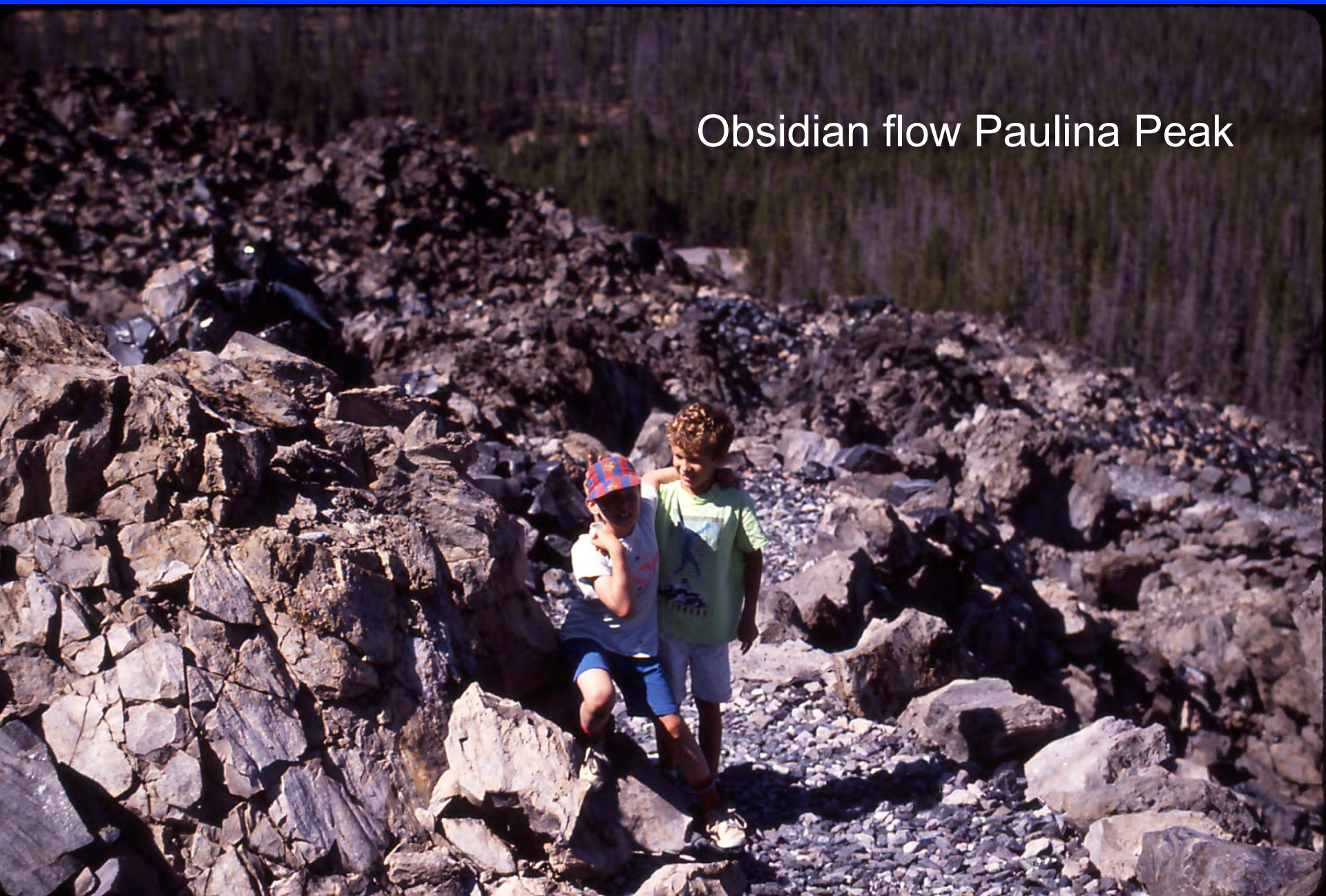
The Stuff We Really Take For Granted:

Industrial Minerals and Construction Materials

The First Industrial Minerals



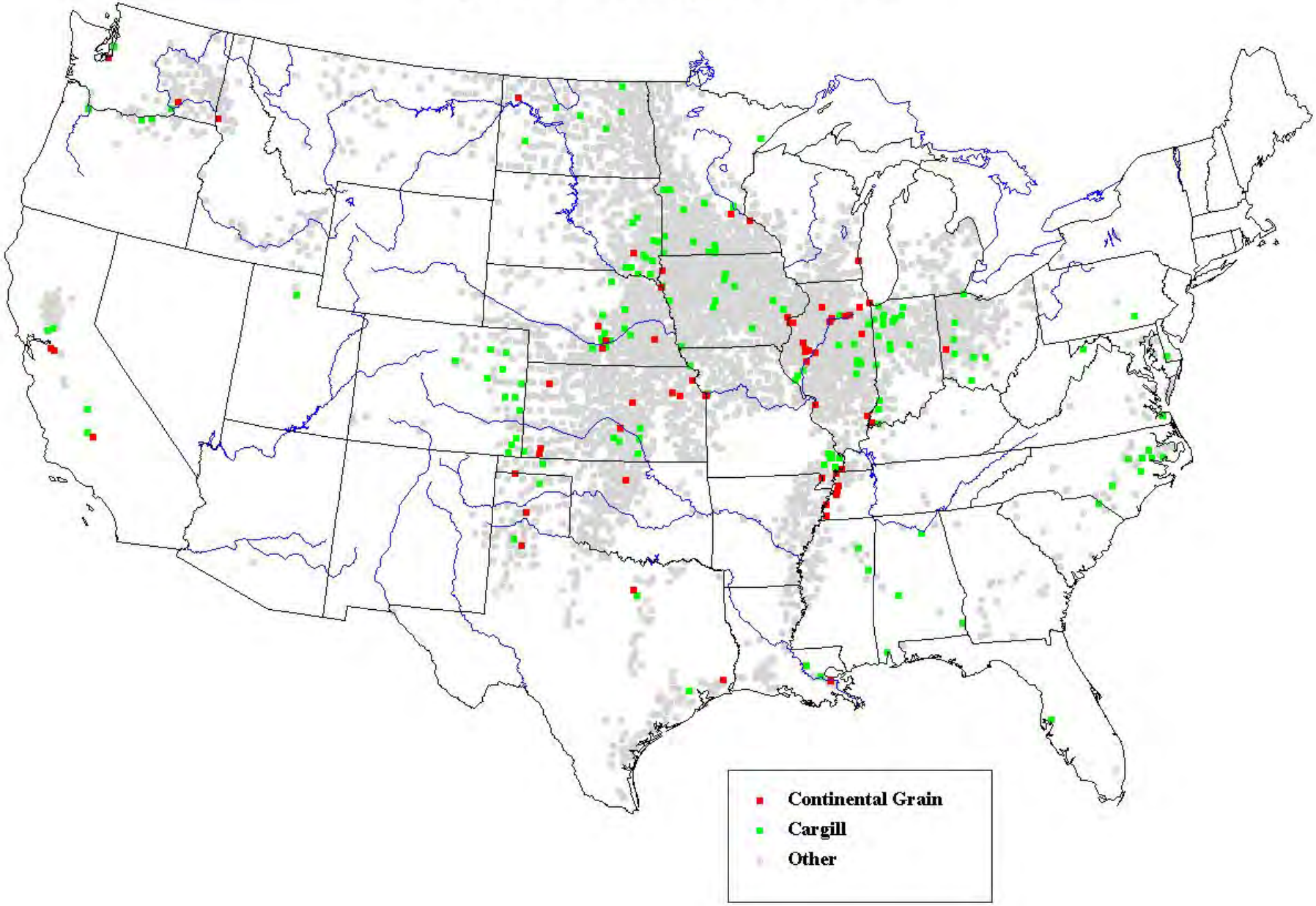

Florida Phosphate Mine

Central Florida
Phosphate Mine

Phosphate Ore
Hand Specimen


Where doe the Phosphate Go?
Osceola Iowa Corn Fields

Figure 2. Storage Locations



Phosphate

- 90+% consumed as nitrogen-phosphate fertilizer
- Rock phosphate is only source of P
- Use varies with season & farm acreage
- 85% US production FL, UT, NC
- Fertilizers plants concentrated on Gulf Coast
- Mississippi River barges move most product

Diatomite

Diatomite Mine west of Lompoc, California

Diatomite

- Composed of diatoms
- Most mines are in Miocene lake deposits
- Fillers, absorbents, insulation, cement
- Processing done at plant
  - Crushing
  - Drying to remove 65% water volume
  - Requires cheap electricity

Sand and Gravel: Portland Oregon

Northeast, Maryland Sand and Gravel Pit

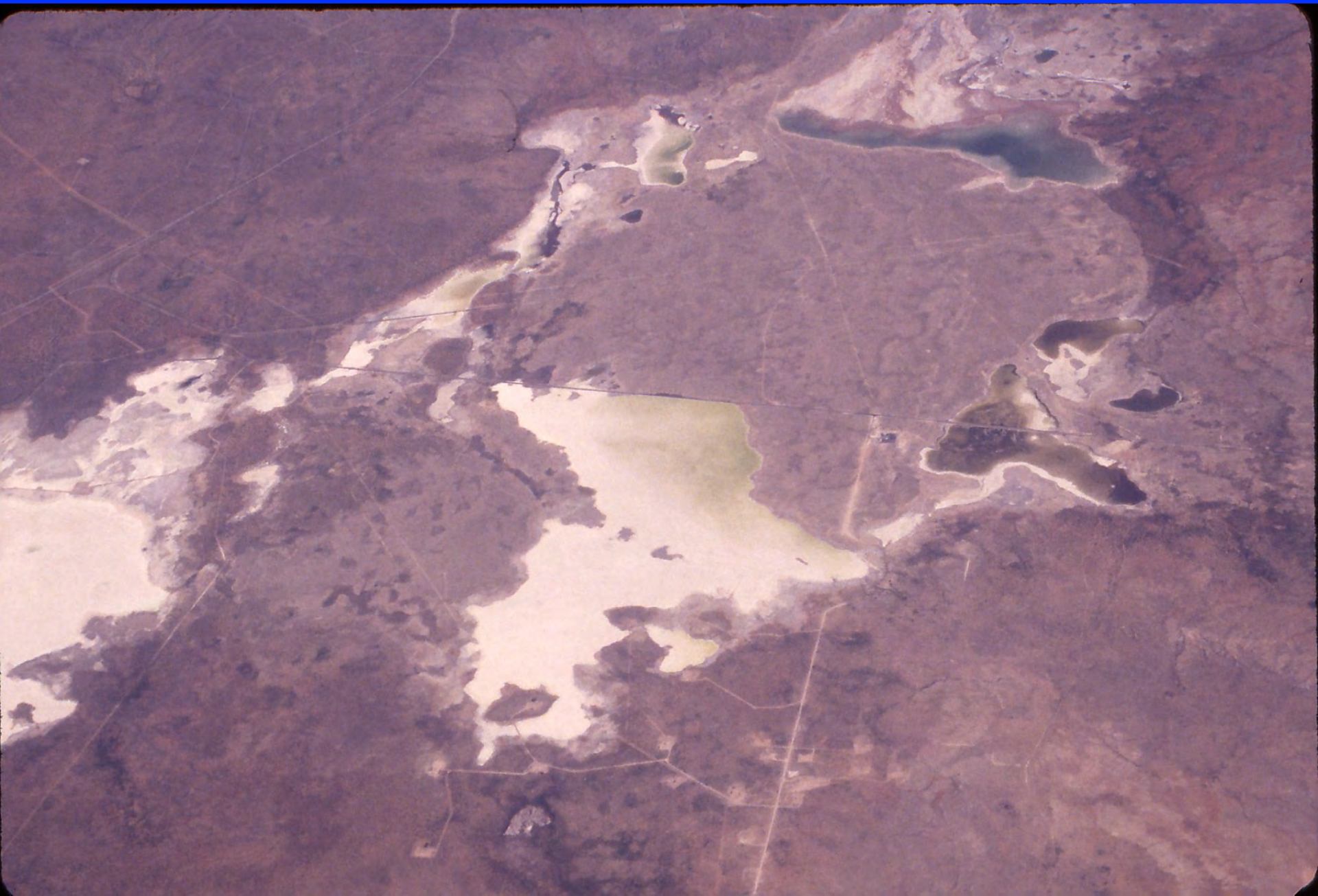
Northeast, Maryland Sand and Gravel Pit

Harrisburg, Pennsylvania Sand Pit: Baseball Infields

Sand and Gravel

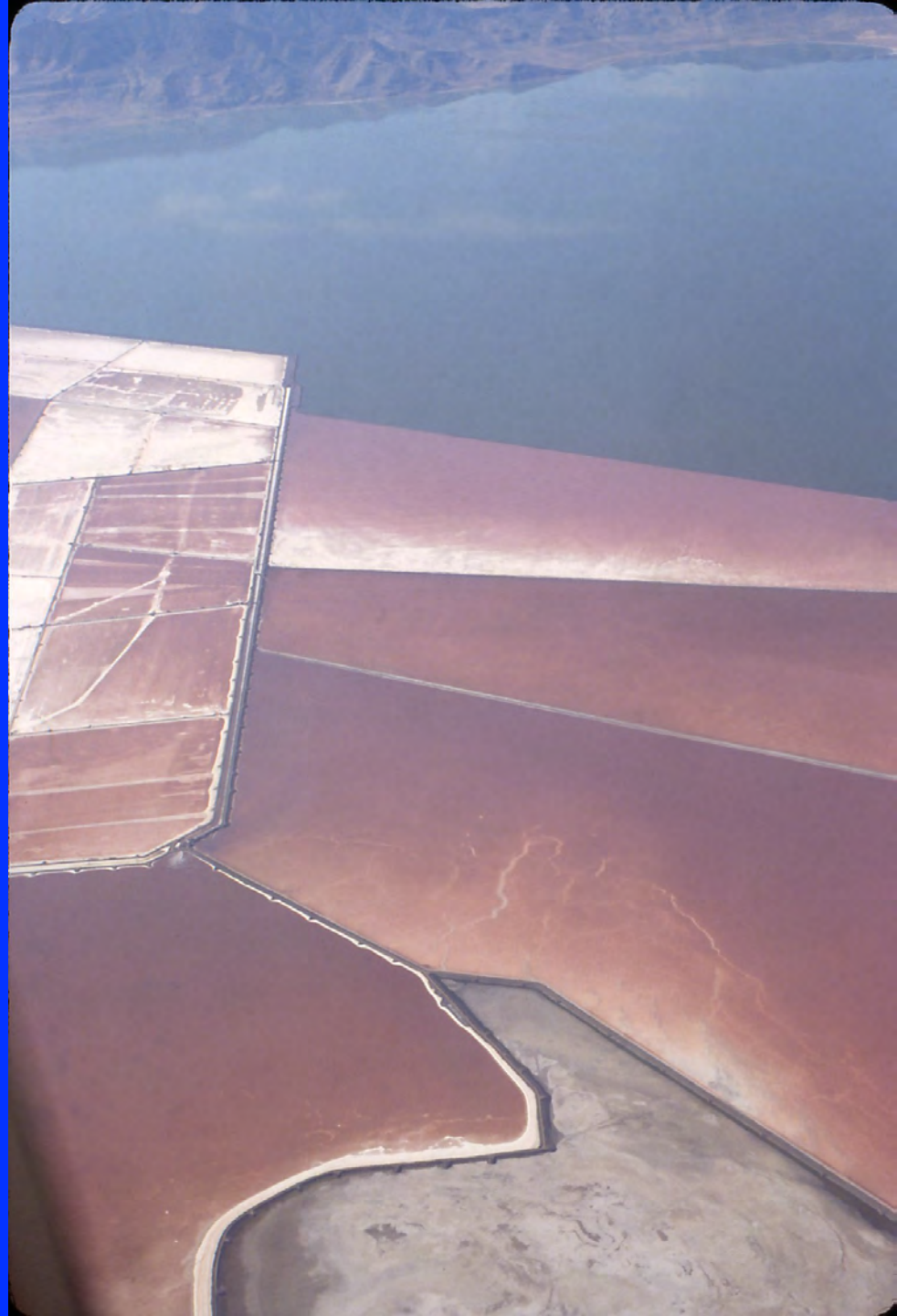
- The most common mining activity
- Location is important: transport costs
- Processing is limited to sorting by size
- Quality is important!
  - Quartz sands are preferred
  - Unstable sand grains (eg feldspars) must be avoided

SE New Mexico Salt Playa



Great Salt Lake, Utah

Morton Salt Evaporation Pans



Salt is not just for food, it has
Also served as a taxable
item . . .

The Great Wall of China

Not visible from the Moon!

Paid for in part by taxes
Levied on salt . . .

Salt

- Deposited by evaporation of brine or sea water
- 50% used to prepare Chlorine gas and caustic soda (NaOH)
- 25% used to remove snow/ice from roads
- 25% used as additive in processed foods, water purification, industrial processes
- $4+ billion per year global business

Potash

http://dogonlanguages.org/photos/index.cfm

Loss of forest due to (1) timber, (2) charcoal, and (3) potash

Potash Mine, near Esterhazay, Saskatchewan, Canada

http://www.lightstalkers.org/images/show/756989

http://saltchamber.com/pl/art/en_art/Salt-Production-Sites-in-North-America.jpg

Potash

- Subject of the first US patent (1790) granted to Samuel Hopkins
- “Potash” water soluble K-bearing salts
- “Potash”: leaves leached in a boiling pot to produce the salts
- Mines of Sylvite (KCl)
- 95% used as fertilizer
- 5% industrial chemical processes

Building Stone: Precambrian Marble

Building Stone: Precambrian Marble


प्रवेश निकास
ENTRY EXIT


Artisan marble quarry, Arravelli Mountains

Building Stone: Salisbury Plain

Two know quarries, one nearby and one

And one in Wales . . .


Carrara
Ligurian Sea
2.5 km

Trevi Fountain, Rome: Carrara Marble and Local Travertine

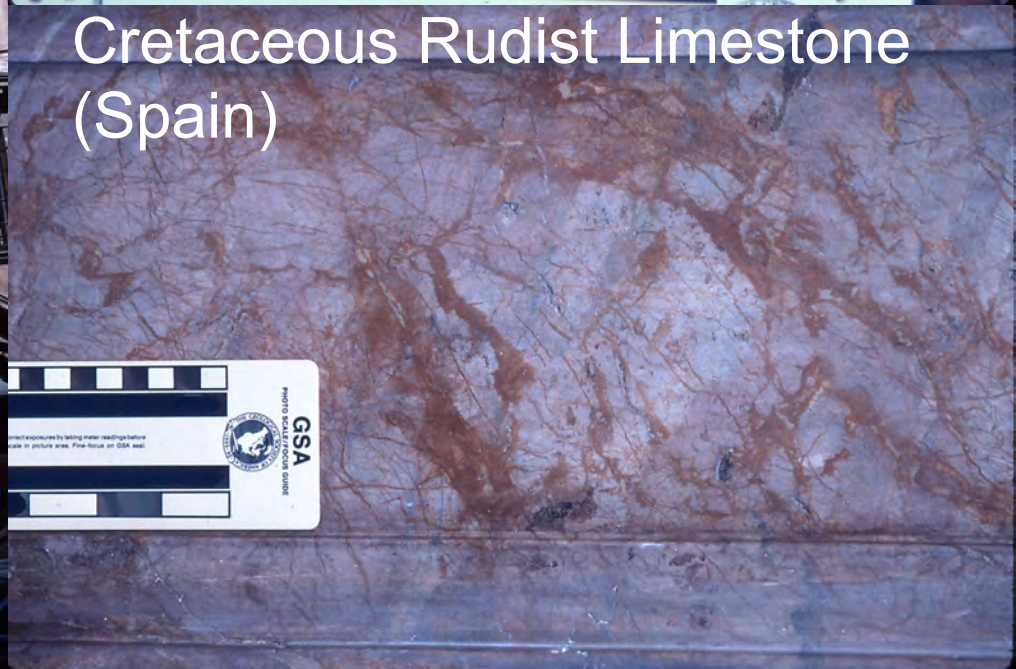
Building Stone and cement: Salisbury Cathedral

Salisbury Cathedral
1220-1380 AD

Columns of locally quarried Lower Jurassic Purbeck
limestone, similar to locally quarried Stonehenge blocks

Cement used in the interior

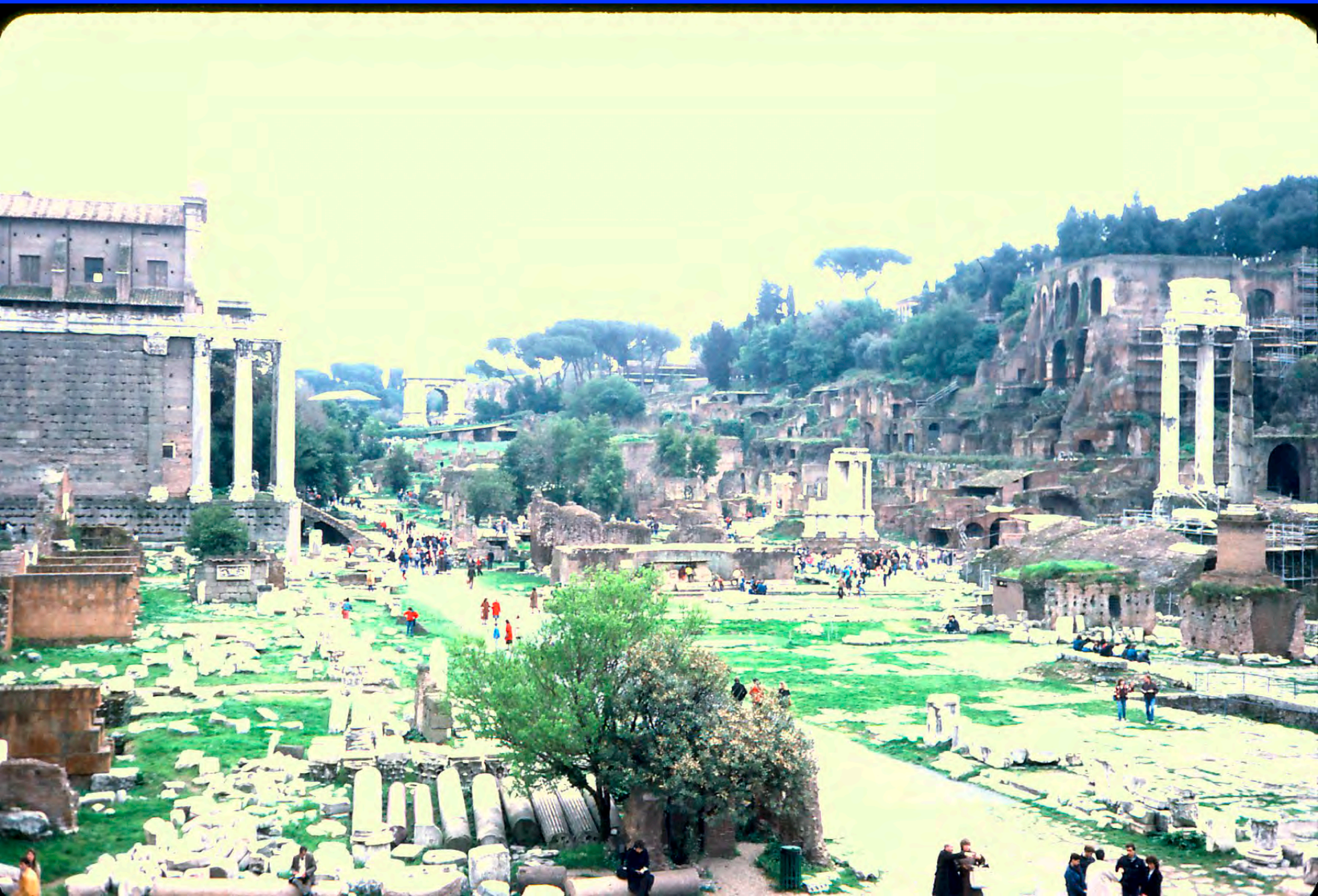
Decorative Stone: Norwich Union Bank: The Real Deal!



Dimension Stone

- 2.5 million tons sold in US during 2015
- Produced from quarries in 34 states
- Limestone (42%), granite (21%), sandstone (18%), Miscellaneous(18%), marble (4%), slate (4%)

Building stone and cement: the Roman Forum



Roman Coliseum: brick, cement, facing stone

http://www.flickr.com/photos/jpdmm/3259659255/sizes/o/

The Pantheon, Rome Built ca 110 AD. Note cement roof

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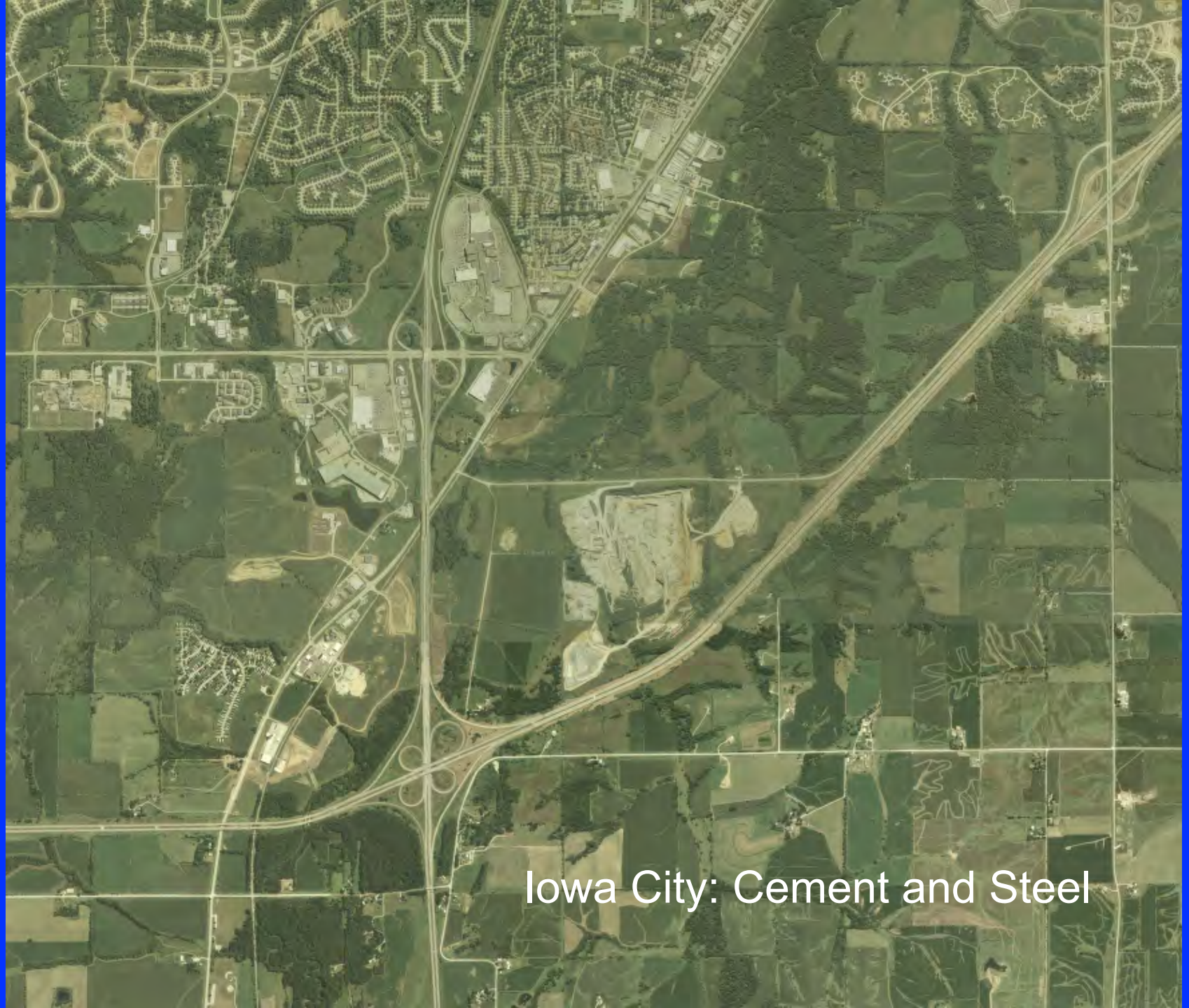

Iowa City: Cement and Steel

Building stone & mortar:
Carcasonne, France
Eocene oolitic limestone
Locally quarried

Cement: lime + clay +water

- Lime mortar in Turkey 9,000-16,000BC
- Lime used construction, agriculture, tanning in ancient Egypt, China, Greece, Rome
- “Lime” = calcined limestone and dolomite
- Requires heat: coal
- Made in 33 states
- 39% used in Metalurgy, 25% in Chemical processing, 24% in water softening, 11% of lime used to make Cement for construction

Glass

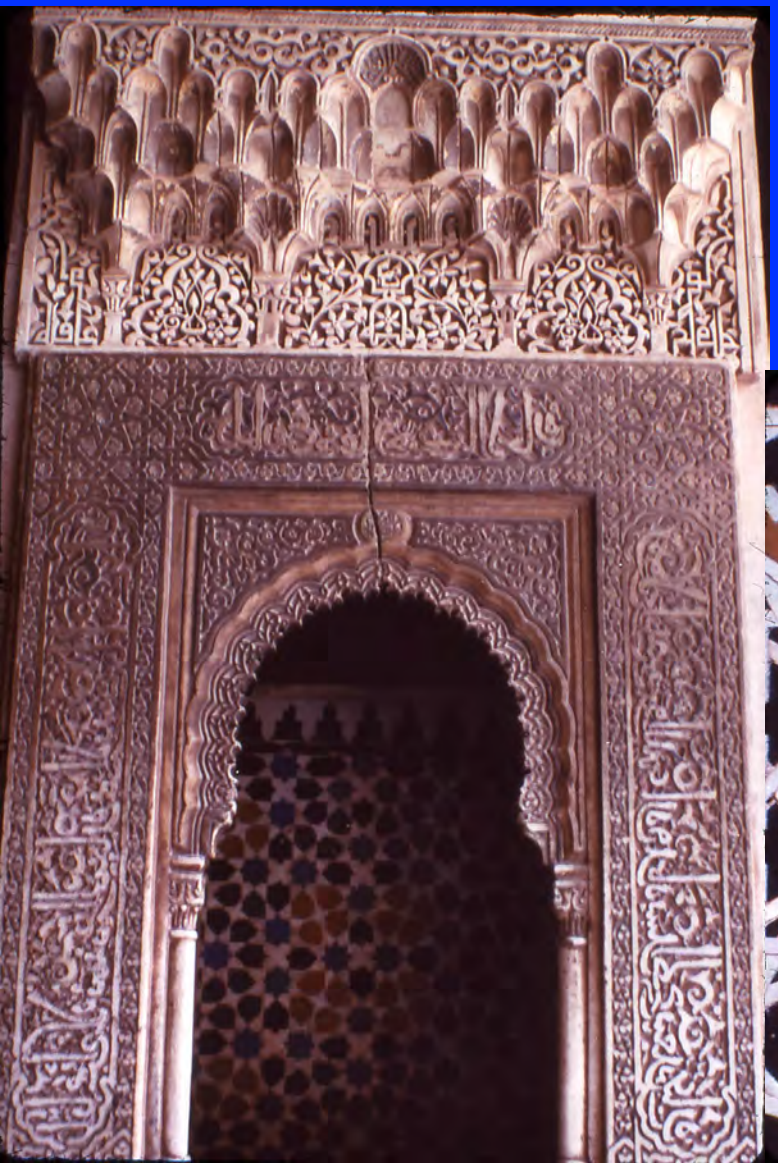
Interior Salisbury Cathedral

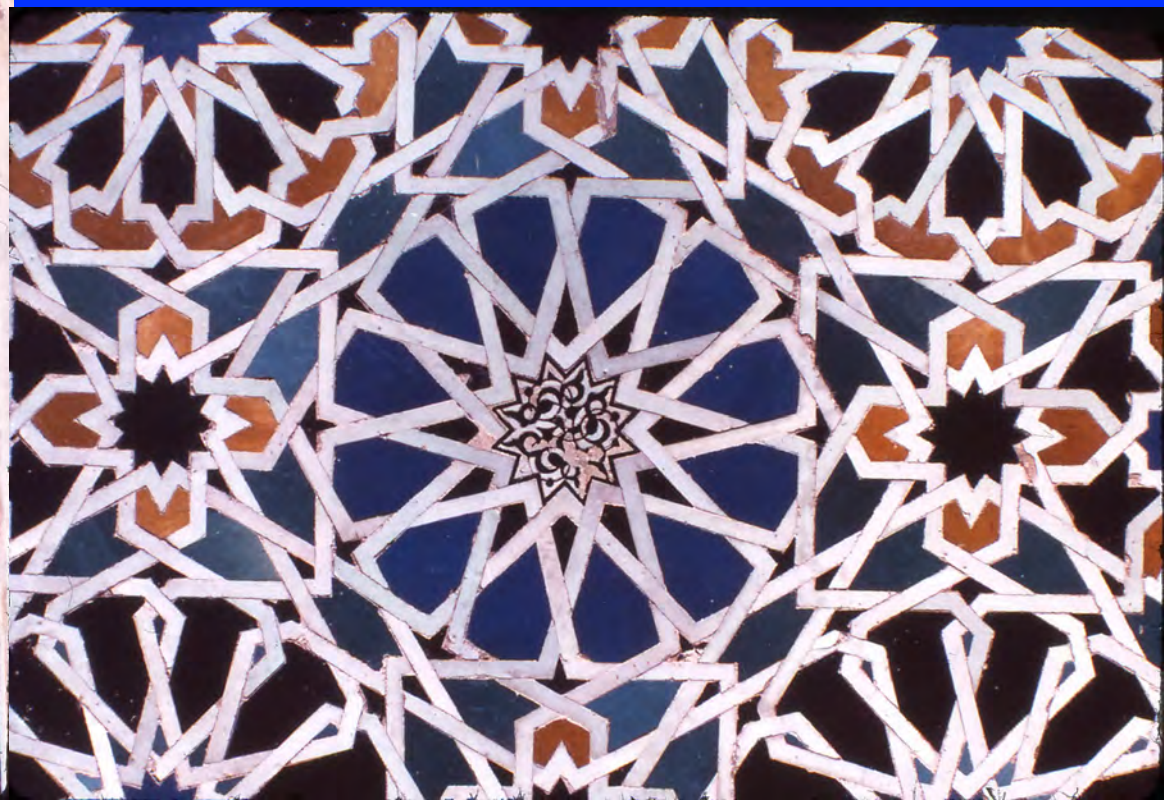
Exterior Dallas Hyatt Regency

Glass

- An amorphous solid without crystal structure
- Melt quartz and other elements, then cool rapidly
- Additives reduce melting temperature
- Additives change glass properties
- Soda Ash (Sodium Carbonate) is principle additive to glass

Ceramics





Modern Ceramics:

Garbage Can
Beijing

Littlejohn Pit, China Clay, Cornwall, UK

http://www.english-nature.org.uk/imagelibrary/image_details.cfm?id=110001

Ceramics

- Made by heating to high temperature in kiln
- “China Clay” or kaolininte: weathered granite
- Japanese kilns first built around 1100 AD
- Chinese kilns first built around 1400 AD
- Oldest ceramic figure from Czech 29,000 BC

Industrial Minerals: Economics

- High volume-Low value materials
  - Used near mine site
  - Low value prohibits long distance transport
  - Quality and quantity varies greatly in region
  - In most places these are the most important mineral resource
  - Regulated differently than from other mines

Industrial Minerals: Economics

- Low volume-high value materials
  - Extensive international trade
  - Processing depends on the commodity

Industrial Minerals: Economics

- Moderate volume-moderate value materials
  - Deposits near markets and/or transport
  - Raw material may be shipped and then processed near site
  - High purity deposits traded internationally

Industrial Minerals: Characteristics

- Value is in their intrinsic properties
  - Minimal processing
  - Low volume waste stream
  - Often environmentally benign

Industrial Materials: Characteristics

- End user controls character of product
  - Specific mines matched to customers
  - Material properties known only to user and supplier

Industrial Minerals: Characteristics

- Deposits tend to be large, mined 30-40 years
  - Viewed as a stable employer
  - Not driven by boom and bust cycles
  - Markets are stable over time
  - Not viewed as a long-term environmental problem

Decorative Stone: Crocker’s Folly, London