

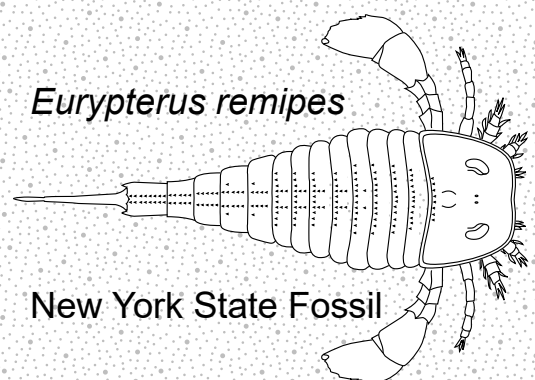
Reference Tables for EARTH & SPACE SCIENCES

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2024 EDITION

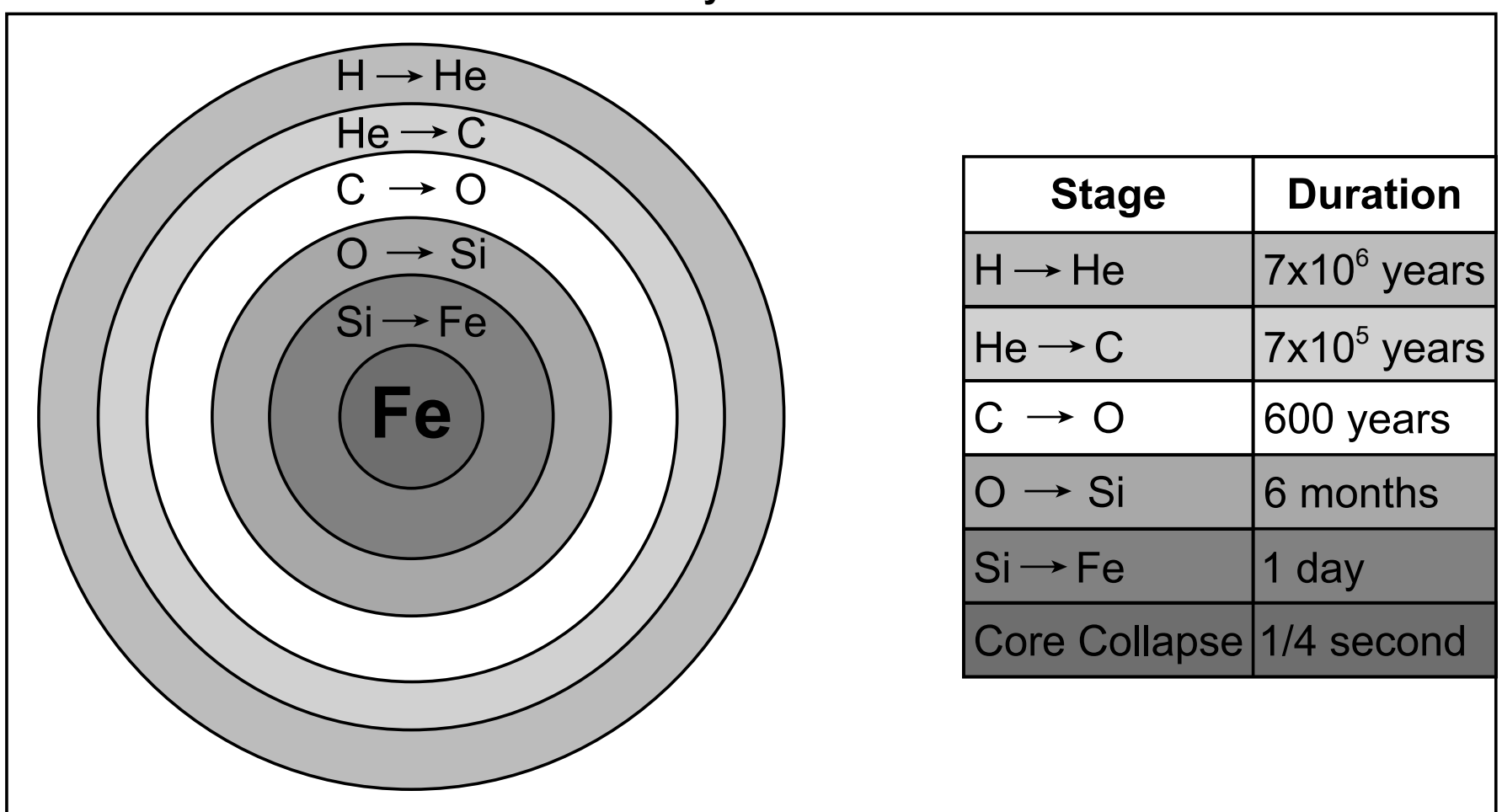
This edition of the Earth and Space Sciences Reference Tables should be used in the classroom beginning in the 2024–25 school year. The first examination for which these tables will be used is the June 2025 Regents Examination in Earth and Space Sciences.



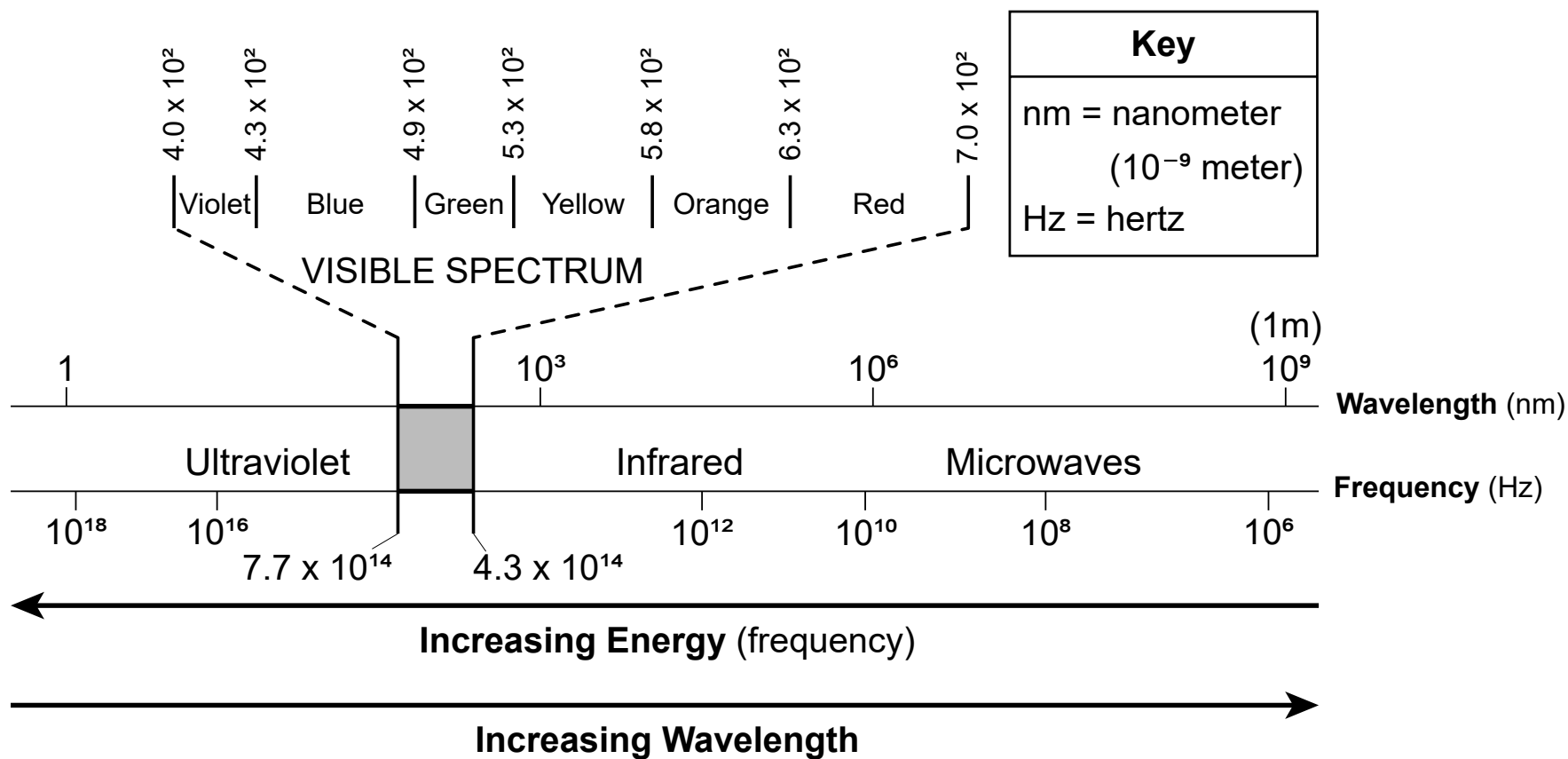
Solar System Objects Data Table

Celestial Object	Mean Distance from Sun (million km)	Period of Revolution (d=Earth days) (y=Earth years)	Period of Rotation at Equator	Eccentricity of Orbit	Equatorial Diameter (km)	Axial Tilt (°)
SUN	---	---	27 d	---	1,392,000	7.25
MERCURY	57.9	88 d	59 d	0.206	4879	0.03
VENUS	108.2	224.7 d	243 d	0.007	12,104	177.4
EARTH	149.6	365.26 d	23 h 56 min 4 s	0.017	12,756	23.49
EARTH'S MOON	149.6 (0.385 from Earth)	27.3 d	27.3 d	0.055	3476	6.68
MARS	228.0	1.9 y	24 h 37 min 23 s	0.094	6792	25.19
CERES	414.0	4.6 y	9 h 6 min	0.076	~939	4.00
PALLAS	414.0	4.6 y	7 h 40 min	0.230	~546	84.00
JUPITER	778.5	11.9 y	9 h 50 min 30 s	0.048	142,984	3.13
SATURN	1432.0	29.5 y	10 h 14 min	0.054	120,536	26.73
URANUS	2867.0	83.7 y	17 h 14 min	0.047	51,118	97.77
NEPTUNE	4515.0	163.7 y	16 h	0.009	49,528	28.32
PLUTO	5906.4	248.0 y	6 d 9 h	0.250	2376	122.5
ERIS	10,000	557.2 y	1 d 1 h 58 min	0.436	2400	78.30

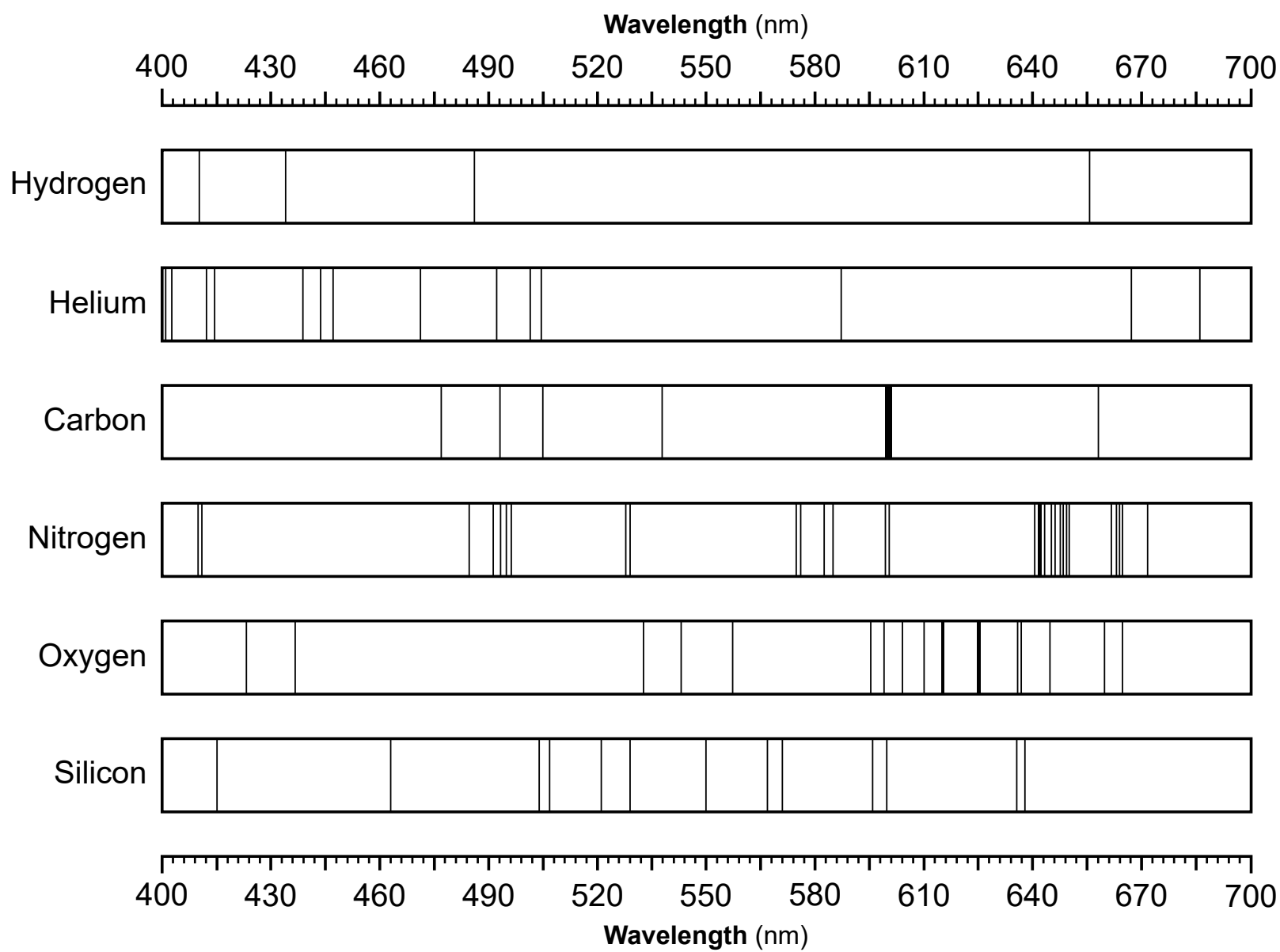
Generalized Nucleosynthesis in a Massive Star



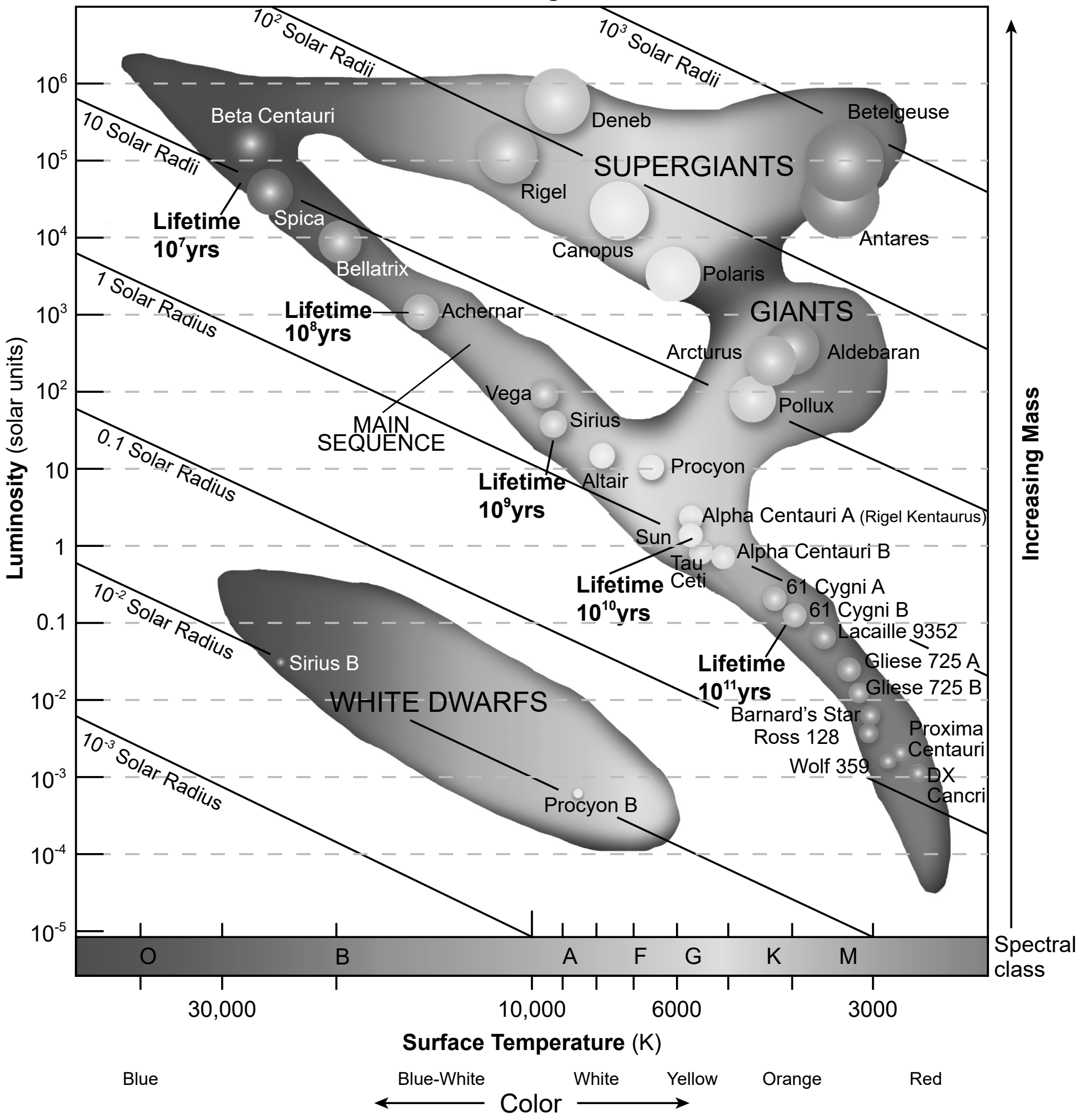
Portion of Electromagnetic Spectrum Related to Earth and Space Sciences



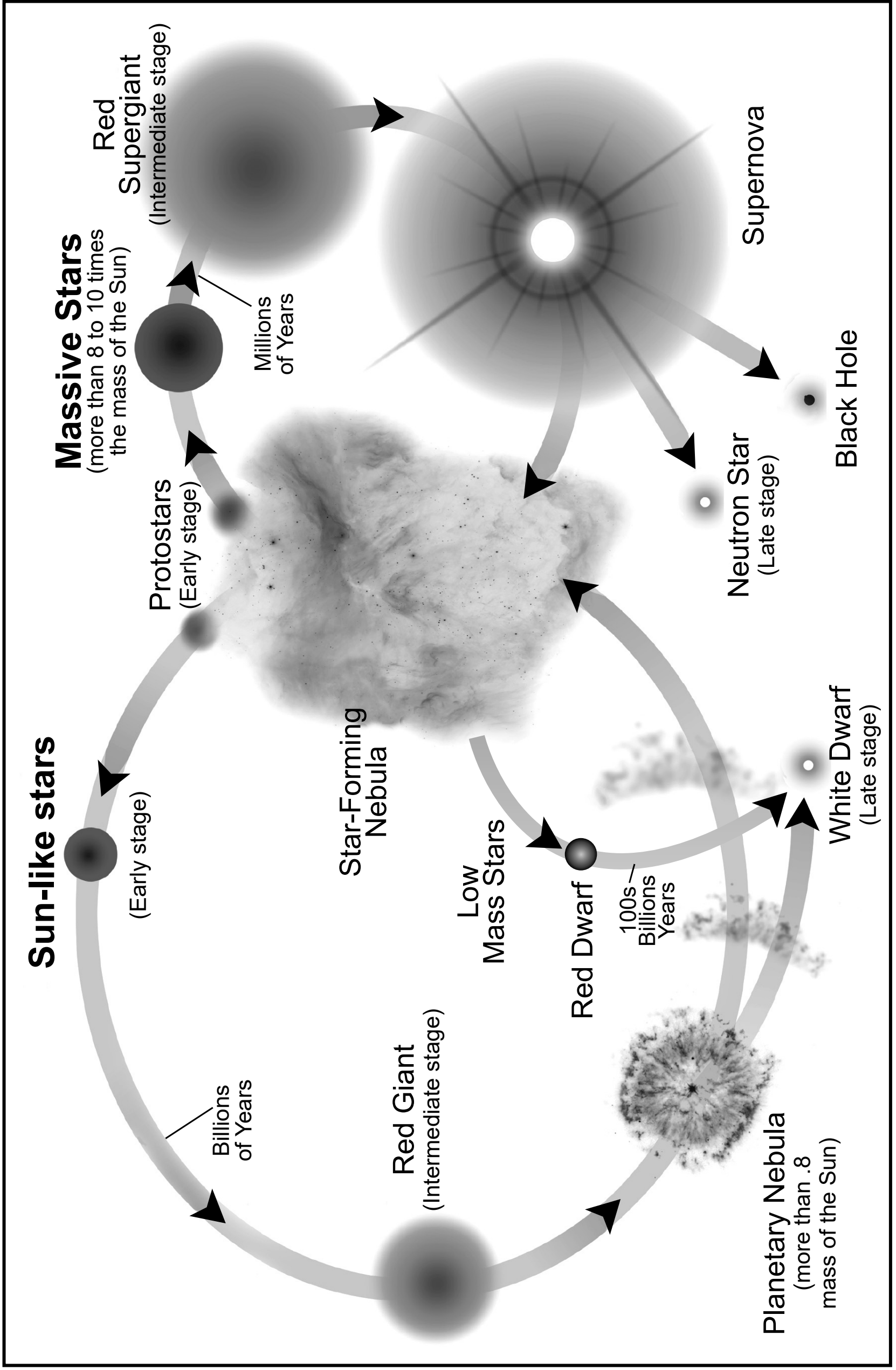
Emission Spectra of Some Elements from Stars



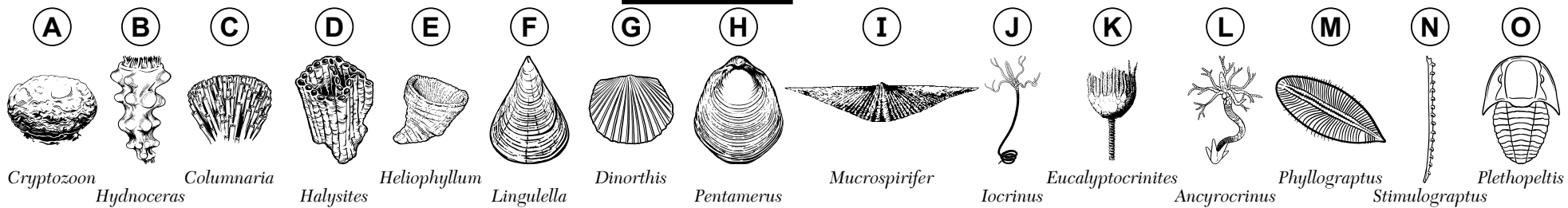
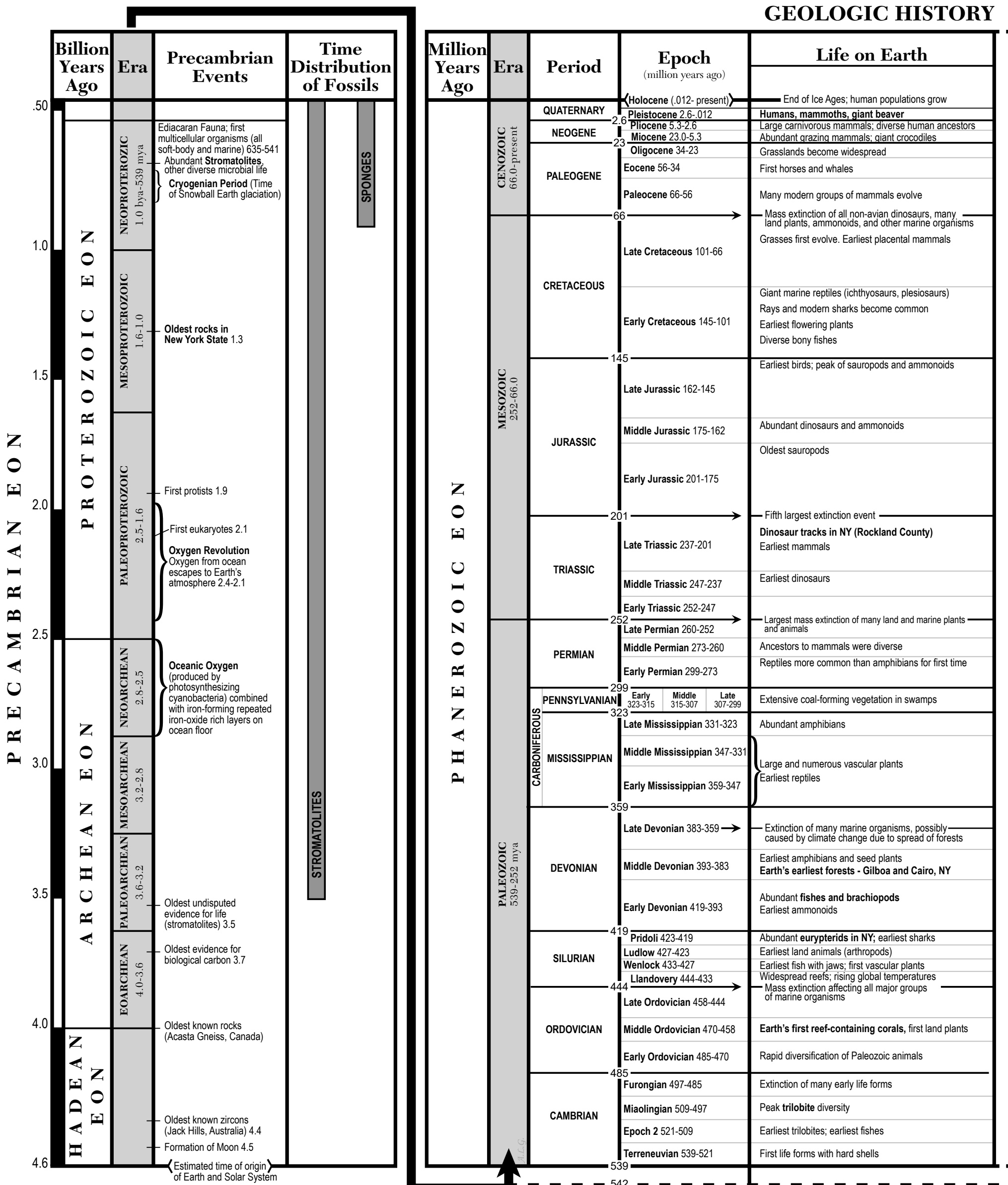
H-R Diagram



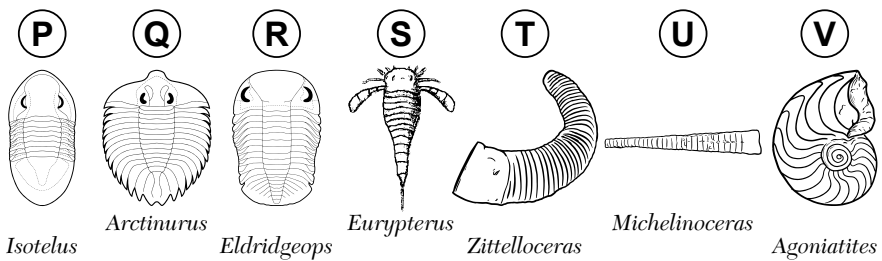
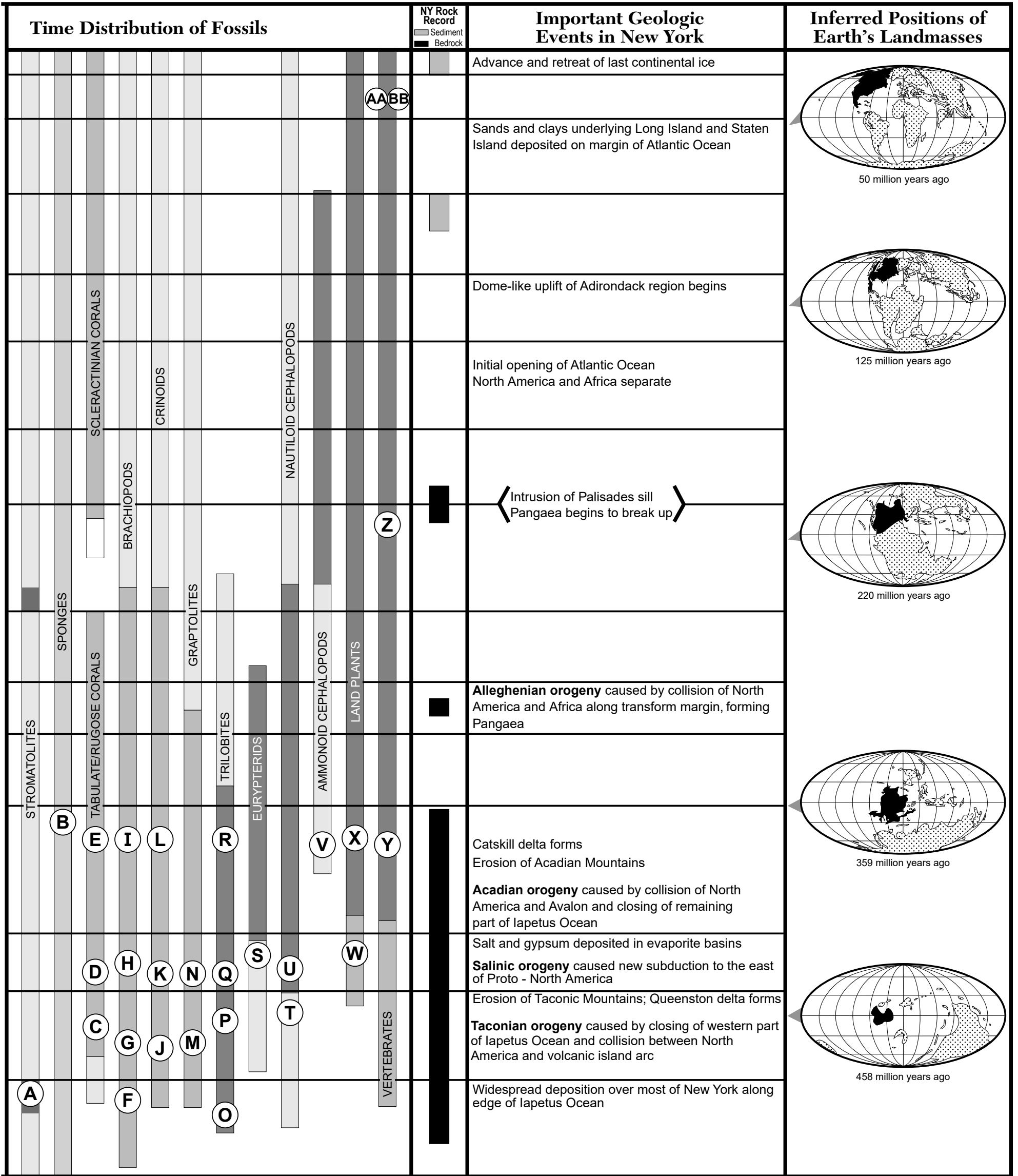
Life Cycles of Stars Model



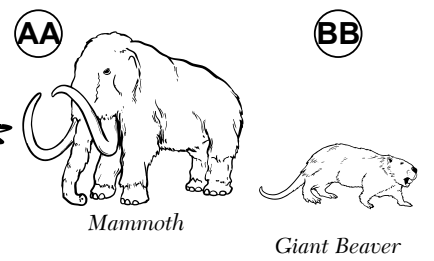
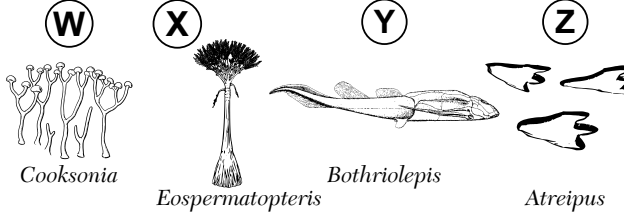
GEOLOGIC HISTORY



OF NEW YORK STATE

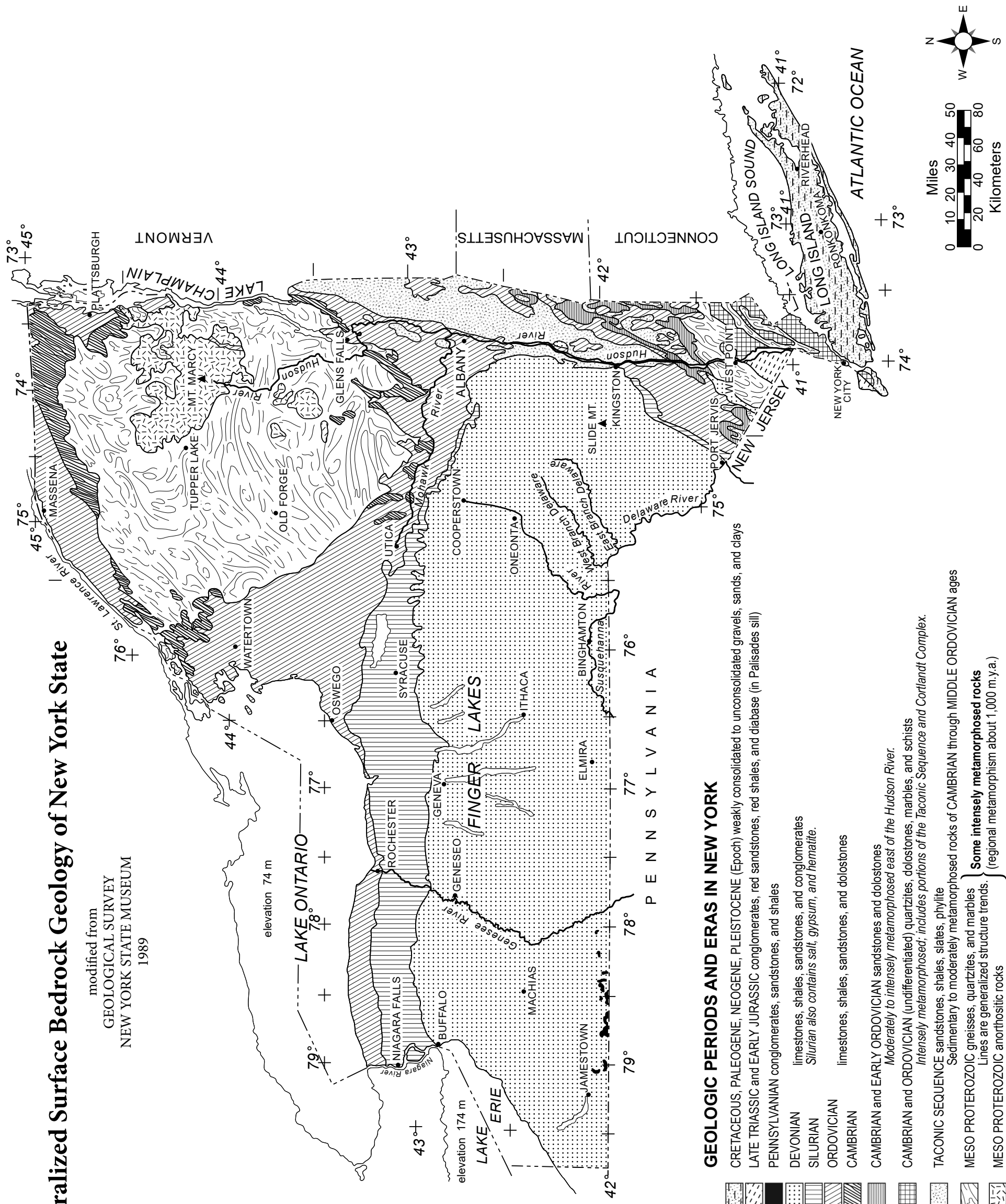


First opening of Iapetus Ocean. **Grenville orogeny:** Metamorphism of exposed bedrock - Adirondacks and Hudson Highlands.



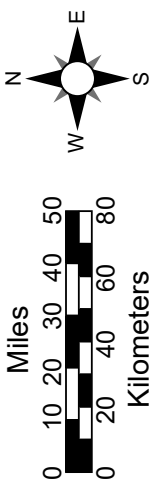
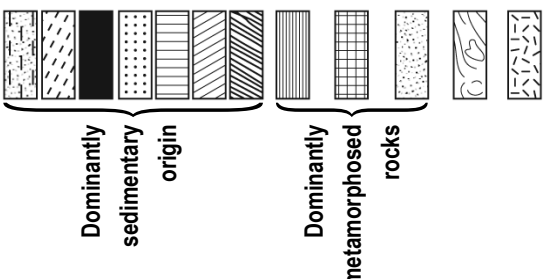
Generalized Surface Bedrock Geology of New York State

modified from
 GEOLOGICAL SURVEY
 NEW YORK STATE MUSEUM
 1989

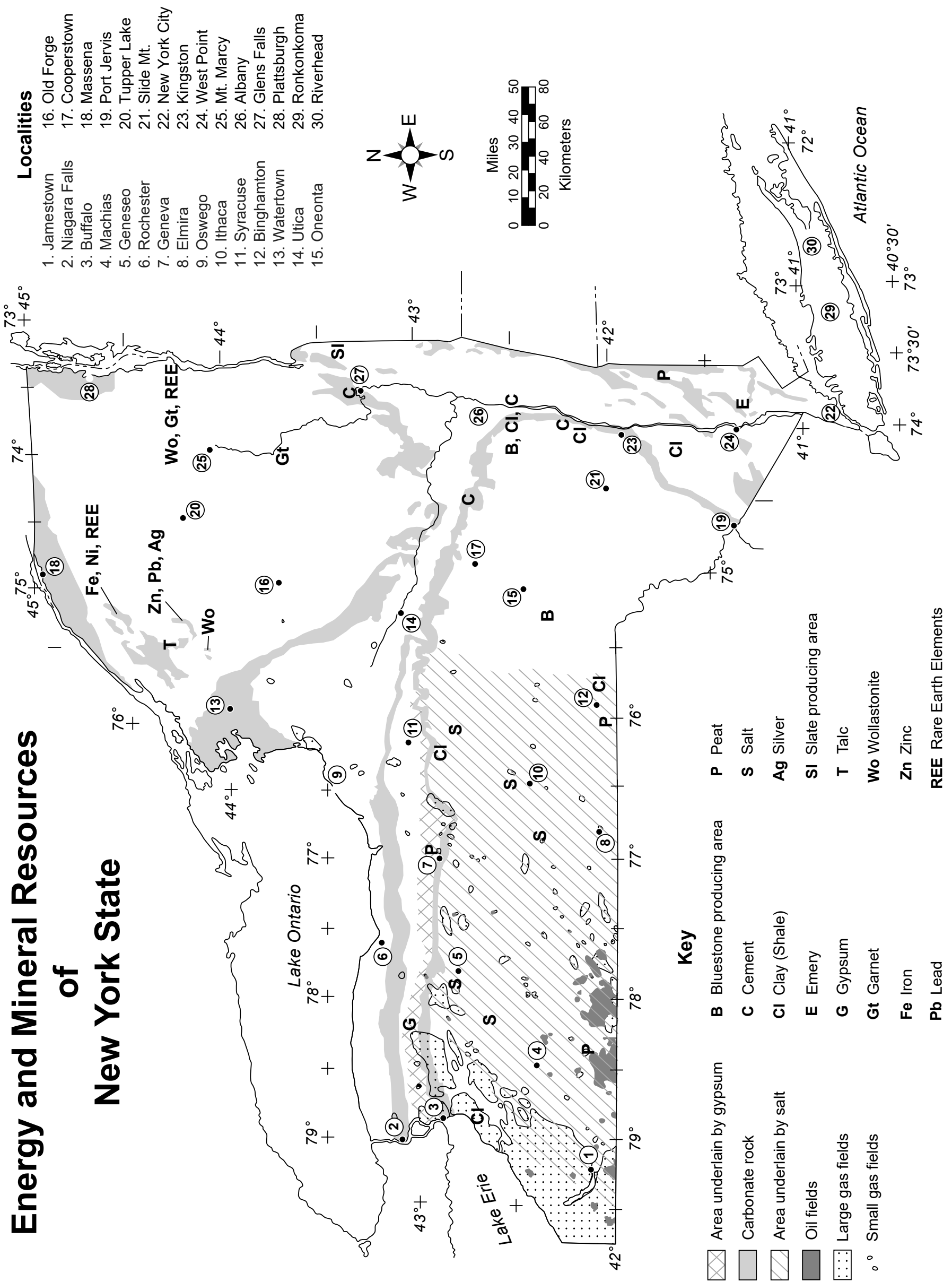


GEOLOGIC PERIODS AND ERAS IN NEW YORK

- CRETACEOUS, PALEOGENE, NEOGENE, PLEISTOCENE (Epoch) weakly consolidated to unconsolidated gravels, sands, and clays
- LATE TRIASSIC and EARLY JURASSIC conglomerates, red sandstones, red shales, and diabase (in Palisades sill)
- PENNSYLVANIAN conglomerates, sandstones, and shales
- DEVONIAN limestones, shales, sandstones, and conglomerates
Silurian also contains salt, gypsum, and hematite.
- SILURIAN limestones, shales, sandstones, and dolostones
- ORDOVICIAN
- CAMBRIAN
- 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, slates, phyllite
Sedimentary to moderately metamorphosed rocks of CAMBRIAN through MIDDLE ORDOVICIAN ages
- MESO PROTEROZOIC gneisses, quartzites, and marbles
Lines are generalized structure trends.
- MESO PROTEROZOIC anorthositic rocks
Some intensely metamorphosed rocks (regional metamorphism about 1,000 m.y.a.)



Energy and Mineral Resources of New York State

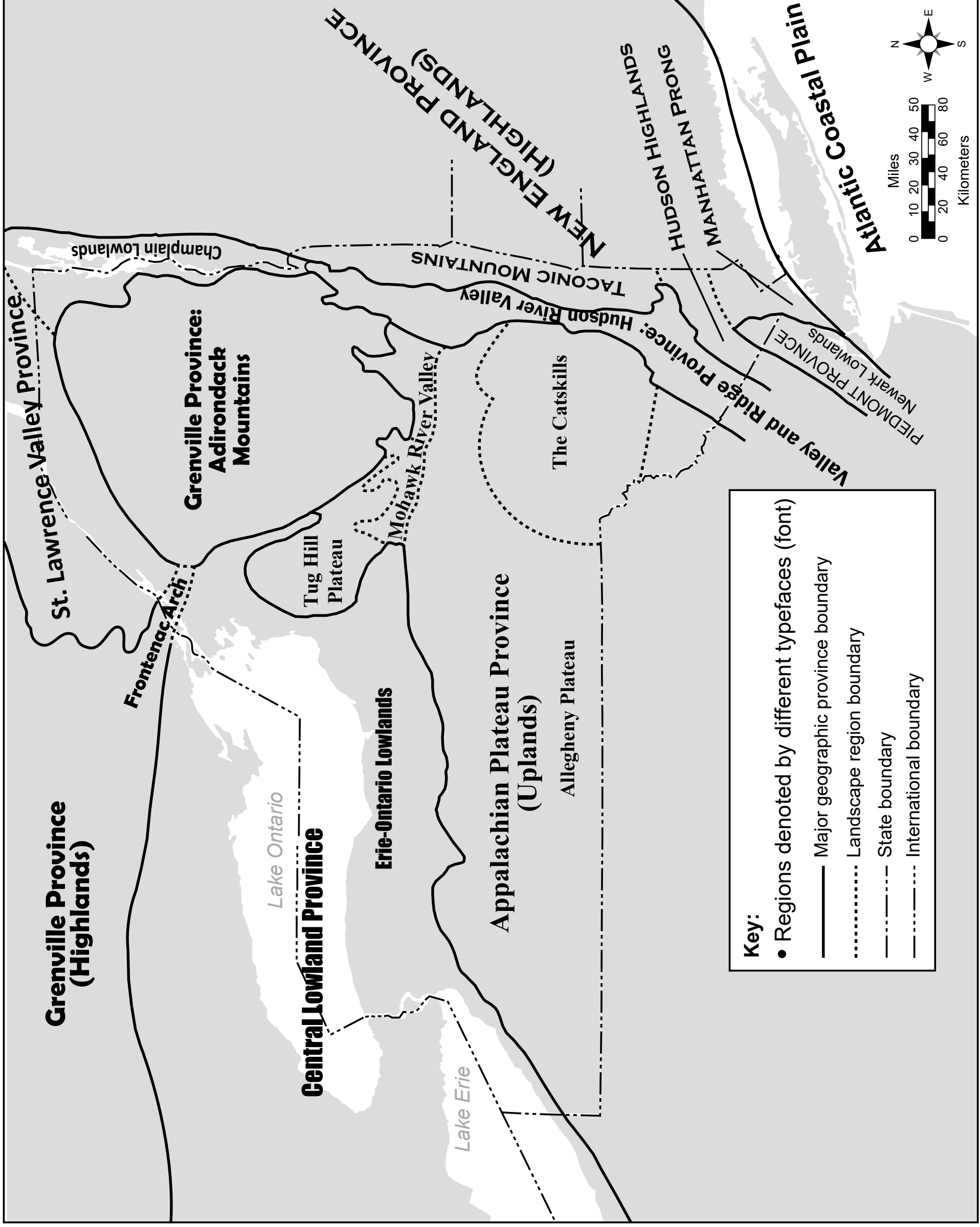


Localities

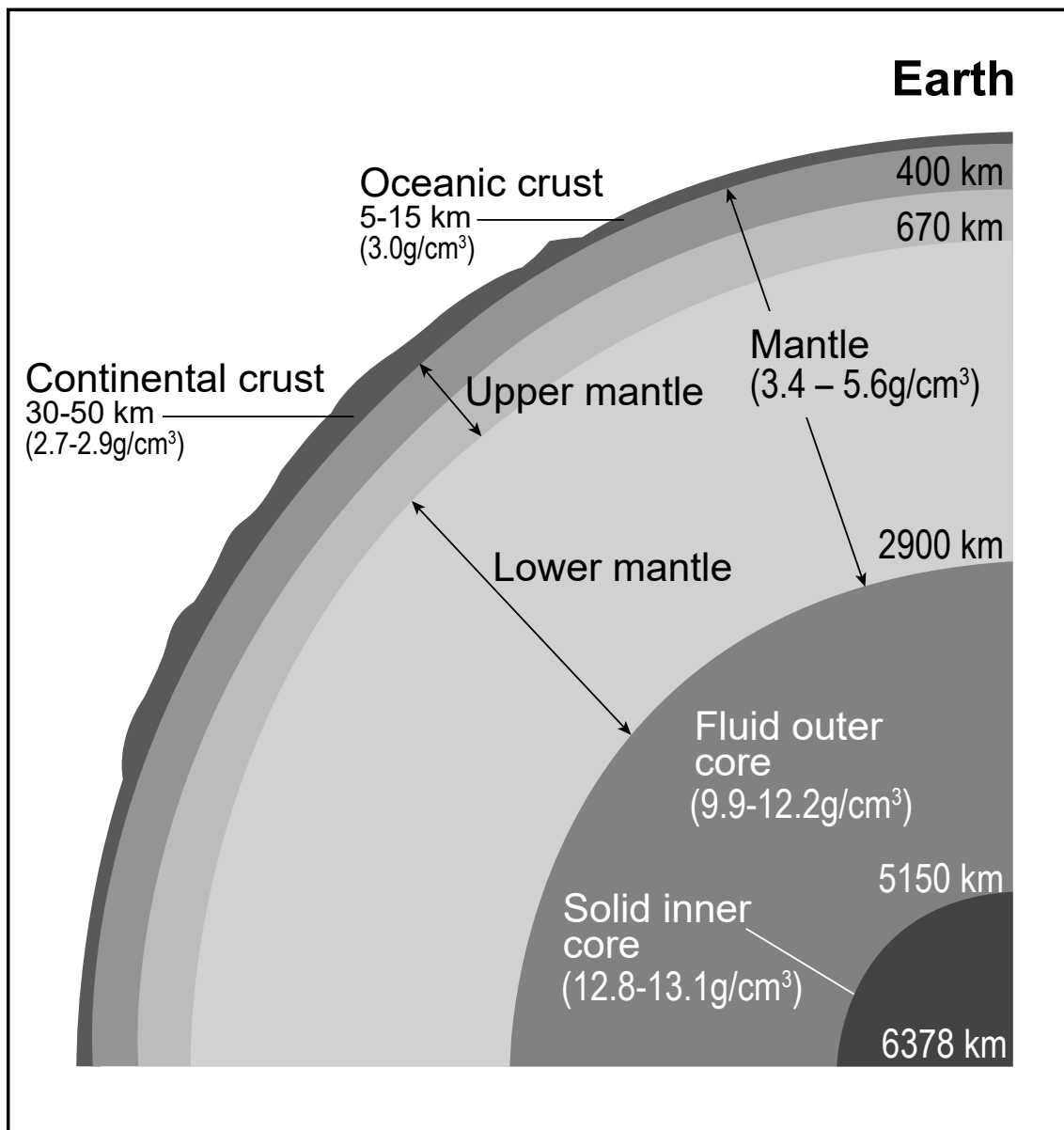
- | | |
|------------------|-------------------|
| 1. Jamestown | 16. Old Forge |
| 2. Niagara Falls | 17. Cooperstown |
| 3. Buffalo | 18. Massena |
| 4. Machias | 19. Port Jervis |
| 5. Geneseo | 20. Tupper Lake |
| 6. Rochester | 21. Slide Mt. |
| 7. Geneva | 22. New York City |
| 8. Elmira | 23. Kingston |
| 9. Oswego | 24. West Point |
| 10. Ithaca | 25. Mt. Marcy |
| 11. Syracuse | 26. Albany |
| 12. Binghamton | 27. Glens Falls |
| 13. Watertown | 28. Plattsburgh |
| 14. Utica | 29. Ronkonkoma |
| 15. Oneonta | 30. Riverhead |

- ### Key
- | | | | | | |
|--|--------------------------|-----------|--------------------------|------------|----------------------|
| | Area underlain by gypsum | B | Bluestone producing area | P | Peat |
| | Carbonate rock | C | Cement | S | Salt |
| | Area underlain by salt | CI | Clay (Shale) | Ag | Silver |
| | Oil fields | E | Emery | SI | Slate producing area |
| | Large gas fields | G | Gypsum | T | Talc |
| | Small gas fields | Gt | Garnet | Wo | Wollastonite |
| | | Fe | Iron | Zn | Zinc |
| | | Pb | Lead | REE | Rare Earth Elements |
| | | Ni | Nickel | | |

GEOGRAPHIC PROVINCE AND LANDSCAPE REGIONS OF NEW YORK STATE

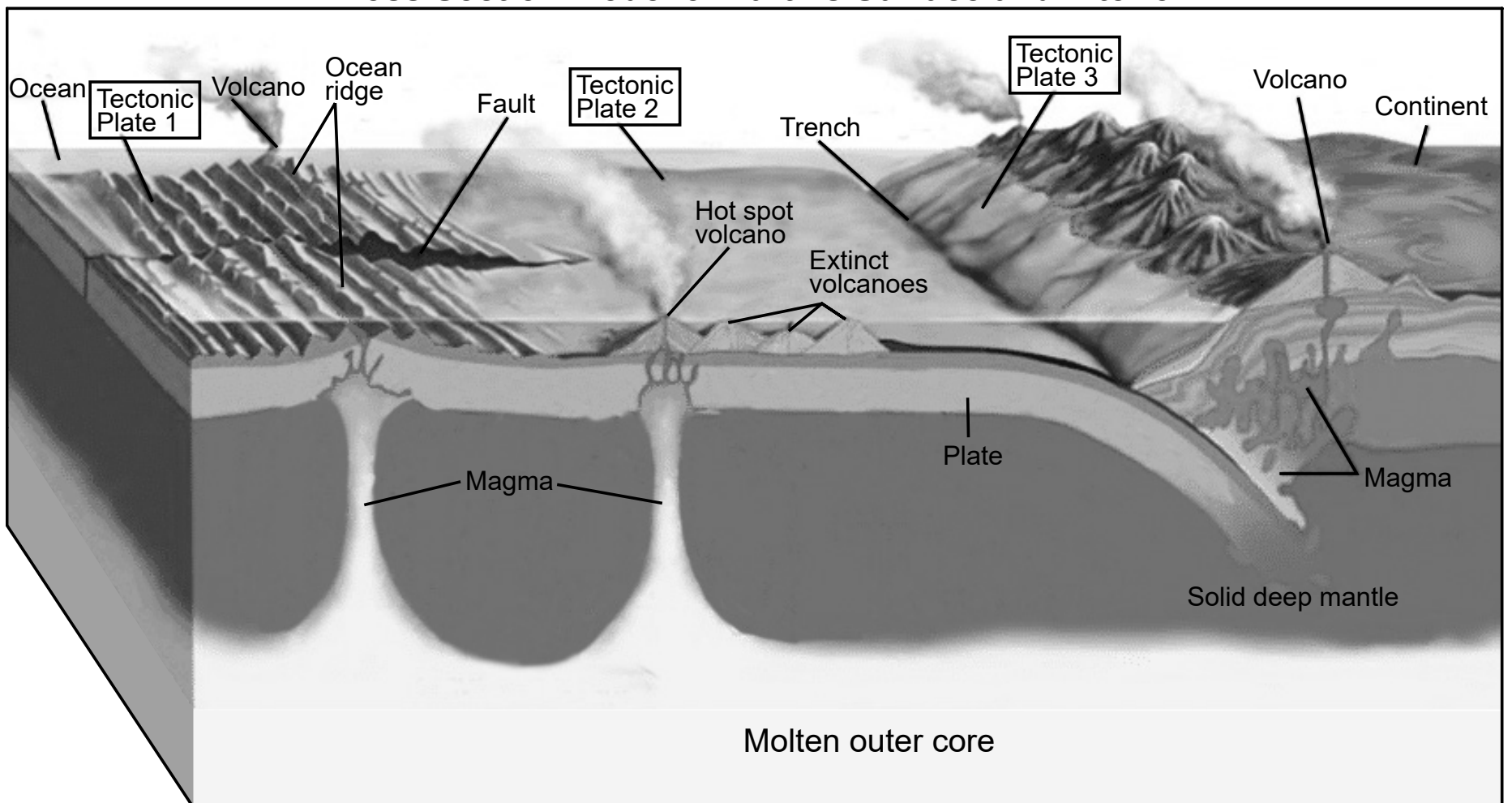


Model of Earth's Interior Structure



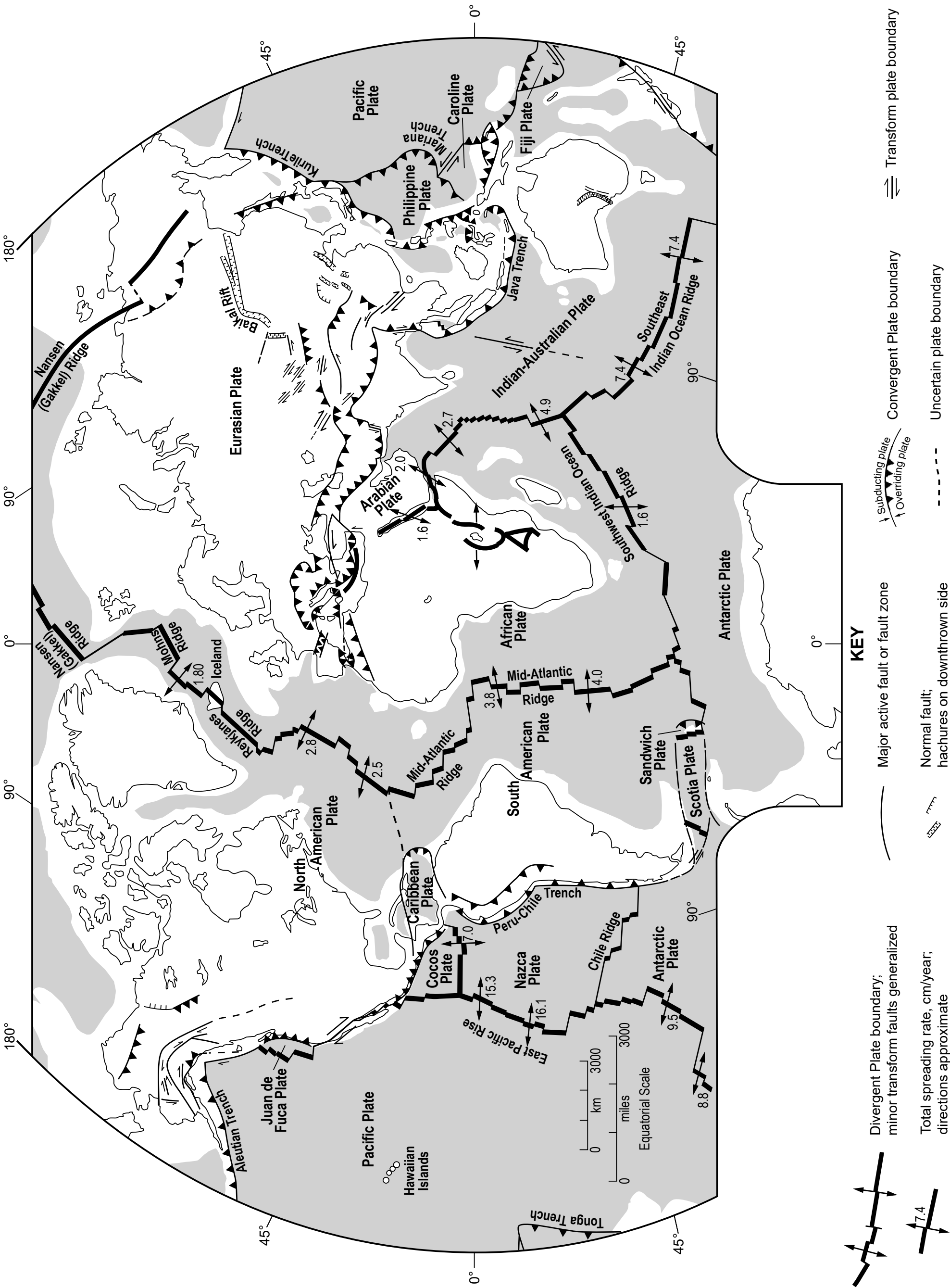
(Not drawn to scale)

Cross Section Model of Earth's Surface and Interior

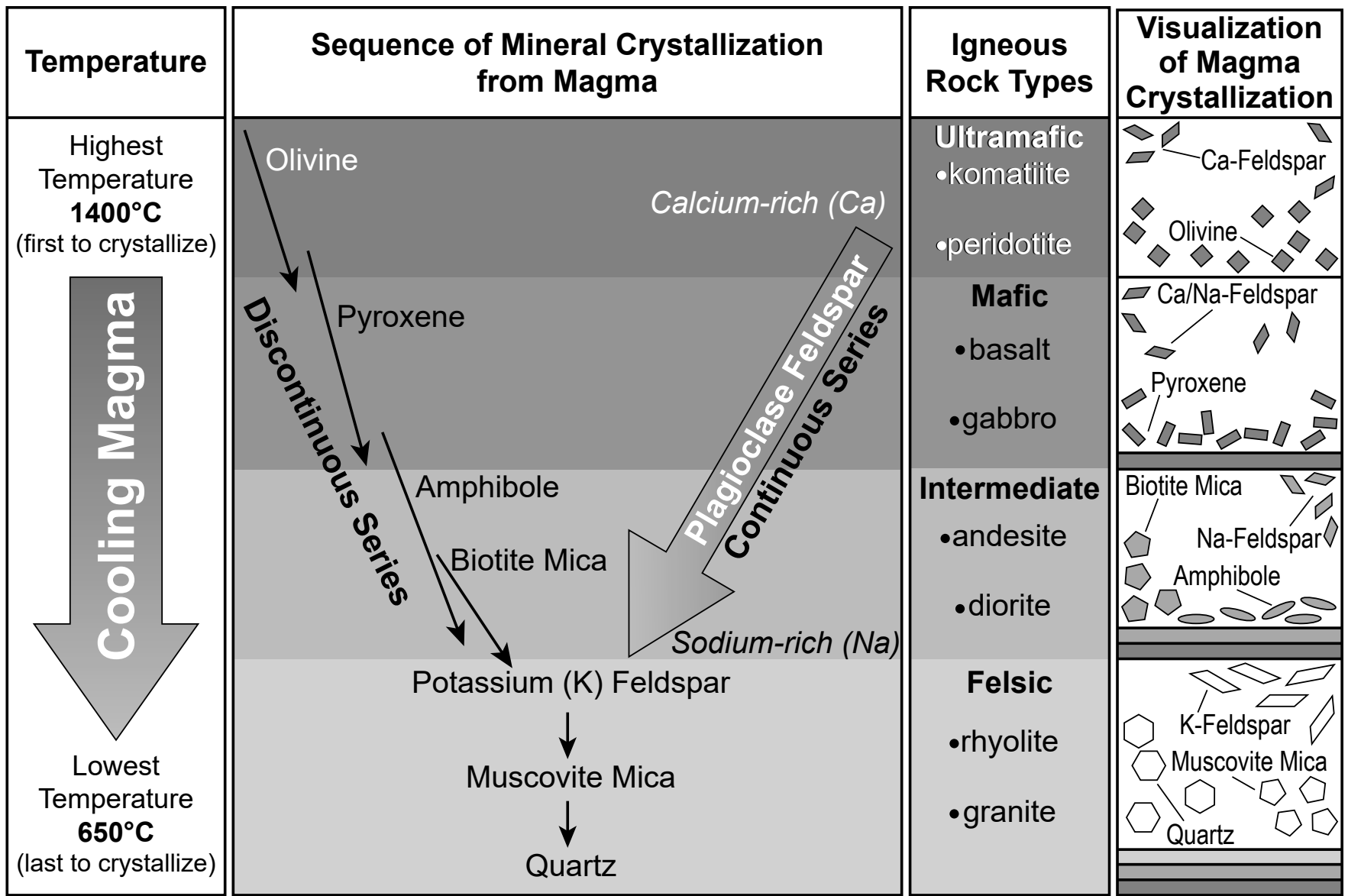


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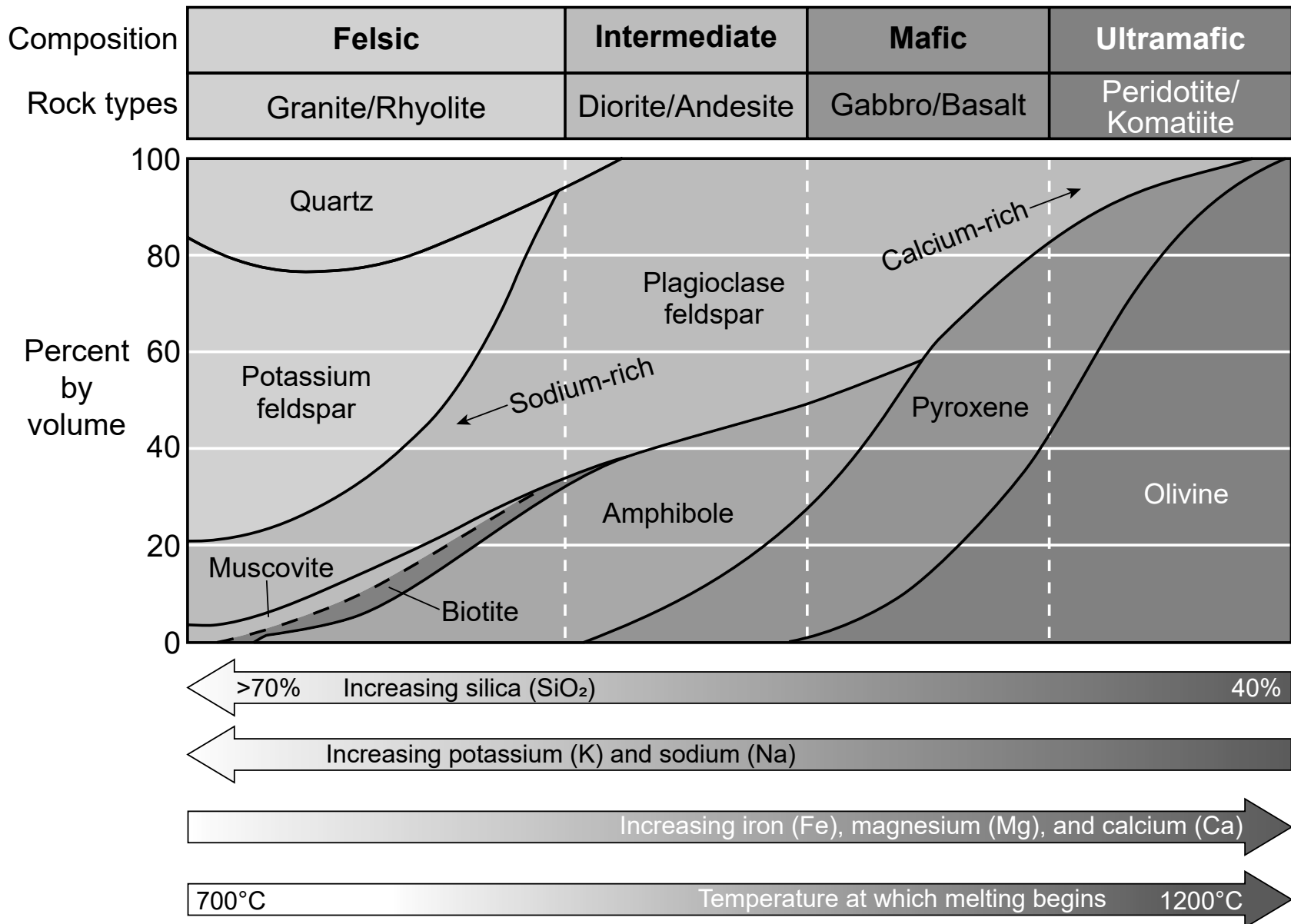
Global Tectonic Activity of the Last One Million Years



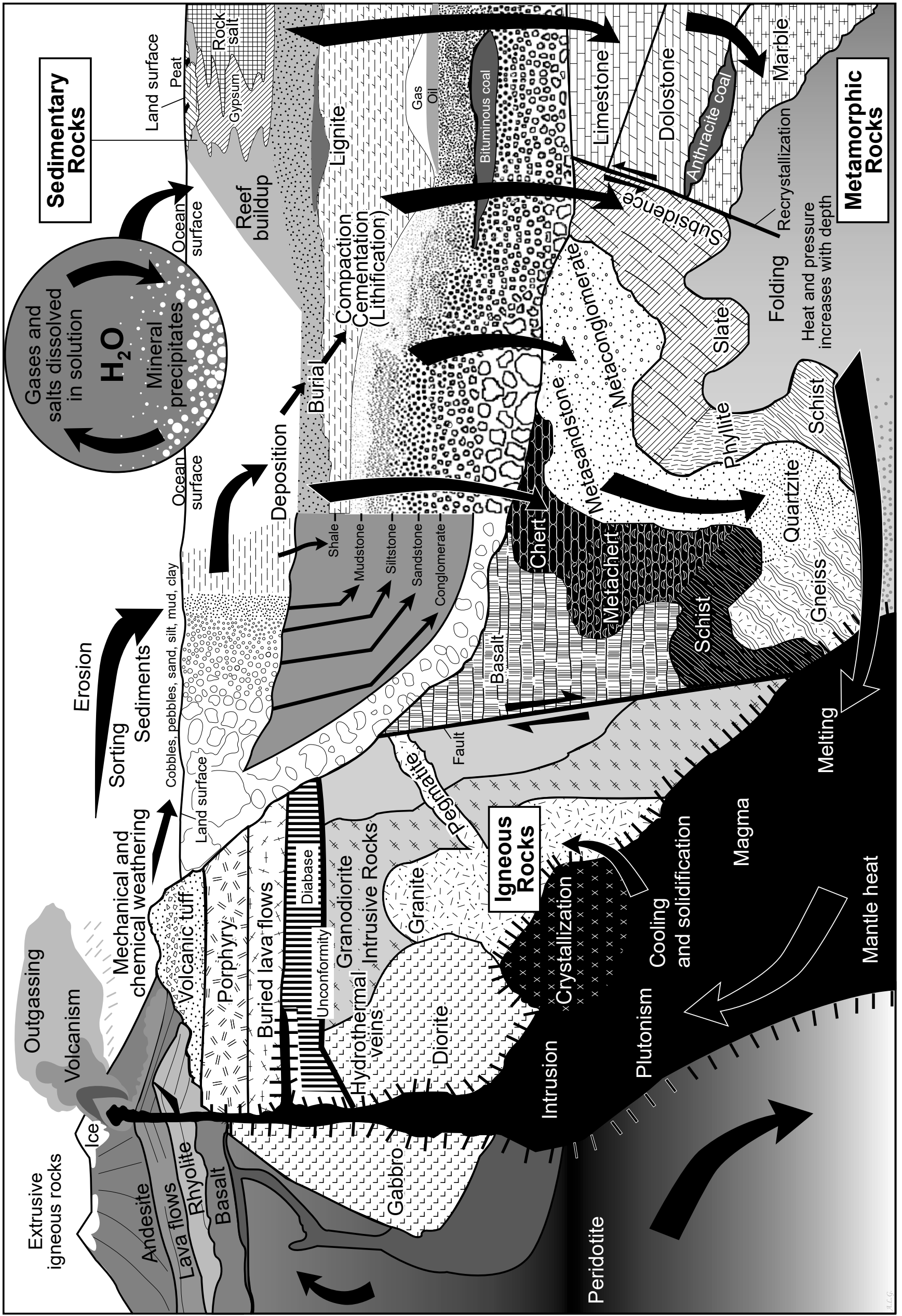
Model of Bowen's Reaction Series



Mineral Composition of Igneous Rocks



Rock Cycle Infographic



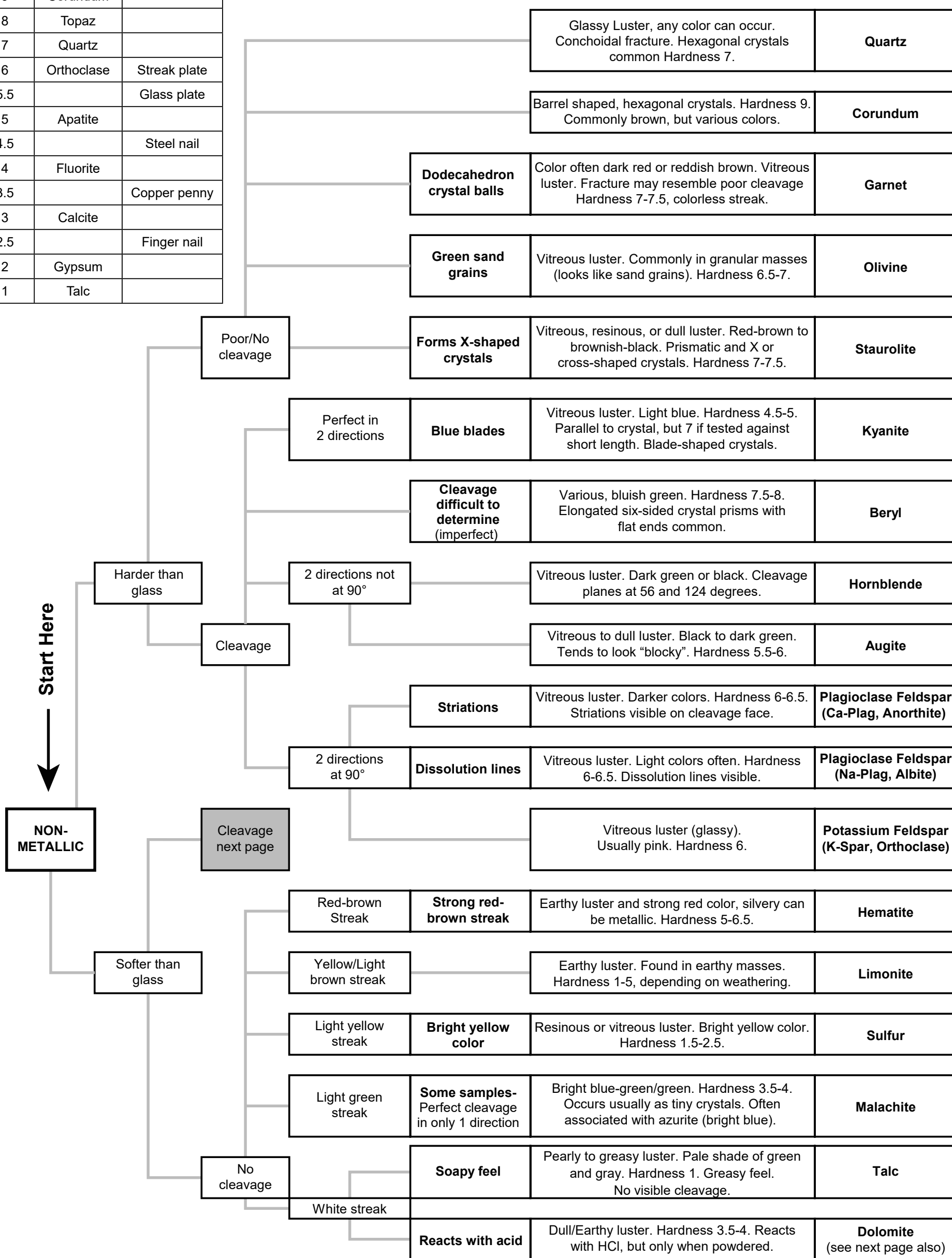
Geologically Important Radioactive Elements Used for Radiometric Dating

Parent Isotope	Daughter Decay Product	Half-life (years)	Useful Dating Range (years)	Datable Materials
Samarium-147	Neodymium-143	106 billion	10 million - 4.6 billion	Garnets, micas
Rubidium-87	Strontium-87	48.8 billion	10 million - 4.6 billion	Potassium-bearing minerals (mica, feldspar, hornblende), whole igneous or metamorphic rock
Uranium-238	Lead-206	4.5 billion	10 million - 4.6 billion	Uranium-bearing minerals (zircon, apatite, uraninite)
Uranium-235	Lead-207	713 million	10 million - 4.6 billion	Uranium-bearing minerals (zircon, apatite, uraninite)
Potassium-40	Argon-40	1.3 billion	100,000 - 4.6 billion	Potassium-bearing minerals (mica, feldspar, hornblende), igneous or volcanic rock tuff and/or lava flows)
Carbon-14	Nitrogen-14	5730	100 - 70,000	Organic materials, glacial ice containing carbon dioxide, groundwater, and ocean water

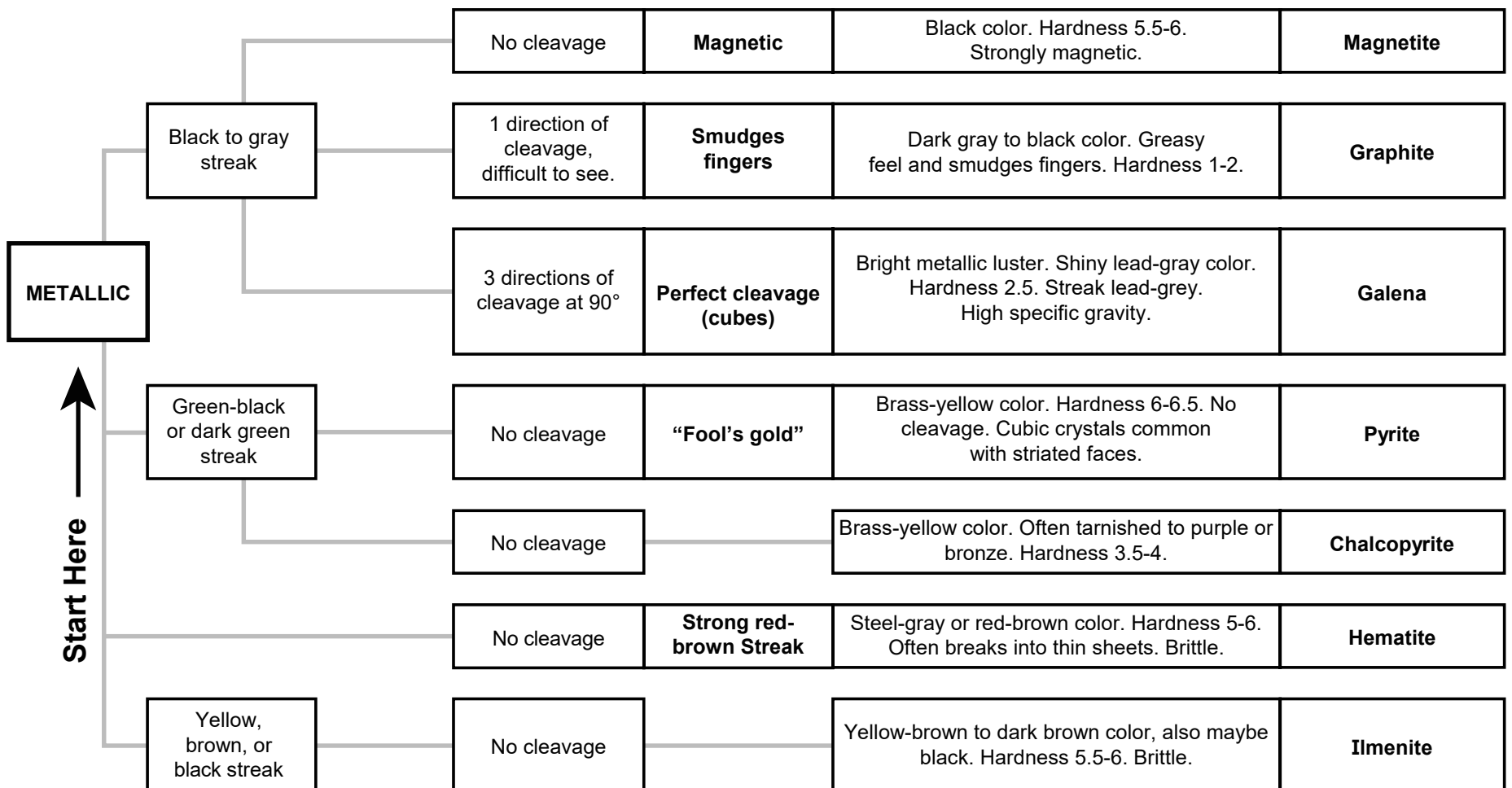
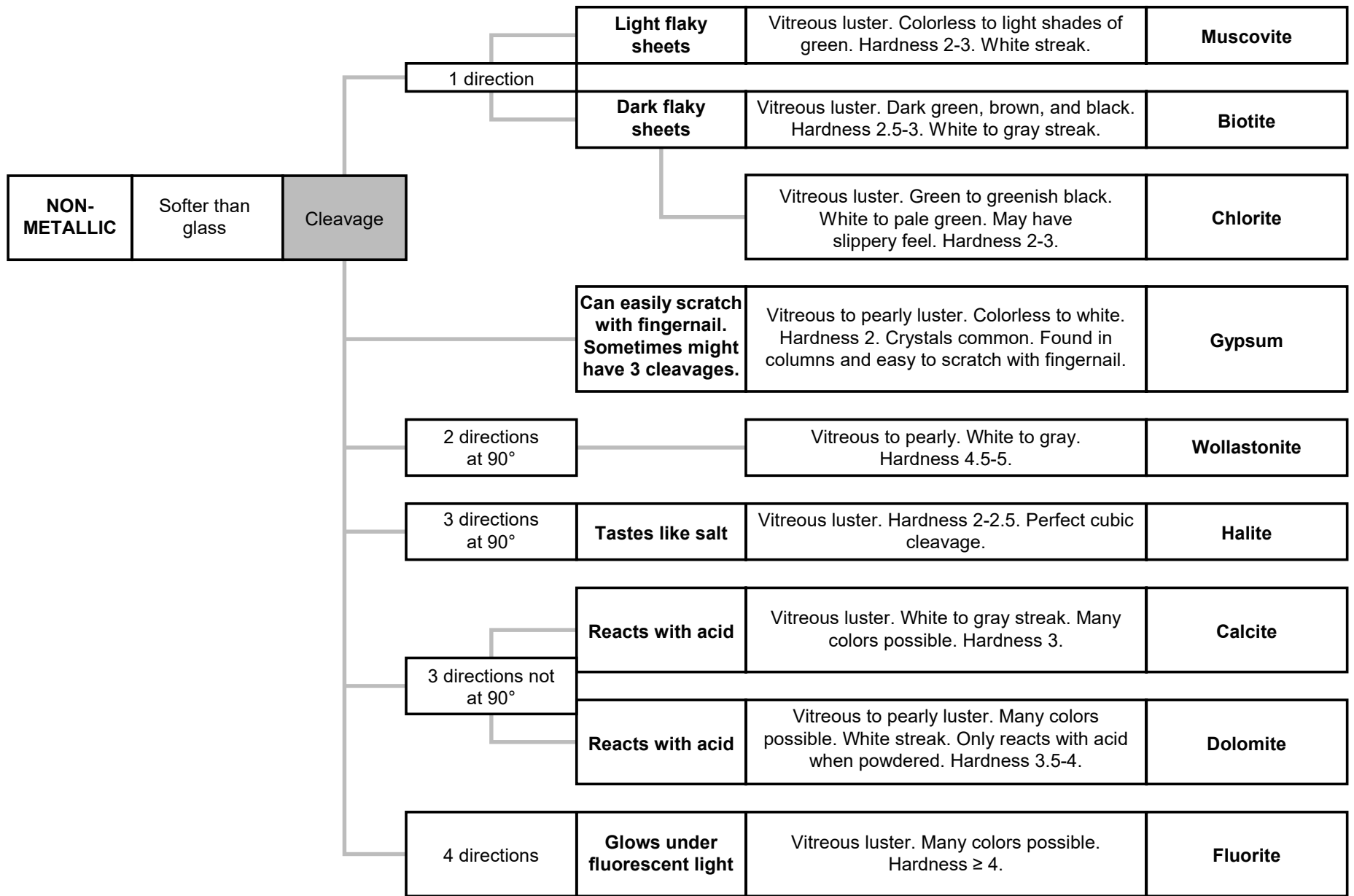
Mohs Hardness Scale

Hardness	Mineral Name	Tools
10	Diamond	
9	Corundum	
8	Topaz	
7	Quartz	
6	Orthoclase	Streak plate
5.5		Glass plate
5	Apatite	
4.5		Steel nail
4	Fluorite	
3.5		Copper penny
3	Calcite	
2.5		Finger nail
2	Gypsum	
1	Talc	

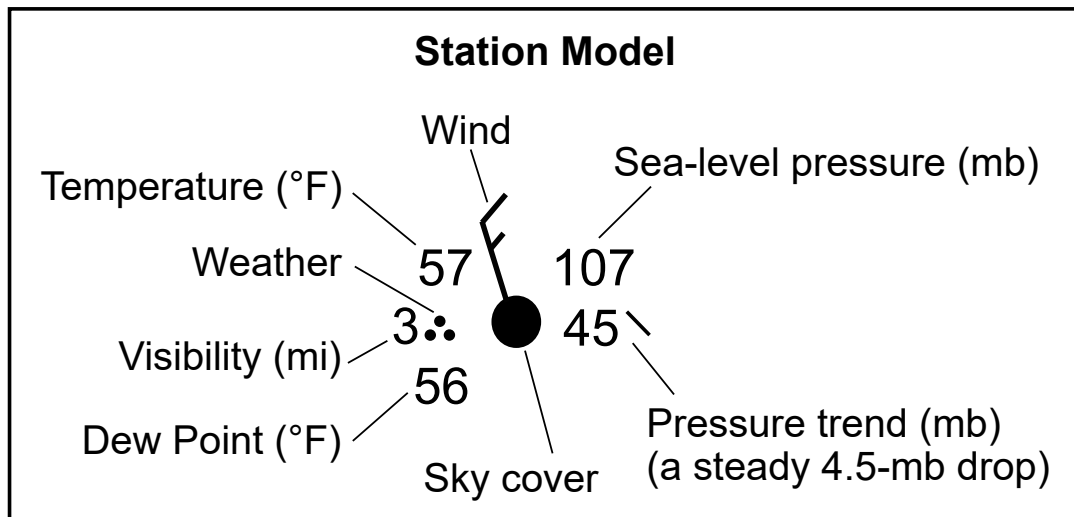
Mineral Identification Flowchart



Mineral Identification Flowchart (Continued)



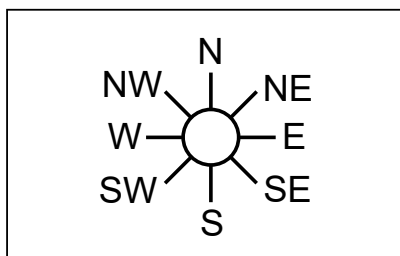
Key to Weather Map Symbols



Wind Speed

	Calm
	<5 knots
	5 knots
	10 knots
	20 knots
	25 knots
	50 knots

Wind Direction



Air Pressure

H	High
L	Low

Pressure

Sea-level pressure is plotted in tenths of millibars (mb) with the leading 10 or 9 omitted.

410:	1041.0 mb
103:	1010.3 mb
987:	998.7 mb
872:	987.2 mb

Weather Conditions

	Intermittent		
	Light	Moderate	Heavy
Rain	●	●●	●●●
Snow	*	**	***
Drizzle	◡	◡◡	◡◡◡
	Steady		
	Light	Moderate	Heavy
Rain	●●	●●●	●●●●
Snow	**	**	**
Drizzle	◡◡	◡◡◡	◡◡◡◡
Thunderstorms			
	Light	Heavy	
Rain			
Snow			
Hail			
Hail			
Tornado			
Hurricane			
Sleet			
Snow grains			
Drifting snow			
	Freezing Drizzle:		
	Light	Heavy	
	Freezing Rain:		
	Light	Heavy	

Sky Cover

	No Clouds
	1/10
	1/4
	1/2
	3/4
	9/10
	Completely overcast
	Sky obscured

Pressure Trend (previous 3 hours)

	Rising continuously
	Falling continuously
	Rising, rising, falling
	Falling, steady, falling

Misc. Sky Cover

	Haze
	Smoke
	Dust/Sand
	Fog in patches
	Light fog
	Heavy fog

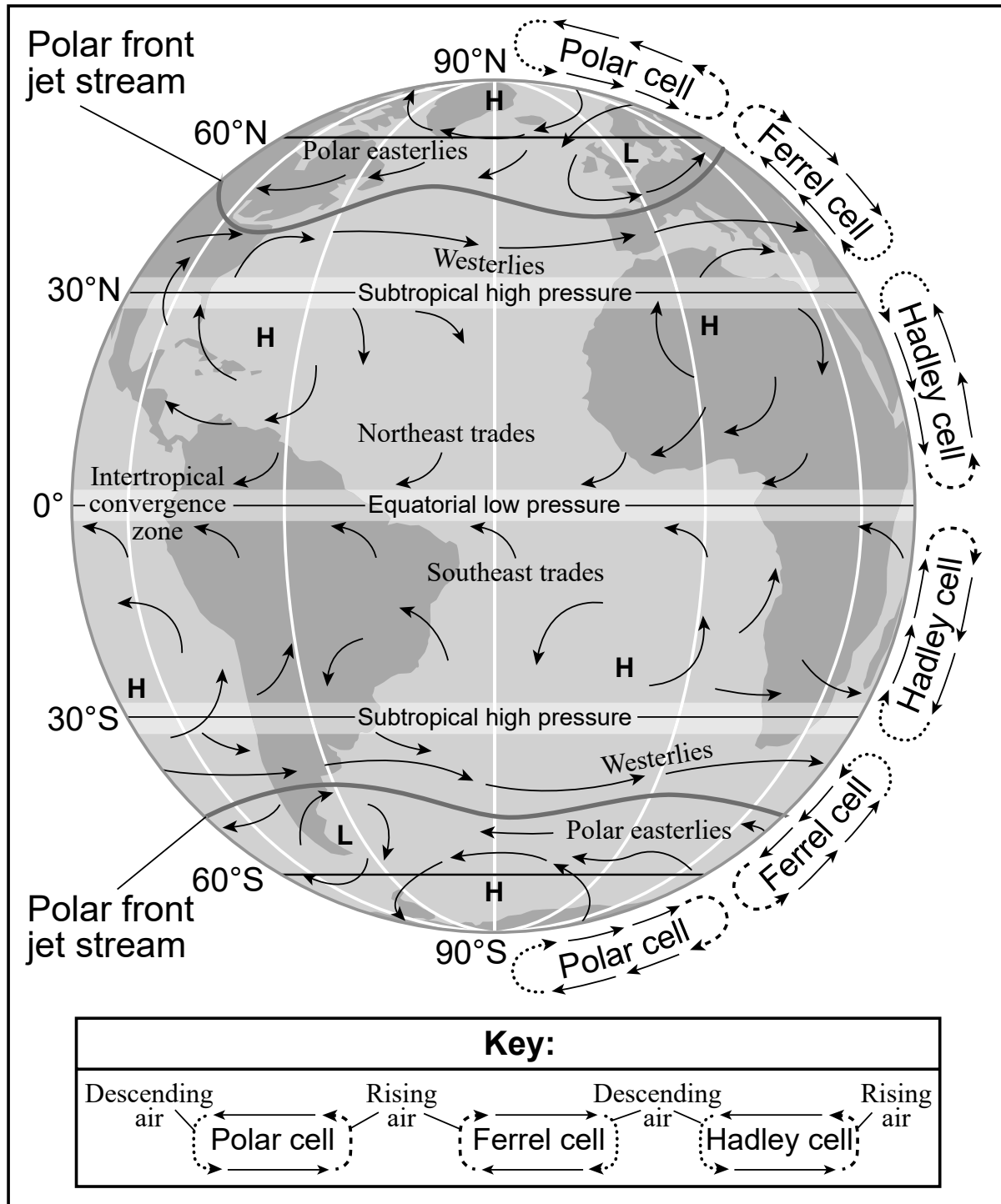
Showers

	Slight rain
	Moderate/Heavy rain
	Violent rain
	Sleet
	Slight snow
	Moderate/Heavy snow

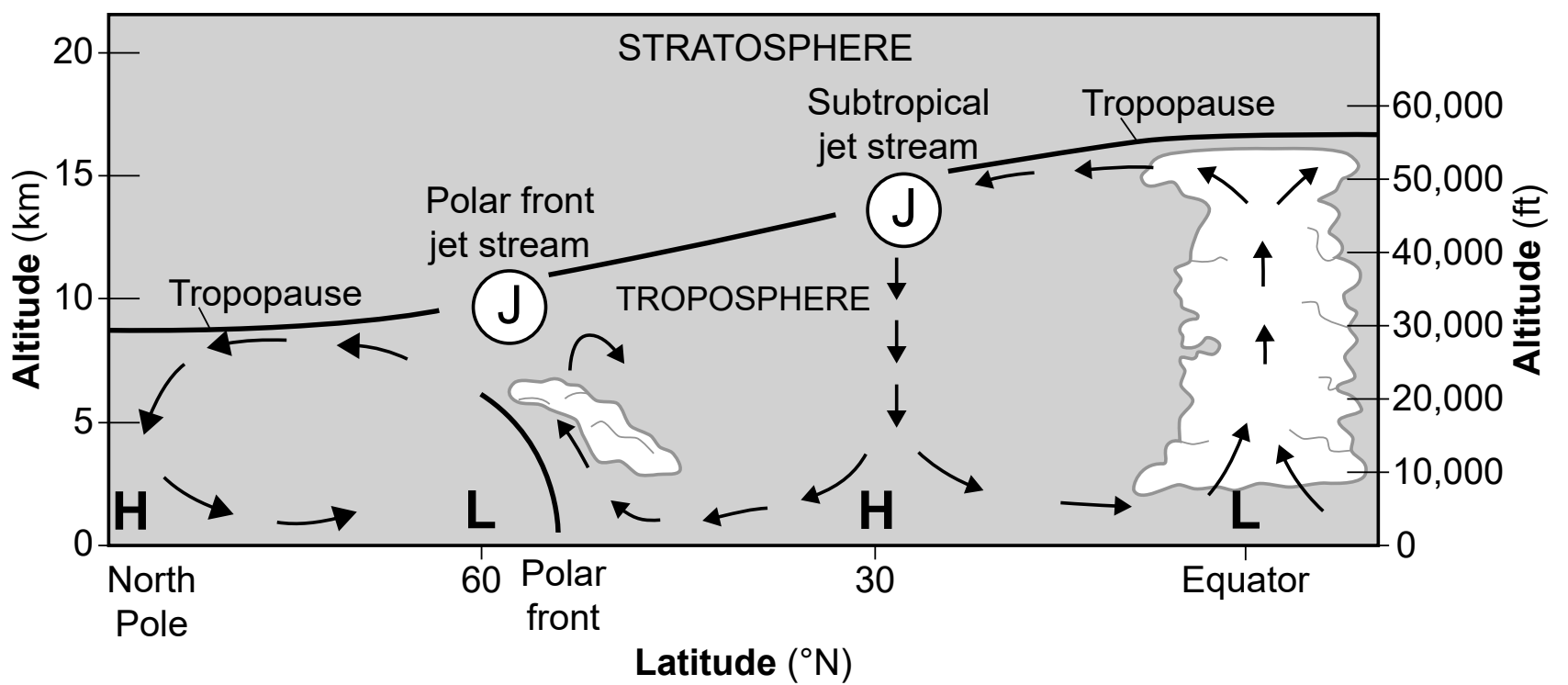
Fronts

Cold	
Warm	
Stationary	
Occluded	

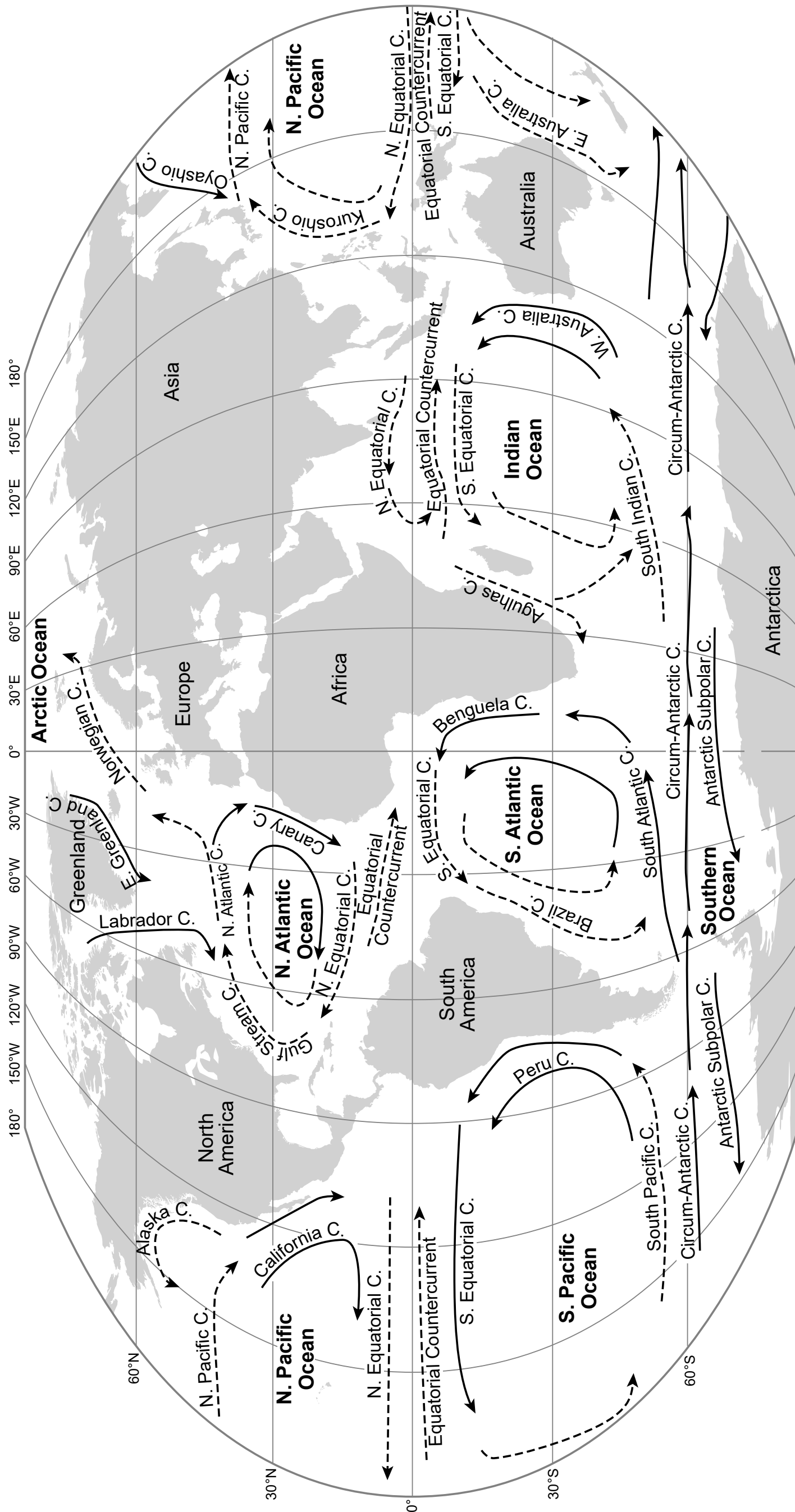
Model of Generalized Planetary Wind Belts in the Troposphere



Cross Section Model of Earth's Lower Atmosphere



Surface Ocean Currents Model



Key	
----->	Warm currents
————>	Cold currents