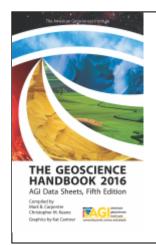


Published on *American Geosciences Institute* (https://www.americangeosciences.org) Home > The Geoscience Handbook, AGI Data Sheets Fifth Edition

## The Geoscience Handbook, AGI Data Sheets Fifth Edition



For more than 40 years, AGI's Data Sheets have been a critical tool for the geoscientist in field, the lab, and the classroom. For decades its bright orange cover and three-ring binding was distinctive in the geoscience community. The book evolved into its current, full-color and spiral bound format with the 2005 debut of the fourth edition.

Now AGI has tapped some of the best minds in the geosciences to produce this fifth edition. Featuring the contributions of over 240 experts worldwide in their respective fields, this new, expanded edition is over 470 full-color pages. Three years of work went into the Handbook to broaden its scope across the disciplines. With more than 170 complete new data sheets, and full revisions of prior data sheets, over 85% of the content is either new or revised for the fifth edition. The Geoscience Handbook is the quick reference tool for key metrics and concepts, a guide to cornerstone papers and recent developments, as well as short tutorials on topics that may not be familiar to all geoscientists.

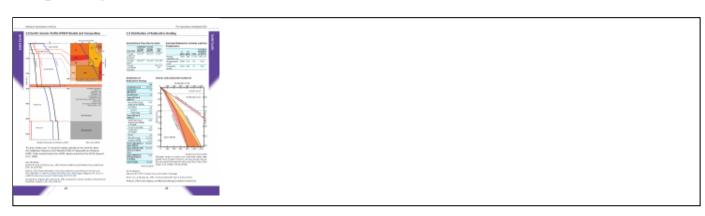
Edited by Mark Carpenter and Christopher M. Keane Graphics by Kathleen Cantner

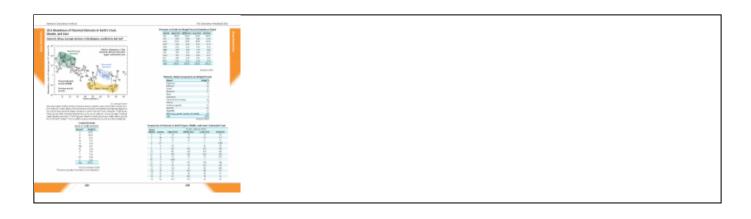
ISBN: 978-0-913312-47-6; \$59.99; 478 pages

# **Purchase Options**

**BUY NOW** from the American Geosciences Institute Bulk Orders. Discounts for orders of 5 or more copies at a time. Amazon.com

# **Sample Pages**





## **Table of Contents**

## **Geologic Time**

- 1.1 Chronostratigraphic Stages of the Last 2.7 Ma
- 1.2 Major Geochronologic and Chronostratigraphic Units
- 1.3 International Commission on Stratigraphy Time Scale
- 1.4 Geomagnetic Polarity Timescale from Marine Magnetic Anomalies
- 1.5 Geologic Time and the Biosphere
- 1.6 Major Fossil Groups Used for Dating and Correlation of Phanerozoic Strata in North America
- 1.7 Geologic Time and Human Evolution

#### **Solid Earth**

- 2.1 Earth's Lithospheric Plates
- 2.2 Age of the Oceanic Lithosphere
- 2.3 The World Magnetic Model 2015-2020
- 2.4 The Geoid
- 2.5 The Geoid in North America
- 2.6 Major Divisions of the Earth
- 2.7 Profile and Properties of Oceanic and Continental Crust
- 2.8 Earth's Seismic Profile (PREM Model) and Composition
- 2.9 Distribution of Radioactive Heating
- 2.10 Physical Data about the Earth

#### **Geologic Mapping**

- 3.1 General Standards for Geologic Maps
- 3.2 Geologic Map Symbols
- 3.3 Lithologic Patterns for Stratigraphic Columns and Cross Sections
- 3.4 U.S. Public Land Survey Grid

## Safety in the Field

- 4.1 Before You Leave
- 4.2 Field Research Safety Plan
- 4.3 Environmental Hazards and Diseases

## Mineralogy

- 5.1 Mineral Hardness
- 5.2 The 7 Crystal Systems
- 5.3 The 14 Bravais Lattices
- 5.4 Macroscopic Identification of Common Minerals and Selected Optical Properties
- 5.5 Data Pertaining to Important Non-Silicate Minerals
- 5.6 The Role of the Microscope and Related Techniques
- 5.7 Routine Mineral Determination in Plane- and Cross-Polarized Light
- 5.8 Selected Mineral Properties in Thin Section

- 5.9 Michel-Levy Birefringence Chart
- 5.10 Selected Minerals under the Microscope
- 5.11 Identification of Peaks in the EDX Spectrum
- 5.12 Selected Crystals under the Scanning Electron Microscope (SEM)
- 5.13 Imaging Spectroscopy of Common Rock-forming Minerals
- 5.14 Geologic Materials and Human Health

### **Igneous Rocks**

- 6.1 Tectonic Settings that Generate Magma
- 6.2 Phase Equilibria Diagrams for Mineralogy and Petrology
- 6.3 Bowen's Reaction Series
- 6.4 Igneous Rocks: Components and Composition
- 6.5 Textures of Igneous Rocks
- 6.6 Thin Sections of Selected Igneous Rocks
- 6.7 Estimating Percentage Composition
- 6.8 IUGS Classifications of Plutonic and Volcanic Rocks
- 6.9 Chemical Classification of Igneous Rocks
- 6.10 Pyroclastic Sediments and Rocks
- 6.11 Characteristics of Fallout Tephra

## **Metamorphic Rocks**

- 7.1 Metamorphic Environments
- 7.2 Pressure-Temperature-Time (P-T-t) Paths: Continental Collision
- 7.3 Metamorphic Facies
- 7.4 Classification of Metamorphic Rocks in the Field
- 7.5 Descriptive Classification of Metamorphic Rocks
- 7.6 Selected Textural Terms for Metamorphic Rocks
- 7.7 Common Metamorphic Rocks in Thin Section
- 7.8 Chemographic Diagrams: ACF, AKF, and AFM
- 7.9 Petrogenetic Grids for Metapelites
- 7.10 Stress and Strain Analysis
- 7.11 Conditions for Shock Metamorphism

### Sedimentology

- 8.1 Total Sediment Thickness of the World's Oceans and Marginal Seas
- 8.2 Sedimentary Basin Types and Subsidence Mechanisms
- 8.3 Global Crustal Volume and Mass of Sedimentary Rocks
- 8.4 Depositional Environments and Sedimentary Characteristics
- 8.5 Recognizing Sequence Boundaries and Other Key Sequence-Stratigraphic Surfaces in Siliciclastic Rocks
- 8.6 Lithofacies Classification Codes
- 8.7 Descriptions of Selected Sedimentary Structures
- 8.8 Core Examination and Stratigraphic Logs
- 8.9 Classification of Sedimentary Rocks
- 8.10 Selected Sedimentary Rocks in Thin Section
- 8.11 Grain-Size Scales and Data
- 8.12 Graphic for Determining the Size of Sedimentary Particles
- 8.13 Chart for Estimating the Roundness and Sphericity of Particles
- 8.14 Chart for Estimating the Sorting of Clastic Sediments

#### Structural Geology

- 9.1 Using a Brunton® Compass
- 9.2 Collecting Field Data Using Mobile Devices
- 9.3 Criteria for Determining Top and Bottom of Beds
- 9.4 Folds
- 9.5 Characterizing the Shapes of Folded Surfaces
- 9.6 Use of Mohr's Circle in Geology
- 9.7 Joints and Faults
- 9.8 Orientation Data and Discontinuities
- 9.9 Projection Nets

- 9.10 Correction for True and Apparent Dip
- 9.11 Physical Engineering Properties of Rocks
- 9.12 Physical Properties of Building Stones

### Geochemistry

- 10.1 Periodic Table of Elements
- 10.2 Abundance of Chemical Elements in Earth's Crust, Mantle, and Core
- 10.3 Isotopic Variations in Mantle Materials
- 10.4 Commonly Studied Stable Isotopes and Applications
- 10.5 Geochemical Analysis of Igneous, Sedimentary, and Metamorphic Rocks
- 10.6 Chemical Weathering of Silicate Minerals in Igneous Rocks
- 10.7 Characterization of Solutions by pH and Eh
- 10.8 Organic and Inorganic Carbon: Reservoirs, Production, and Preservation
- 10.9 Organic and Inorganic Compounds, and Biogenic and Non-Biogenic Materials
- 10.10 Geochronological Methods
- 10.11 Instrumental Techniques Common To Analytical Mineralogy, Petrology, and Solid-Earth Geochemistry
- 10.12 Geochemistry Equations

#### Geophysics

- 11.1 Application of Geophysical Methods: Studying Earth's Crust Using Seismic Reflection
- 11.2 Studying Earth's Interior Using Seismic Tomography
- 11.3 Hydraulic Fracturing
- 11.4 Surface Methods
- 11.5 Geophysical Well Logging Techniques
- 11.6 Elements of Borehole Logging for Hydrocarbon Assessment
- 11.7 Summary of Geophysical Methods Applicable to Exploration and Geoenvironmental Studies
- 11.8 Geophysical Properties of Selected Materials

#### **Energy Resources**

- 12.1 Global Distribution of Major Oil and Gas Fields
- 12.2 Selected Geologic Characteristics of Major Oil Fields
- 12.3 Global Distribution of Proved Reserves in Oil, Natural Gas, and Coal
- 12.4 Shale Gas and Shale Oil Global Reserves
- 12.5 Major Trade Movements of Oil and Natural Gas
- 12.6 Reserves to Production (R/P) Ratios for Global Oil and Natural Gas
- 12.7 U.S. Energy Production, Trade, and Consumption 1950-2014
- 12.8 U.S. Petroleum Fuel Stocks by Type 1950-2014
- 12.9 Shale Gas Plays in the Lower 48 States
- 12.10 U.S. Production from Unconventional Gas Reservoirs
- 12.11 U.S. Coal Distribution and Production
- 12.12 Geothermal Heat Flow Map of the Conterminous United States
- 12.13 Production Costs for Petroleum and Alternative Fuel Resources
- 12.14 Crude Oil: Refinement, Products, and Consumption
- 12.15 Physical Properties of Crude Oil
- 12.16 Laboratory Analysis of Petroleum: Brent Crude Assay Example
- 12.17 Comparison of Selected Properties of Gasoline to Alternative Fuels
- 12.18 Energy Conversion Tables

#### **Mineral Resources**

- 13.1 Classification of Mineral Deposit Models by Litho-Tectonic Environment
- 13.2 World and U.S. Production, Imports, and Exports of Selected Non-Fuel Mineral Commodities
- 13.3 U.S. Net Import Reliance of Selected Non-Fuel Mineral Commodities
- 13.4 Major Metal and Industrial Mineral Producing Areas of the United States
- 13.5 The Rare Earth Elements
- 13.6 Minerals Found in Rare Earth Elements Deposits
- 13.7 Global Distribution of Rare Earth Elements
- 13.8 Classification of Deposits Containing Rare Earth Elements
- 13.9 Global Mine Production and Reserves of Rare Earth Elements

#### **Earthquakes**

- 14.1 Selected Major and Notable Earthquakes
- 14.2 Global Seismic Hazard Map
- 14.3 Global Seismographic Network
- 14.4 U.S. National Seismic Hazard Map
- 14.5 ShakeMap A Tool for Earthquake Response
- 14.6 Earthquake Hazards Mitigation: PAGER from USGS
- 14.7 Geologic Study of Earthquake Effects
- 14.8 Fault-plane Solutions of Earthquakes
- 14.9 Checklist for Earthquake Effects

#### Volcanology

- 15.1 Remote Sensing Applications: Volcanic Eruptions
- 15.2 Monitoring Ground Deformation from Space Using InSAR
- 15.3 Global Distribution of Volcanoes
- 15.4 Global Distribution of Large Igneous Provinces
- 15.5 Volcanism, Large Igneous Provinces, and Mass Extinctions
- 15.6 Volcanic and Plutonic Regions in North and Central America
- 15.7 Morphologic Types of Volcanoes
- 15.8 Classification and Characteristics of Volcanic Eruptions
- 15.9 Selected Data Pertaining to Volcanic Activity
- 15.10 The Volcanic Explosivity Index
- 15.11 Volcano Monitoring by United States Volcano Observatories
- 15.12 Historic Volcanic Eruptions

#### Oceans

- 16.1 Selected Ocean Data
- 16.2 Global Histogram and Hypsographic Curve of Earth's Surface
- 16.3 Global Heat Transfer by the Oceans and Atmosphere
- 16.4 Global Map of M2 Tide
- 16.5 Sea Surface Temperature (SST)
- 16.6 Annual Salinity of the Ocean Surface
- 16.7 Ocean Temperature, Density and Nutrients at Depth
- 16.8 Physical Properties of Atlantic Water at Depth
- 16.9 Ocean Circulation: A Southern Hemisphere Perspective
- 16.10 El Niño and La Niña Southern Oscillation Events
- 16.11 Marine Carbon Production
- 16.12 Concentrations and Residence Times of Solutes in Seawater
- 16.13 Marine Carbonate Production and Buffering
- 16.14 Calcite and Aragonite Seas

## Atmosphere

- 17.1 Sea-Level Pressure and Global Winds
- 17.2 Seasonal Radiation and the Redistribution of Heat
- 17.3 Composition of Air in Earth's Troposphere
- 17.4 Natural and Anthropogenic Sources of a Selection of Trace Gases
- 17.5 Variation of Temperature, Pressure, and Composition with Altitude
- 17.6 Absorptivity of Selected Gases of the Atmosphere
- 17.7 Radiative Forcings from 1750-2010
- 17.8 Lapse Rates
- 17.9 The Radiosonde in Meteorology
- 17.10 Interpretation of Doppler Radar Imagery
- 17.11 The Saffir-Simpson Hurricane Wind Scale
- 17.12 The Fujita Tornado Damage Scale
- 17.13 The Beaufort Wind Scale
- 17.14 Action in Extreme Weather
- 17.15 Weather Symbols Used in Meteorology

#### **Environmental Change**

- 18.1 Common References to Time Periods in the Climate Literature
- 18.2 Changes in Global Glacial Mass Balance
- 18.3 Global Mean Sea-Level from Altimetry from 2005 to 2012
- 18.4 Monthly Sea Ice Extent Anomalies
- 18.5 Holocene Environmental Change
- 18.6 Processes that Remove Carbon Dioxide from the Atmosphere
- 18.7 Millennial Scale Climate Change in Greenland and West Antarctic over the last 90,000 years BP
- 18.8 Global Chronostratigraphic Correlation for the last 2.7 Ma
- 18.9 Late Pleistocene Sea Level and ?180 from 150 ka to Present
- 18.10 9 Million Year Climate Record from Foraminiferal ?180 Curves
- 18.11 Earth's 65 Million Year Atmospheric CO2 History by Proxy
- 18.12 Estimated Record of Global Sea-Level for the Past 100 Million Years
- 18.13 Paleoclimate Proxies

## Hydrology

- 19.1 Remote Sensing in Hydrology using GRACE
- 19.2 Global Hydrology
- 19.3 Hydraulic Characteristics of Groundwater Regions in the United States
- 19.4 Principal Aquifers of the United States
- 19.5 Hydrological Network Design: Station Density by Physiographic Region
- 19.6 Network Design: Data Requirements for Water Management
- 19.7 Metadata Fields for Recording Catchment Data
- 19.8 Recommended Accuracy of Hydrological Measurements
- 19.9 Hydrogeology Equations and Calculations
- 19.10 Groundwater Flow into a Well
- 19.11 Symbols, Units, and Conversion Factors
- 19.12 Modeling and Statistics in Hydrology
- 19.13 Commonly Used Frequency Distributions
- 19.14 An Overview of MODFLOW
- 19.15 USGS Water Resources Software
- 19.16 Selected Hydrologic Properties of Soil and Rock
- 19.17 Permeability Conversion Chart
- 19.18 National Primary Drinking Water Regulations

## Geomorphology

- 20.1 Structure from Motion (SfM) Photogrammetry vs Terrestrial Laser Scanning
- 20.2 Geophysical Methods in Geomorphology
- 20.3 A Hierarchical Classification of Terrestrial Geomorphological Features by Scale
- 20.4 A Systems Approach to Geomorphology
- 20.5 Physiographic Regions of the United States
- 20.6 Uplift and Denudation
- 20.7 Chemical Weathering
- 20.8 Measuring Rock Hardness in the Field
- 20.9 Selected Characteristics of Fluvial Systems
- 20.10 Characterization of Alluvial Fans and Facies
- 20.11 Major Types of Landslide
- 20.12 Historic Landslide Hazards
- 20.13 Classification of Glacigenic Deposits
- 20.14 Selected Features of Desert Environments
- 20.15 Selected Characteristics of Coastal Environments
- 20.16 Types of Beaches

### Soils

- 21.1 Soil Taxonomy
- 21.2 Checklist for Field Descriptions of Soils
- 21.3 Unified Soil Classification System

## 21.4 National Soils Map Dominant Orders and Suborders

## Astronomy

- 22.1 Hertzsprung-Russell (H-R) Diagram and Pulsating Variable Stars
- 22.2 Compositions of the Sun, Chondrites, the Moon, and Continental Crust
- 22.3 Condensation of Materials from the Solar Nebula
- 22.4 Selected Stars Visible from Earth
- 22.5 Locations of Stars with Exoplanets
- 22.6 Properties of the Sun
- 22.7 Selected Properties of the Planets
- 22.8 Fraunhofer Lines and Solar Spectra
- 22.9 Magnetic Fields: Solar and Terrestrial
- 22.10 Sun Spots
- 22.11 Near Earth Objects
- 22.12 Space Weather