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Pioneering geologic mapping in northwestern South America

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In the late 19th Century regional maps of *Nueva Granada* (present-day Colombia, Panama and parts of Venezuela and Ecuador) were published by Italian geographer Agustín Codazzi (1793–1859) and German botanist and geologist Hermann Karsten (1817–1908). Codazzi was trained in military engineering, served under Napoleon, then Bolívar, and emigrated to Venezuela and Colombia to serve as a government cartographer and geographer. His *Atlas físico y político de la República de Venezuela* (1840) and *Resumen de la geografía de Venezuela* (1844), for which he was awarded the French *Légion d'honneur*, and *Atlas geográfico e histórico de la Republica de Colombia* (1889) provided geographic, economic, political, cultural and social commentary with accurate data on elevations, waterways, and many important geographical, physical and statistical details. He organized the *Comisión Corográfica* (1850) that utilized geographic data to foster national development. However, geologic mapping and most observations provided in Codazzi's 1889 atlas were directly taken from Karsten's *Géologie de l'ancienne Colombie bolivarienne: Vénézuéla, Nouvelle-Grenade et Ecuador* (1886), as cited by Manuel Paz who edited the atlas following Codazzi's death. Karsten defined four epochs in Earth history: *Primera* – without life – primary crystalline rocks, *Segunda* – with only marine life – chiefly sedimentary rocks, *Tercera* – with terrestrial quadrupeds and fresh water life forms – chiefly sedimentary rocks, and *Cuarta* – mankind appears, includes diluvial [glacigenic] and post-diluvial terranes. He noted that Colombia is composed chiefly of Cretaceous – Quaternary sedimentary formations plus plutonic and volcanic rocks, and that Earth's internal heat (*calor central*) accounted, by escape of inner gases, for volcanism, seismicity and uplift of mountains. Karsten's regional mapping and interpretation thus constitutes the primary source and ultimate pioneering geologic research.

