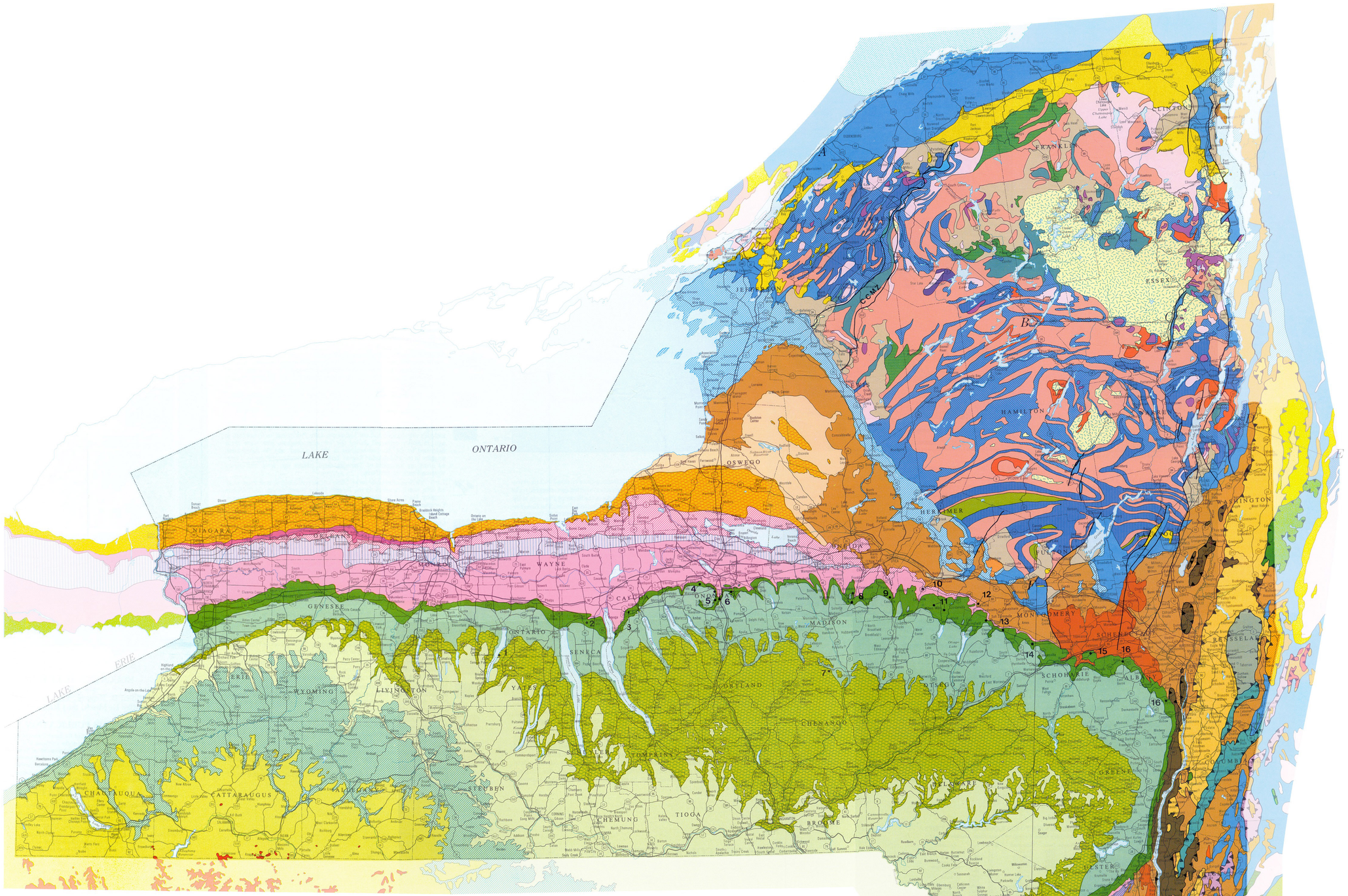
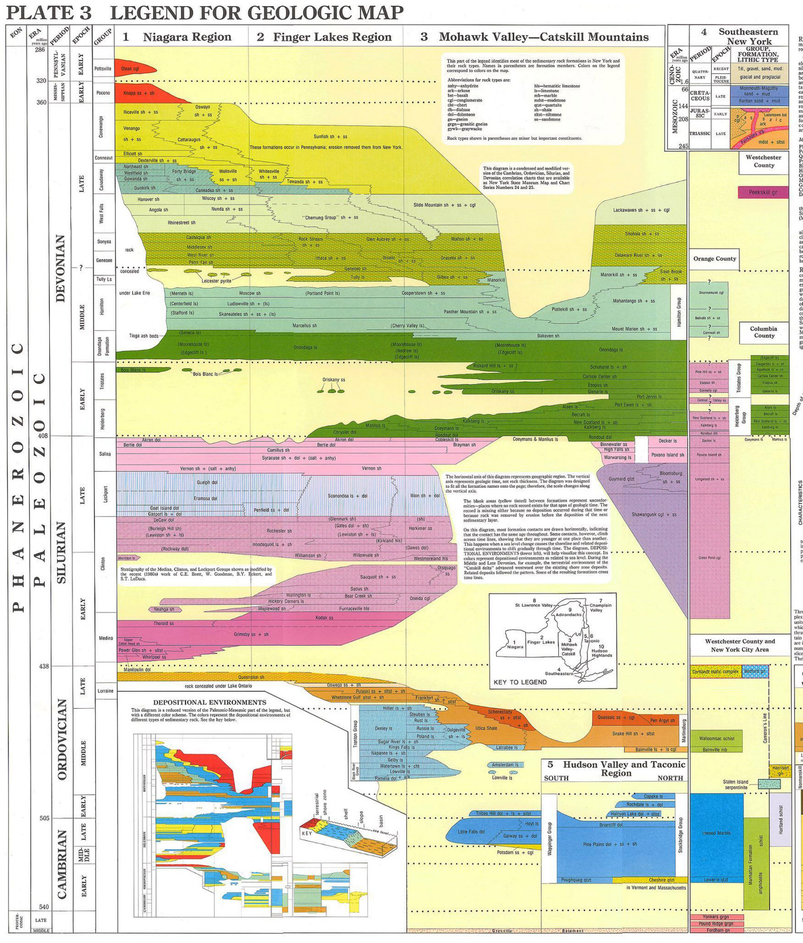
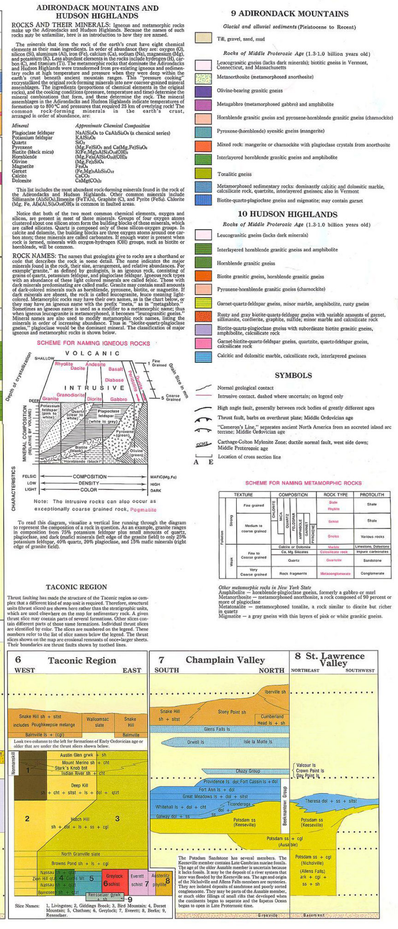


PLATE 3 LEGEND FOR GEOLOGIC MAP





ADIRONDACK MOUNTAINS AND HUDSON HIGHLANDS

ROCKS AND THEIR MINERALS: Igneous and metamorphosed rocks are composed of minerals. Minerals are the building blocks of rocks and rocks are the building blocks of the mountains. Here is an introduction to how they are formed.

The minerals that form the rock of the earth's crust have eight chemical elements as their main ingredients. In order of abundance they are: oxygen (O), silicon (Si), aluminum (Al), iron (Fe), calcium (Ca), sodium (Na), magnesium (Mg), and potassium (K). The metamorphic rocks that dominate the Adirondack Mountains and Hudson Highlands were transformed from pre-existing igneous and sedimentary rocks at high temperature and pressure when they were deep within the earth's crust (ancient mountain ranges). The "protoliths" (original rocks) underwent chemical changes to become the rocks and minerals of today's mountains. The ingredients (proportions of chemical elements in the original rocks), and the cooking conditions (pressure, temperature and time) determine the kinds of minerals and rocks. The rocks of the Adirondack and Hudson Highlands indicate temperatures of 1500°C and pressures that required 25 km of overlying rock! The minerals are made of "building blocks" — the elements — in the earth's crust, arranged in order of abundance, are:

Mineral	*Approximate Chemical Composition*
Plagioclase feldspar	$NaAlSiO_8$ to $CaAl_2SiO_8$ (a chemical series)
Potassium feldspar	$KAlSiO_3$
Quartz	SiO_2
Pyroxenes	$MgSiO_3$ and $CaMgSiO_3$
Biotite (black mica)	$KO_2Al_2Al_2Si_6O_{20}(OH)_4$
Hornblende	$NaCa_2Fe_4Al(Al,Si)_8O_{22}(OH)_2$
Garnet	$Fe_3Al_2Si_3O_{12}$
Muscovite	$KAl_3Si_3O_{10}(OH)_2$
Calcite	$CaCO_3$
Dolomite	$CaMgCO_3$

This list includes the most abundant rock-forming minerals found in the rock of the Adirondacks and Hudson Highlands. Other common minerals include Sillimanite (Al_2SiO_5), Ilmenite ($FeTiO_3$), Graphite (C), and Pyrite (FeS_2). Chlorite ($Mg, Fe, Al)_6(Al,Si)_4O_{10}(OH)_8$ is common in faulted areas.

Notice that both of the two most common chemical elements, oxygen and silicon, are present in most of these minerals. Groups of four oxygen atoms surrounding one silicon atom are the building blocks of the silicate minerals, which are called silicates. Quartz is composed only of these silicon-oxygen groups. In calcite and dolomite, the building blocks are three oxygen atoms around one carbon atom, called carbonate groups. Minerals made of these groups are where the rock is formed, minerals with oxygen-hydrogen (OH) groups, such as biotite or hornblende, will be common.

ROCK NAMES: The survey that geologists give to rocks are a shorthand or code that describes the rock in some detail. The name indicates the major minerals in the rock. For example, "granite" means a light-colored igneous rock of granitic grain," as defined by geologists, is an igneous rock, consisting of grains of quartz, potassium feldspar, and plagioclase feldspar. Igneous rock types are based on percentages of the light-colored minerals in the rock. Most granitic rock minerals predominating are called mafic. Granite may contain small amounts of dark-colored minerals such as hornblende, pyroxene, biotite, or magnetite. If the dark-colored minerals in a granite are hornblende, the granite is called a colored. Metamorphic rocks may have their own names, as in the chart below, or they may have an igneous name with the prefix "meta," as in "metagabbro." Metamorphic rocks may also be named for the parent rock from which they formed, when igneous bicarbonate is metamorphosed, it becomes "bicarbonate gneiss." Mineral names are also used to modify metamorphic rock names, listing the most abundant first, as in "garnet-biotite-quartz gneiss." If the dominant mineral is gneiss," plagioclase would be the dominant mineral. The classification of major igneous and metamorphic rocks is shown below.

SCHEME FOR NAMING IGNEOUS ROCKS

VOLCANIC
INTRUSIVE
Rhyolite
Trachyte
Andesite
Basalt
Diabase
Granodiorite
Diorite
Gabbro
Peridotite
Granite
Syenite
Monzonite
Anorthosite
Pegmatite
Cross Granular
Fine Granular
Porphyritic
Vesicular
Glassy
Pyroclastic
Fine Grained
Medium Grained
Coarse Grained
Very Coarse Grained
Felsic
Mafic
Ultramafic
Quartz
Feldspar
Feldspathoid
Plagioclase
Alkali Feldspar
Mica
Amphibole
Pyroxene
Olivine
Opaque
Glass
Fragments
Felsic
Intermediate
Mafic
Ultramafic
Alkali Feldspar
Plagioclase
Feldspathoid
Quartz