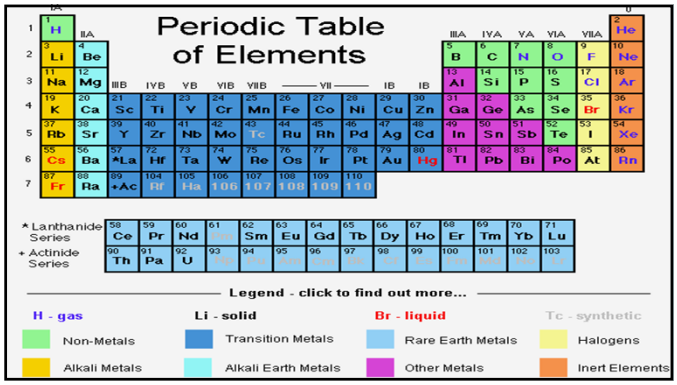
Minerals & Rocks of Iowa

GEOLOGIC RESOURCES OF IOWA

UNIVERSITY OF NORTHERN IOWA &
THE IOWA LIMESTONE PRODUCERS ASSOCIATION



Minerals

Natural occurring

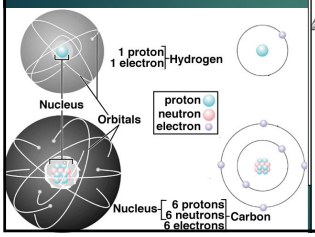
Inorganic

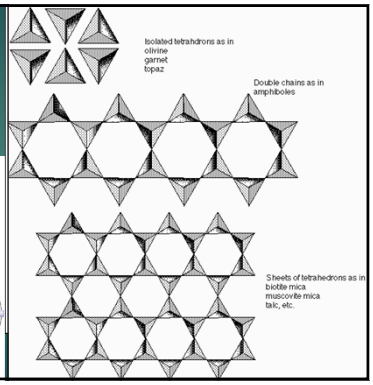
Homogenous solids

Specific Chemical compositions

Atomic structures

Silica Tetrahedrons





Mineral identification

Minerals are identified by their physical and chemical properties

Luster

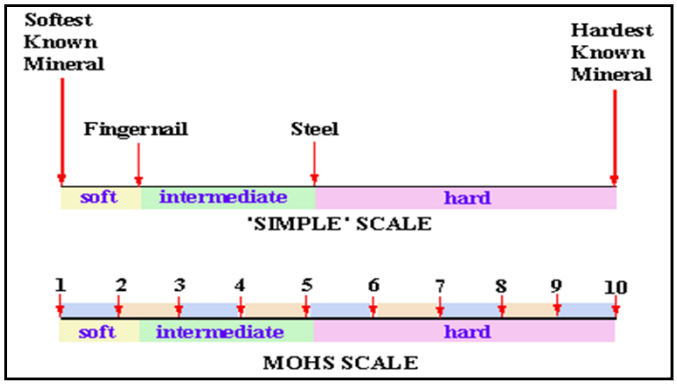
Metallic

Sub-metallic

Non-Metallic


Color


Crystal form



The Physical Properties of minerals

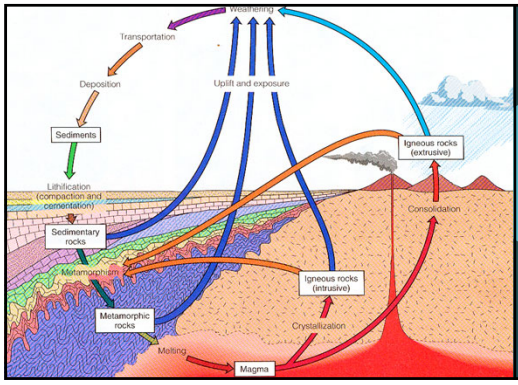
- Luster (Metallic OR Non-Metallic)
- Color
- Breakage / Cleavage
- Hardness
- Specific Gravity
- Streak
- Other…

Other…

- Magnetic
- React with Hydrochloric Acid (HCL)
- Taste
- Smell
- Optical

Rocks

Are heterogeneous –
Made up of multiple minerals AND/OR other rocks

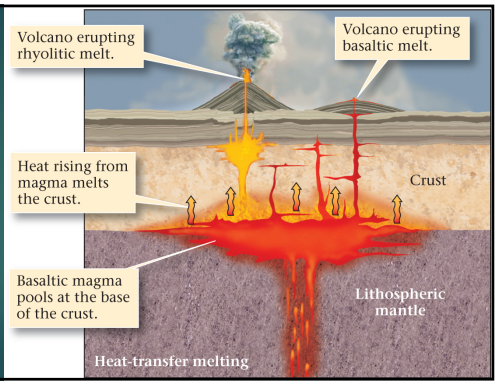


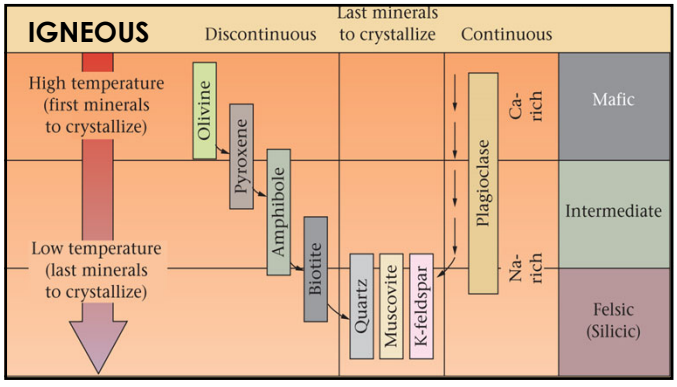
The earth's crust IGNEOUS

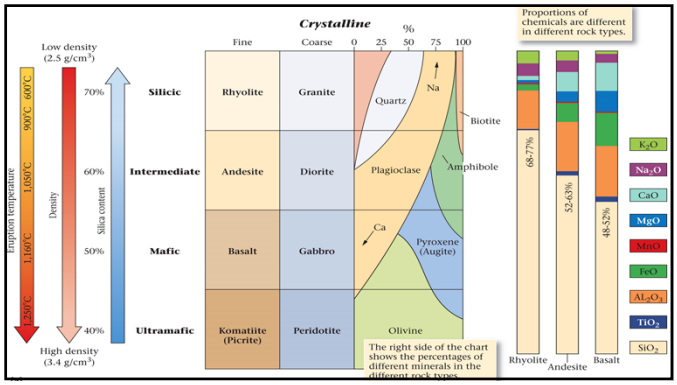
Felsic Mafic

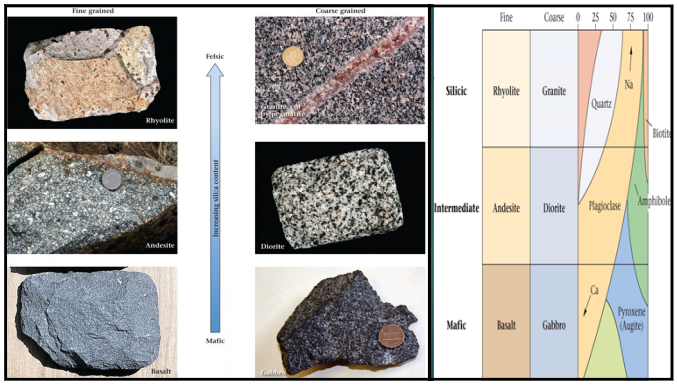
Extrusive

VERSUS






Crystalline
Fine
Coarse
%
0 25 50 75 100
Low density (2.5 g/cm³)
High density (3.4 g/cm³)
Eruption temperature
900°C 600°C
1,050°C
1,160°C
1,250°C
Density
Silica content
70%
60%
50%
40%
Silicic
Intermediate
Mafic
Ultramafic
Rhyolite
Granite
Andesite
Diorite
Basalt
Gabbro
Komatiite (Picrite)
Peridotite
Quartz
Na
Biotite
Plagioclase
Amphibole
Ca
Pyroxene (Augite)
Olivine
The right side of the chart shows the percentages of different minerals in the different rock types.
Proportions of chemicals are different in different rock types.
68-77%
52-63%
48-52%
Rhyolite
Andesite
Basalt
K2O
Na2O
CaO
MgO
MnO
FeO
Al2O3
TiO2
SiO2


Fine grained
Coarse grained
Rhyolite
Granite (coarse-grained)
Andesite
Diorite
Basalt
Gabbro
Felsic
Increasing silica content
Mafic
Fine
Coarse
0 25 50 75 100
Silicic
Intermediate
Mafic
Rhyolite
Granite
Andesite
Diorite
Basalt
Gabbro
Quartz
Na
Biotite
Plagioclase
Amphibole
Ca
Pyroxene (Augite)

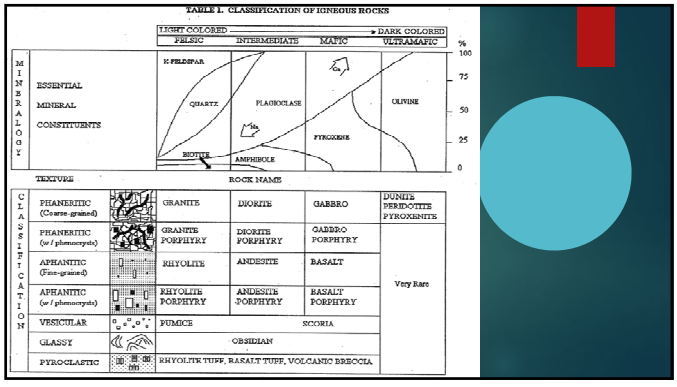
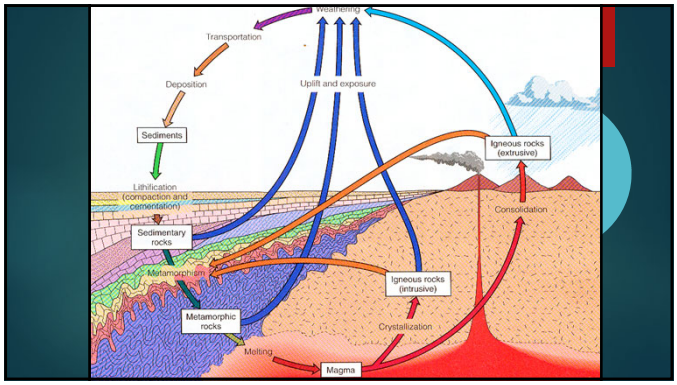


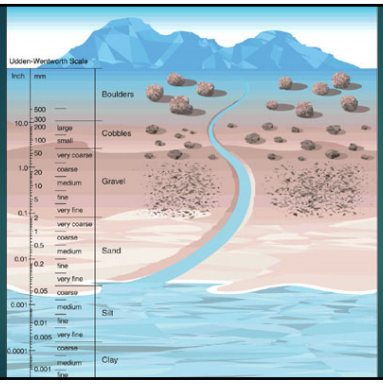
TABLE 1. CLASSIFICATION OF IGNEOUS ROCKS
LIGHT COLORED → DARK COLORED
FELSIC
INTERMEDIATE
MAFIC
ULTRAMAFIC
MINERALOGY
ESSENTIAL MINERAL CONSTITUENTS
K-FELDSPAR
QUARTZ
PLAGIOCLASE
OLIVINE
PYROXENE
BIOTITE
AMPHIBOLE
%
100
75
50
25
0
TEXTURE
ROCK NAME
CLASSIFICATION
PHANERITIC (Coarse-grained)
GRANITE
DIORITE
GABBRO
DUNITE
PERIDOTITE
PYROXENITE
PHANERITIC (or / phenocrysts)
GRANITE PORPHYRY
DIORITE PORPHYRY
GABBRO PORPHYRY
APHANITIC (Fine-grained)
RHYOLITE
ANDESITE
BASALT
Very Rare
APHANITIC (or / phenocrysts)
RHYOLITE PORPHYRY
ANDESITE PORPHYRY
BASALT PORPHYRY
VESICULAR
PUMICE
SCORIA
GLASSY
OBSIDIAN
PYROCLASTIC
RHYOLITIC TUFF, BASALT TUFF, VOLCANIC BRECCIA



Sedimentary Rocks

CLASTIC

CHEMICAL



Sedimentary

TEXTURE or PARTICAL

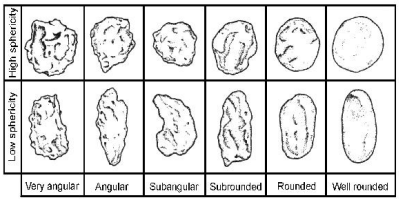
B. Chemical Precipitates / Nonclastic Rocks

Text	Texture	Mineral Composition		Name
Coar Grai (ove	Medium to coarse grained	Calcite ($CaCO_3$)	LIMESTONES	Crystalline Limestone
	Microcrystalline,conchoidal fracture			Micrite
	Aggregates of oolites			Oolitic Limestone
	Shell fragments loosely cemented			Coquina
Med Grai (1/1(2	Abundant fossils in calcareous matrix			Fossiliferous Limestone
	Shells of microscopic organisms, clay-soft			Chalk
	Banded calcite			Travertine
	Textures are similiar to those in limestone	Dolomite ($CaMg(CO_3)_2$)		Dolomite
	Microcrystalline, dense	Quartz (SiO_2)		Chert
Fine (1/2:	Fine to coarse crystalline	Gypsum ($CaSO_4 \cdot 2H_2O$)		Gypsum
	Fine to coarse crystalline	Halite (NaCl)		Rock Salt
Very (< 1	Massive or laminated	Organic Matter (Carbonaceous)		Coal

Sedimentary

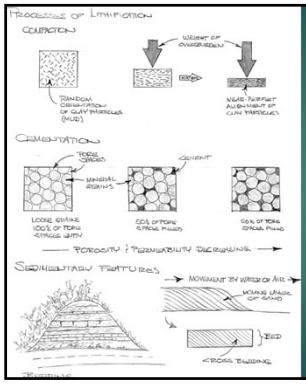
Grain roundness & sphericity

Bladed, oblate and prolate grains may become well *rounded* but will never attain high *sphericity*

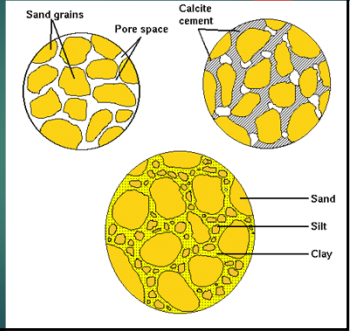


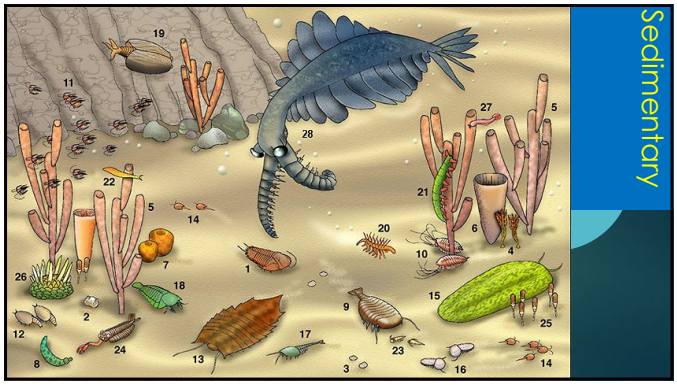
COLOR

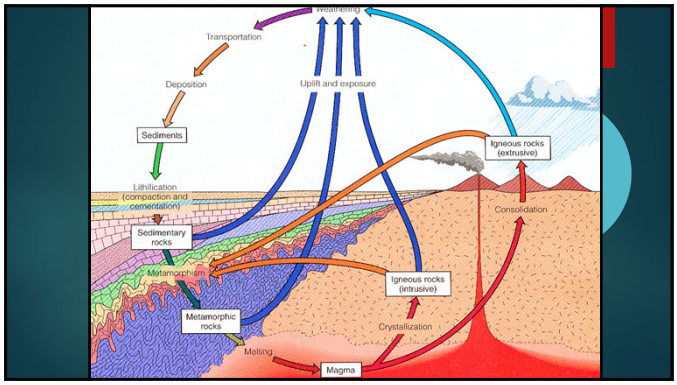
SORTING



Sedimentary




Sedimentary


Weathering
Transportation
Deposition
Uplift and exposure
Sediments
Igneous rocks (extrusive)
Lithification (compaction and cementation)
Consolidation
Sedimentary rocks
Metamorphism
Igneous rocks (intrusive)
Metamorphic rocks
Crystallization
Melting
Magma

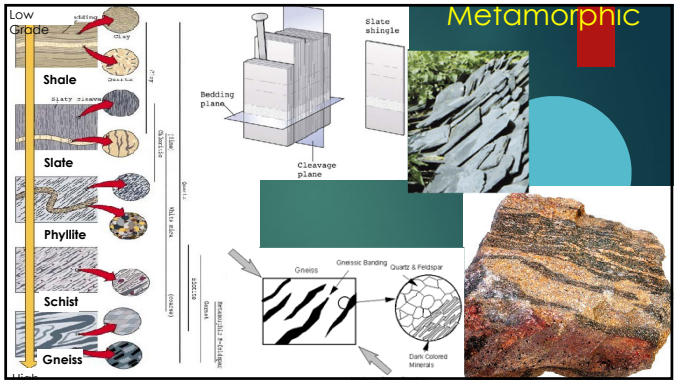
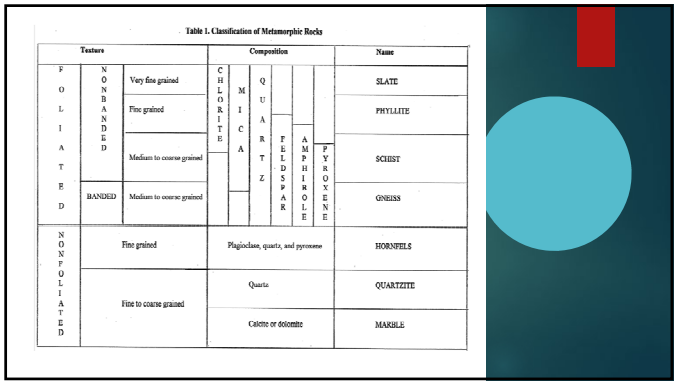
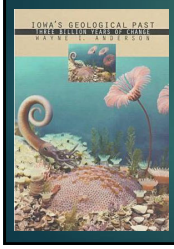

Metamorphic
Low Grade
Shale
Slate
Phyllite
Schist
Gneiss
Slate shingle
Bedding plane
Cleavage plane
Gneissic Banding
Quartz & Feldspar
Dark Colored Minerals

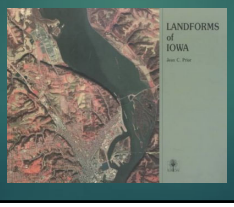
Table 1. Classification of Metamorphic Rocks

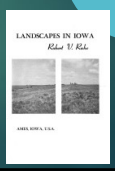
Texture			Composition	Name
FOLIATED	NONBANDED	Very fine grained	CHLORITE, MICA	SLATE
		Fine grained		PHYLLITE
		Medium to coarse grained	QUARTZ, FELDSPAR, AMPHIBOLE, PYROXENE	SCHIST
	BANDED	Medium to coarse grained		GNEISS
NONFOLIATED	Fine grained		Plagioclase, quartz, and pyroxene	HORNFELS
	Fine to coarse grained		Quartz	QUARTZITE
			Calcite or dolomite	MARBLE

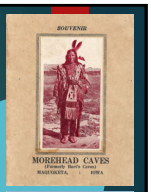


Minerals & Rocks of Iowa





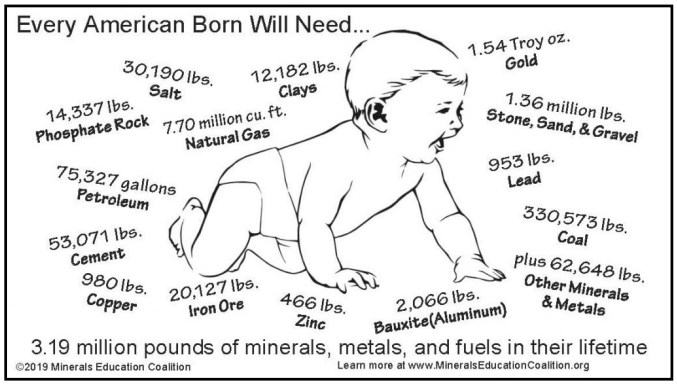




Geologic Resources of Iowa

The Earth's naturally occurring products of geologic, biologic, and/or chemical processes that are useful to society and economically feasible to extract…

(?Short-term versus long-term?)



Local minerals

Gypsum

- Chemical formula = $CaSO_4 \cdot 2H_2O$
- Luster- Non-Metallic (vitreous, silky)
- Color – White to clear
- Breakage – 1 perfect 'platy' 2 others
- Streak - White

Gypsum's 'BIA'graphy

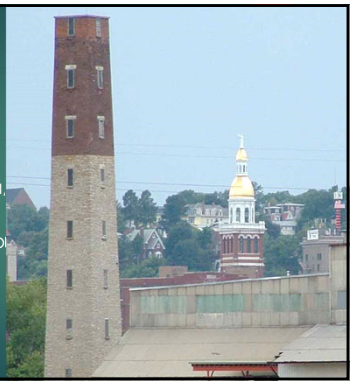
- Name – *Gypsos*, Greek for plaster
- Source – Webster, Des Moines, and Marion Counties
- Use – plaster, drywall, cement
- Economy – Approx. 2 million tons mined from Iowa per year ($11 million)

Galena

- Chemical formula – PbS
- Luster = Metallic
- Color – Grey, silver
- Breakage – Cubic
- Streak – grey

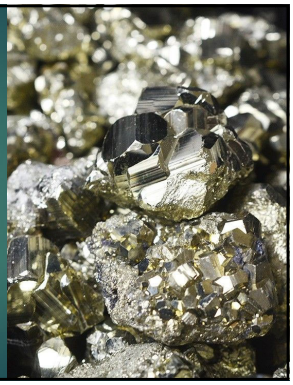
Galena's 'BIA'graphy

- Name – *Galena,* Latin for lead-ore
- Source – Dubuque, IA – Galena, IL
- Use – lead ore – bullets, transistor
- Economy – Peak (1845 to 1855) around 4000 tons per year



Pyrite

Chemical formula – FeS_2
Luster = Metallic
Color – Yellow, brass
Breakage – none/fracture
Streak – yellowish grey
Hardness – 4 (penny to nail)



Pyrite's 'BIA'graphy

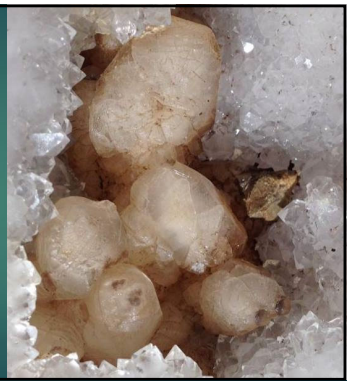
- Name – *Pyrite, Greek pyr for fire*
- Source – minor amounts in limestone
- Use – Sulfur, sulfuric acid
- Economy – not economically feasible in Iowa, not concentrated

Calcite

Chemical formula – $CaCO_3$
Luster = Non Metallic
Color – Yellow, clear, red, brown
Breakage – 3 perfect planes not @ 90
Streak – white
Hardness = 3 (fingernail to penny)

Calcite's 'BiA'graphy

- Name – Chalx – Greek for lime
- Source – primary mineral of limestone, pure crystals are not common..
- Use – to help make steel, cement, and glass
- Economy – not as a mineral, only as aggregate



Quartz

Chemical formula – SiO_2
Luster = Non Metallic
Color – clear, white, rose, smoky
Breakage – None / fracture
Streak – none
Hardness = 7 (glass)

Quartz's 'BIA'graphy

- Name – Quartz, German?
- Source – Igneous rocks,
  - In Iowa as silicate sand
- Use – foundry, glass, and chemical industries
- Economy – 'exploding' as fracking sand

Local Rocks

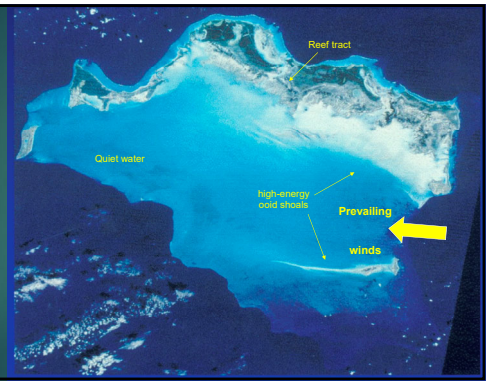
Rocks are aggregates of more than one mineral and or other rocks…

Rocks are heterogeneous

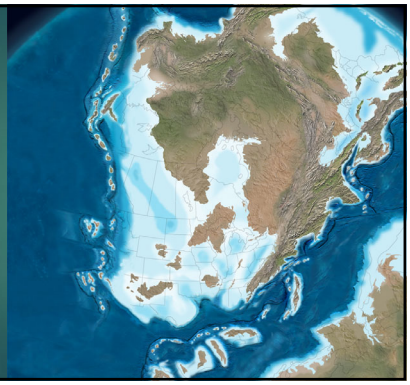
Limestone

- Majority of Iowa's bedrock
- Major source of aggregate
- Major types
  - Crystalline
  - Fossiliferous
  - Micrite / Lithographic
  - Oolitic

Caicos Platform (Bahamas)



Iowa during the Devonian



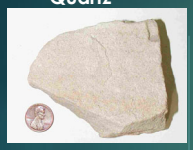
Crinoids

Dolostone

- Mg replaces Ca within $CaCO_3$
- May contain fossils
- Also used as aggregate, though typically not as much as limestone

Sandstone

Quartz



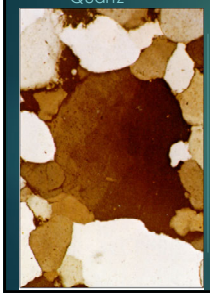
Arkosic (feldspar)

Lithic

GREYWACKE

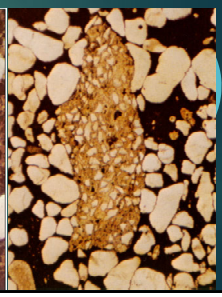
Sandstone

Quartz



Arkosic (feldspar)

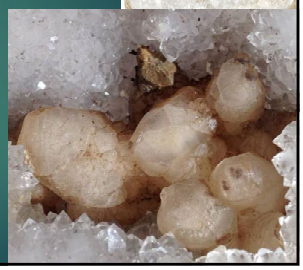
Lithic



Shale

- Silt to clay sized particles
- Mixed assemblage of minerals
- Deposited in low energy environments
  - Ponds
  - Floodplains

Geode



- Latin – Earthlike
- Geologic recourses of great beauty
- 1967, named the official state rock by the Iowa General Assembly
- Warsaw and Keokuk formations of SE Iowa, W. Illinois, and NE Missouri
- May also be found in NE Iowa near Jesup

How do geodes form?

4) Minerals/crystals inside geodes were transported in groundwater (saturated) solutions and then precipitated as replacements of the geode walls or as crystalline growths within their hollow interiors.

5) The ultimate source of the mineralizing waters remains speculative.

6) Many common geode mineral, especially quartz, are weakly soluble. Therefore, substantial volumes of water had to migrate through the lower Warsaw strata to precipitate the observed minerals.

Brian J. Witzke