

# Earth Science Reference Tables

## PHYSICAL CONSTANTS

### Radioactive Decay Data

RADIOACTIVE ISOTOPE	DISINTEGRATION	HALF-LIFE (years)
Carbon-14	$C^{14} \rightarrow N^{14}$	$5.7 \times 10^3$
Potassium-40	$K^{40} \rightarrow \begin{matrix} Ar^{40} \\ Ca^{40} \end{matrix}$	$1.3 \times 10^9$
Uranium-238	$U^{238} \rightarrow Pb^{206}$	$4.5 \times 10^9$
Rubidium-87	$Rb^{87} \rightarrow Sr^{87}$	$4.9 \times 10^{10}$

### Specific Heats of Common Materials

MATERIAL	SPECIFIC HEAT (calories/gram • C°)	
Water {	solid	0.5
	liquid	1.0
	gas	0.5
Dry air	0.24	
Basalt	0.20	
Granite	0.19	
Iron	0.11	
Copper	0.09	
Lead	0.03	

### Properties of Water

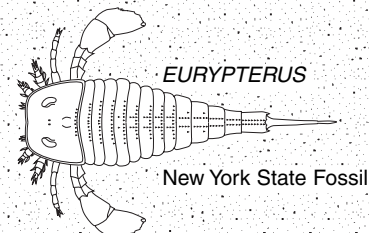
Energy gained during melting	80 calories/gram
Energy released during freezing	80 calories/gram
Energy gained during vaporization	540 calories/gram
Energy released during condensation	540 calories/gram
Density at 3.98°C	1.00 gram/milliliter

## EQUATIONS

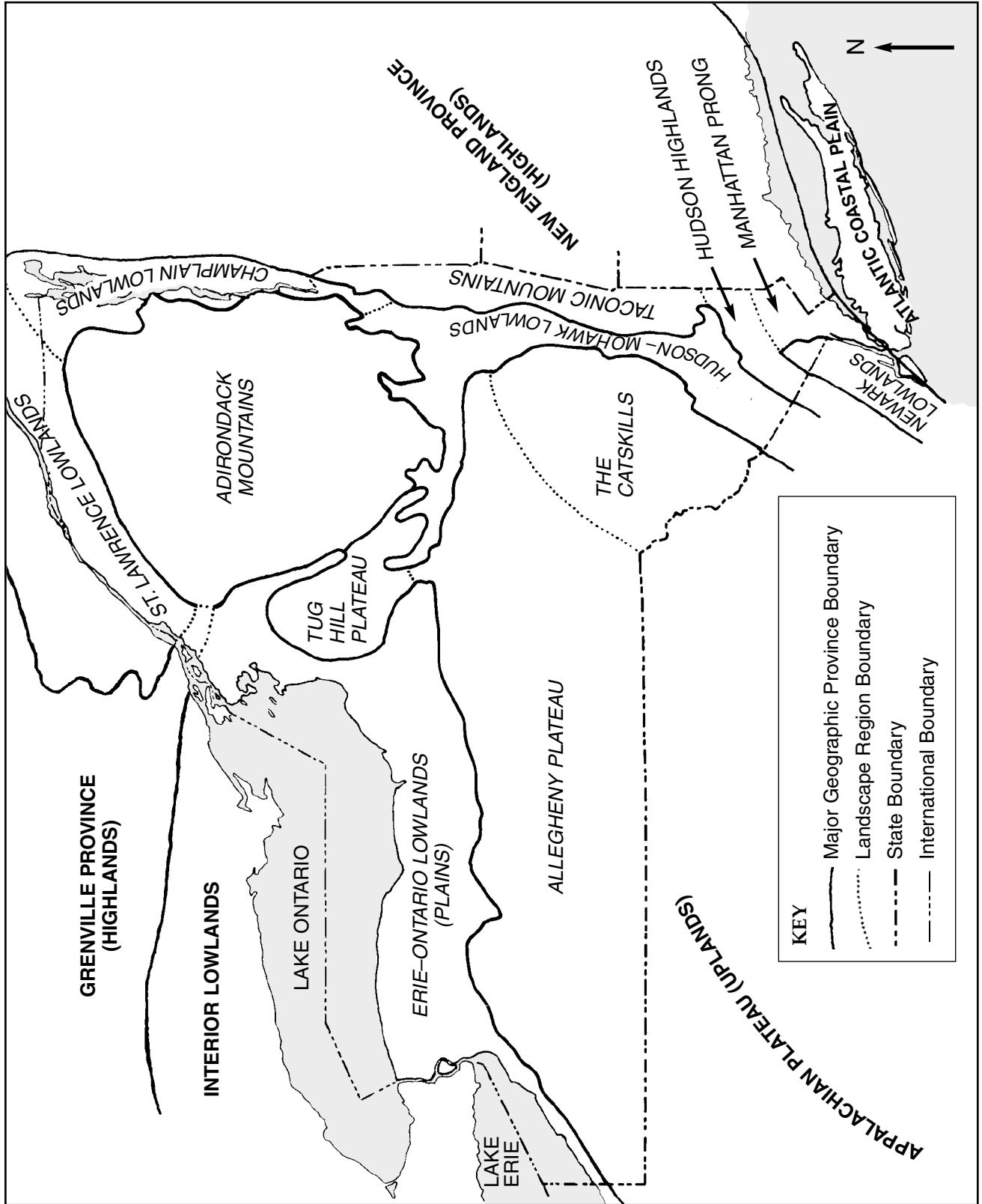
Percent deviation from accepted value	$\text{deviation (\%)} = \frac{\text{difference from accepted value}}{\text{accepted value}} \times 100$
Eccentricity of an ellipse	$\text{eccentricity} = \frac{\text{distance between foci}}{\text{length of major axis}}$
Gradient	$\text{gradient} = \frac{\text{change in field value}}{\text{distance}}$
Rate of change	$\text{rate of change} = \frac{\text{change in field value}}{\text{time}}$
Density of a substance	$\text{density} = \frac{\text{mass}}{\text{volume}}$

### 2001 EDITION

This edition of the Earth Science Reference Tables should be used in the classroom beginning in the 2000–2001 school year. The first examination for which these tables will be used is the January 2001 Regents Examination in Earth Science.

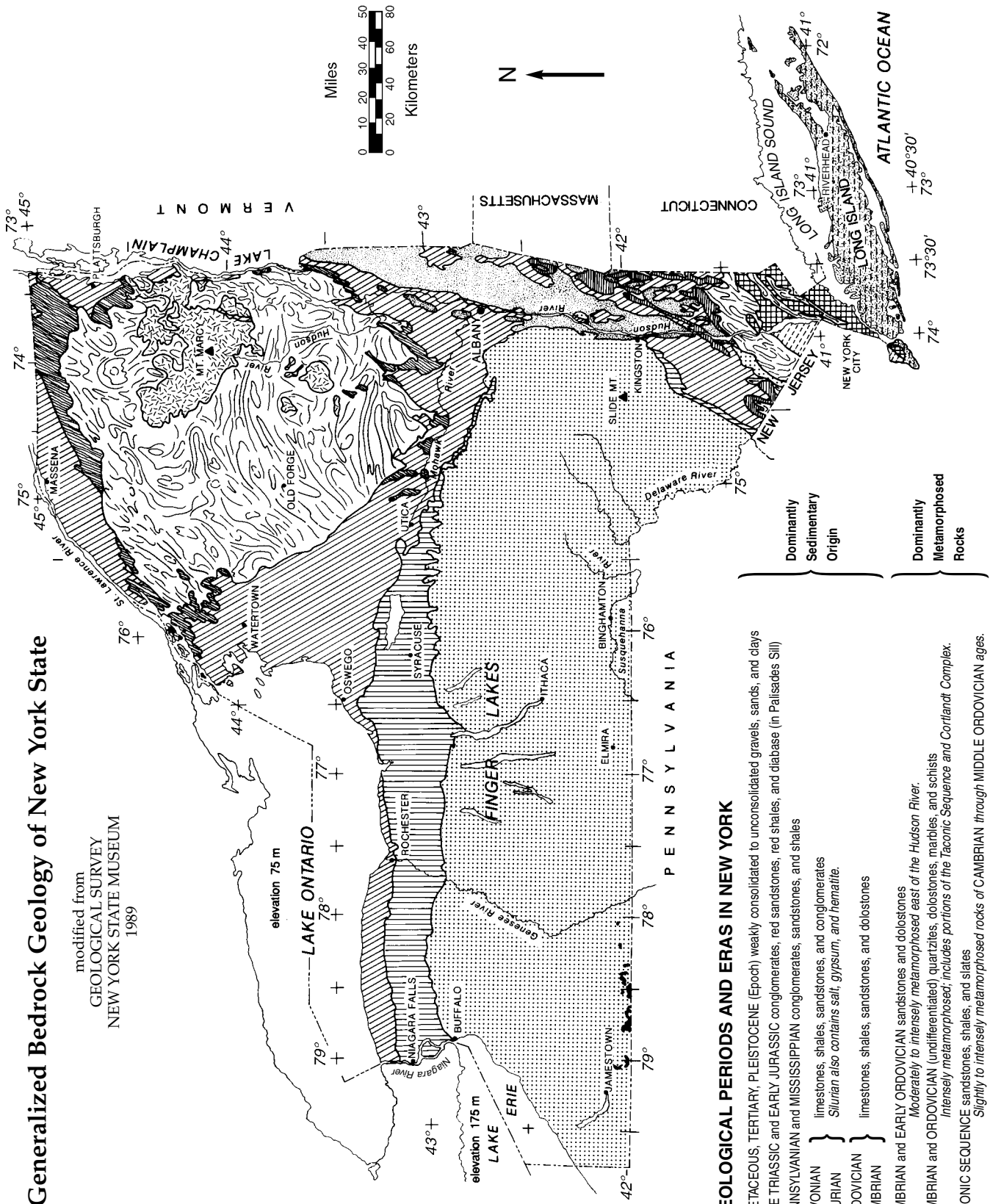


# Generalized Landscape Regions of New York State



# Generalized Bedrock Geology of New York State

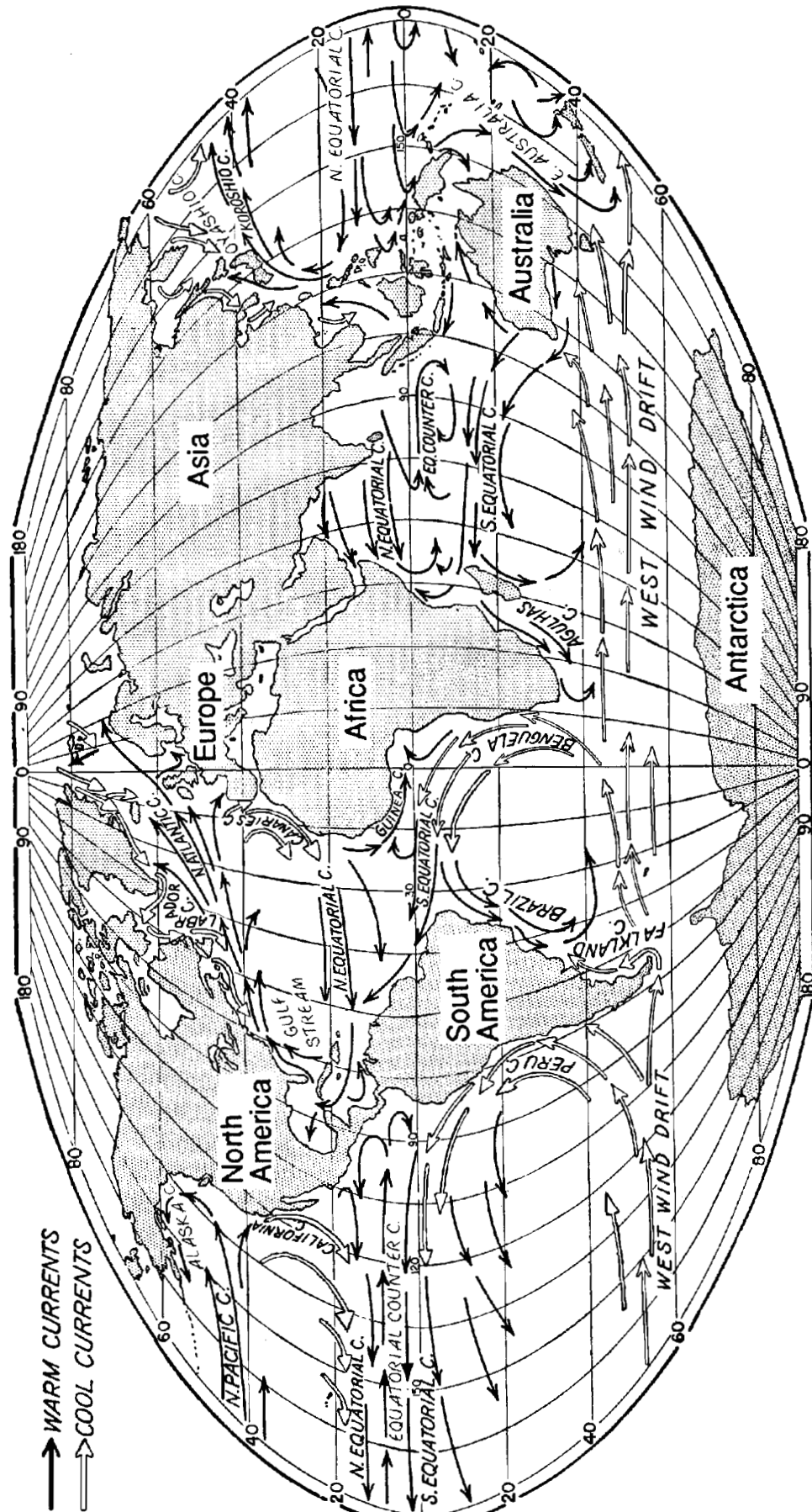
modified from  
GEOLOGICAL SURVEY  
NEW YORK STATE MUSEUM  
1989



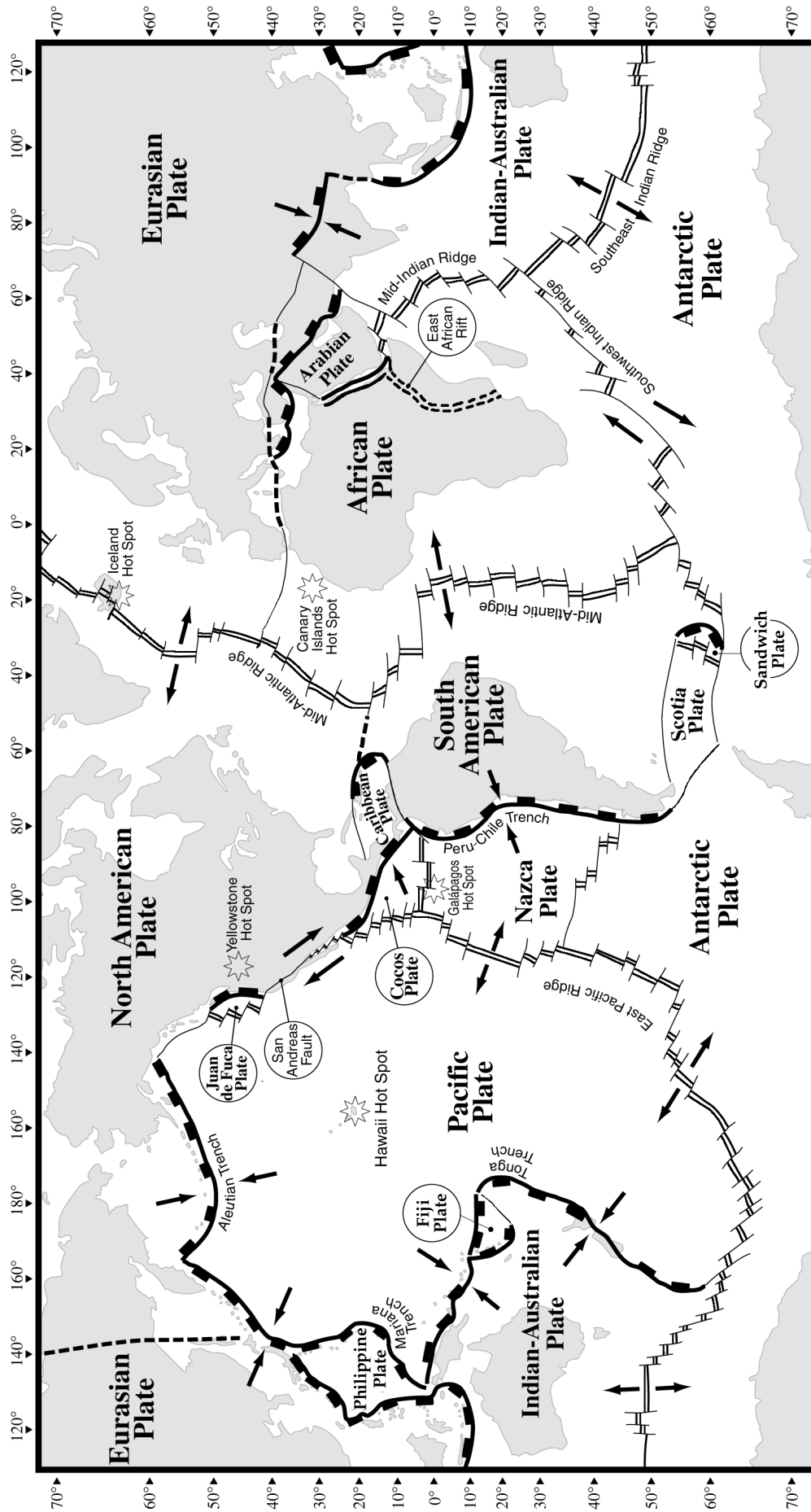
## GEOLOGICAL PERIODS AND ERAS IN NEW YORK

- CRETACEOUS, TERTIARY, PLEISTOCENE (Epoch) weakly consolidated gravels, sands, and clays
- LATE TRIASSIC and EARLY JURASSIC conglomerates, red shales, and diabase (in Palisades Sill)
- PENNSYLVANIAN and MISSISSIPPIAN conglomerates, sandstones, and shales
- DEVONIAN } limestones, shales, sandstones, and conglomerates
- SILURIAN } Silurian also contains salt, gypsum, and hematite.
- ORDOVICIAN } limestones, shales, sandstones, and dolostones
- CAMBRIAN } limestones, shales, sandstones, and dolostones
- CAMBRIAN and EARLY ORDOVICIAN sandstones and dolostones  
Moderately to intensely metamorphosed east of the Hudson River.
- CAMBRIAN and ORDOVICIAN (undifferentiated) quartzites, dolostones, marbles, and schists  
intensely metamorphosed; includes portions of the Taconic Sequence and Corlandt Complex.
- TACONIC SEQUENCE sandstones, shales, and slates  
Slightly to intensely metamorphosed rocks of CAMBRIAN through MIDDLE ORDOVICIAN ages.
- MIDDLE PROTEROZOIC gneisses, quartzites, and marbles  
Lines are generalized structure trends.
- MIDDLE PROTEROZOIC anorthositic rocks  
Intensely Metamorphosed Rocks  
(regional metamorphism about 1,000 m.y.a.)

# Surface Ocean Currents



# Tectonic Plates

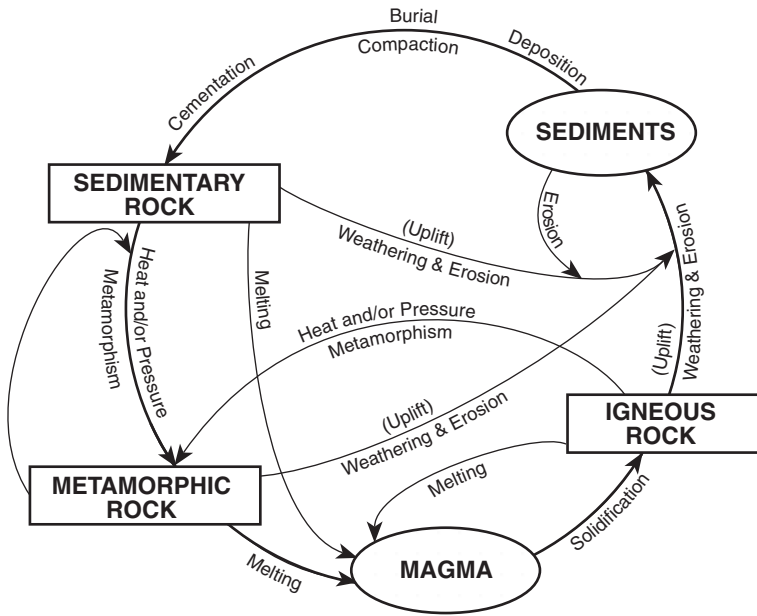


**KEY:**

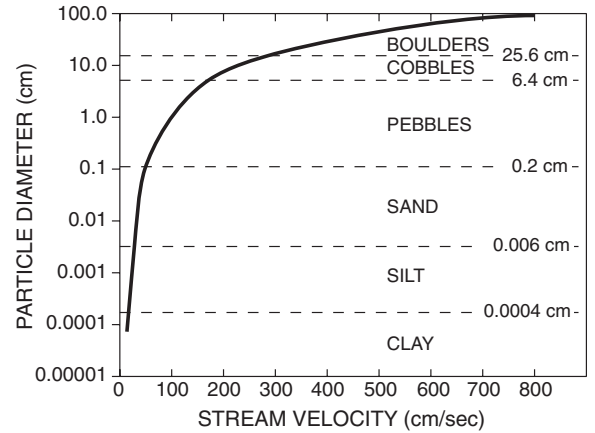
- Divergent Plate Boundary (usually broken by transform faults along mid-ocean ridges)
- Convergent Plate Boundary (Subduction Zone)
  - overriding plate
  - subducting plate
- Transform Plate Boundary (Transform Fault)
- Complex or Uncertain Plate Boundary
- Relative Motion at Plate Boundary
- Mantle Hot Spot
- Mid-Ocean Ridge

NOTE: Not all plates and boundaries are shown.

## Rock Cycle in Earth's Crust



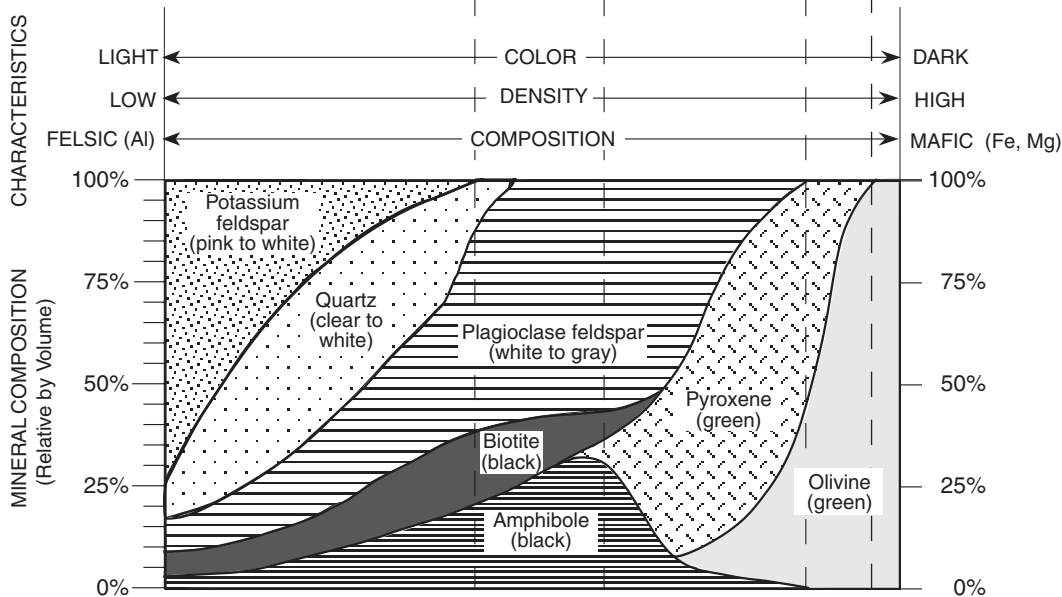
## Relationship of Transported Particle Size to Water Velocity




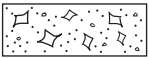
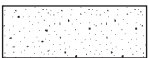
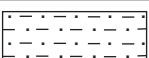

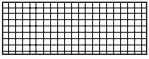
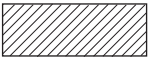
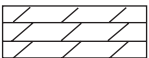
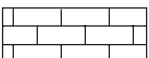

\*This generalized graph shows the water velocity needed to maintain, but not start, movement. Variations occur due to differences in particle density and shape.

## Scheme for Igneous Rock Identification








				GRAIN SIZE		TEXTURE			
IGNEOUS ROCKS	ENVIRONMENT OF FORMATION EXTRUSIVE (Volcanic)	Obsidian (usually appears black)		Basaltic Glass		Non-crystalline	Glassy	Non-vesicular	
		Pumice		Vesicular Basaltic Glass				Vesicular (gas pockets)	
		Vesicular Rhyolite	Vesicular Andesite	Scoria / Vesicular Basalt		less than 1 mm	Fine	Non-vesicular	
		Rhyolite	Andesite	Basalt					
		ENVIRONMENT OF FORMATION INTRUSIVE (Plutonic)	Granite	Diorite	Gabbro	Peridotite Dunite	1 mm to 10 mm	Coarse	Non-vesicular
			Pegmatite						
						10 mm or larger	Very Coarse		



## Scheme for Sedimentary Rock Identification

INORGANIC LAND-DERIVED SEDIMENTARY ROCKS					
TEXTURE	GRAIN SIZE	COMPOSITION	COMMENTS	ROCK NAME	MAP SYMBOL
Clastic (fragmental)	Pebbles, cobbles, and/or boulders embedded in sand, silt, and/or clay	Mostly quartz, feldspar, and clay minerals; may contain fragments of other rocks and minerals	Rounded fragments	Conglomerate	
			Angular fragments	Breccia	
	Sand (0.2 to 0.006 cm)		Fine to coarse	Sandstone	
	Silt (0.006 to 0.0004 cm)		Very fine grain	Siltstone	
Clay (less than 0.0004 cm)	Compact; may split easily	Shale			
CHEMICALLY AND/OR ORGANICALLY FORMED SEDIMENTARY ROCKS					
TEXTURE	GRAIN SIZE	COMPOSITION	COMMENTS	ROCK NAME	MAP SYMBOL
Crystalline	Varied	Halite	Crystals from chemical precipitates and evaporites	Rock Salt	
	Varied	Gypsum		Rock Gypsum	
	Varied	Dolomite		Dolostone	
Bioclastic	Microscopic to coarse	Calcite	Cemented shell fragments or precipitates of biologic origin	Limestone	
	Varied	Carbon	From plant remains	Coal	

## Scheme for Metamorphic Rock Identification

TEXTURE	GRAIN SIZE	COMPOSITION	TYPE OF METAMORPHISM	COMMENTS	ROCK NAME	MAP SYMBOL
FOLIATED  MINERAL ALIGNMENT   BAND- ING	Fine	MICA QUARTZ FELDSPAR AMPHIBOLE GARNET PYROXENE	Regional  (Heat and pressure increase with depth) ↓	Low-grade metamorphism of shale	Slate	
	Fine to medium			Foliation surfaces shiny from microscopic mica crystals	Phyllite	
	Medium to coarse			Platy mica crystals visible from metamorphism of clay or feldspars	Schist	
				High-grade metamorphism; some mica changed to feldspar; segregated by mineral type into bands	Gneiss	
NONFOLIATED	Fine	Variable	Contact (Heat)	Various rocks changed by heat from nearby magma/lava	Hornfels	
	Fine to coarse	Quartz	Regional or Contact	Metamorphism of quartz sandstone	Quartzite	
		Calcite and/or dolomite		Metamorphism of limestone or dolostone	Marble	
	Coarse	Various minerals in particles and matrix		Pebbles may be distorted or stretched	Metaconglomerate	