

Chrysoberyl Cat’s Eye

(Aluminate of beryllium $BeAl_2O_4$)

- **“Cat's eye” (cymophane) = chatoyancy, caused by microscopic, parallel needle inclusions in stone.**
- **Sri Lankan cat’s eye is celebrated for exceptional transparency and strong milk-and-honey chatoyancy.**


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LG_Kay

Shilin Stone Forest Geological Park (昆明市石林风景区)

Limestone ($CaCO_3$)

- Yunnan Province, China.
- 500 km^2
- 270 million years old
- Strata = gentle (2-6 degree) W-dipping monocline (fold).
- Conjugate shear joints (NE-SW and NE-SE) are well developed and these fractures provided main passageways for surface and underground water in the pre-karst development stage.
- Red streaks are iron inclusions.


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Natural History Museum of LA County

Kyawthuite
Mogok, Myanmar
($Bi_3^{+}Sb_5^{+}O_4$)

- Only one specimen ever found (“holotype”).
- Unprecedented atomic structure (too crazy to go into here!).
- Crystallized in heavy-metal-rich magmas at over 1000°C—rich in bismuth (Bi), antimony (Sb), and oxygen (O).
- Trace elements such as titanium, niobium, tungsten, uranium, and tantalum further define the rare conditions required for its development.
- Officially the rarest gemstone in the world (International Mineralogical Association (IMA)

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