Ore Geology Reviews xxx (2016) xxx–xxx

Contents lists available at ScienceDirect

Ore Geology Reviews

journal homepage: www.elsevier.com/locate/oregeorev

Mesozoic tectono-magmatic evolution of Mexico: An overview

Elena Centeno-García

Instituto de Geología, Universidad Nacional Autónoma de México, Laboratorio Nacional de Geoquímica y Mineralogía, Ciudad Universitaria, 04510 Ciudad de México, México

ARTICLE INFO

Article history:
Received 23 March 2015
Received in revised form 3 August 2016
Accepted 14 October 2016
Available online xxxx

Keywords:
Mexico
Guerrero composite terrane
Triassic
Jurassic
Cretaceous
Magmatism
Rift
Tectonics
Mexican geology
Tectono-stratigraphic terrane
Pangea
Laramide
Sevier

ABSTRACT

The Geological Framework of Mexico is formed by a mosaic of tectono-stratigraphic terranes that were assembled during the Paleozoic and Mesozoic as the result of the complex interaction between Laurentia, Gondwana, and the paleo-Pacific plate. Even though the Mexican tectono-magmatic evolution is still object of study, some main representative stages can be recognized. Determining the time span and regional distribution of magmatism throughout the geological history of Mexico is crucial for the exploration of mineral resources. This paper contains a brief description of the terranes and is focused on summarizing the main Mesozoic tectono-magmatic events, from the assembling of Pangea in Late Paleozoic time to the end of the Mesozoic. These main events are: 1) Permo-Triassic continental (submarine) arc that developed along eastern Oaxaquia and was related to a subduction zone developed along the paleo-pacific margin. 2) Magmatic activity ceased in central and southern Mexico, during Middle to Late Triassic time, and a wide submarine fan was formed along the western margin of Pangea, which apparently acted like a passive margin. Evidence of a contemporaneous intra-oceanic arc is found at Baja California. 3) Inland Early Jurassic volcanism is found in northeast and central Mexico. Whether this magmatic event evolved in a rift or arc (Nazas) tectonic setting is still undetermined. 4) By Late Jurassic, magmatism was widespread. It is the time of the breakup of Pangea, leading to the opening of the Gulf of Mexico and the Arperos Basin. Therefore, volcanism was mostly related to subduction and supra-subduction rifting. 5) The Gulf of Mexico and Arperos basins were formed by Early Cretaceous time. Igneous rocks of that age have a wide range of composition (arc, continental rift, strike slip, and oceanic rift, within plate), and are geographically widespread. 6) At the end of Early Cretaceous, volcanism moved to a more localized belt along the paleo Pacific margin; it is also the time of formation of major carbonate platforms along east Mexico. 7) Coeval to Sevier-Laramide orogeny of North America, a large fold and thrust belt developed throughout Mexico, during Late Cretaceous time. It was accompanied by arc magmatism along the pacific margin of Mexico (Tarahumara Arc). It is the first continental arc that evolved after accretion and consolidation of Guerrero and Alisitos terranes to Continental Mexico. These Mesozoic tectonic processes originated westward-eastward migrations of arc-related and rift-related volcanism, which in turn lead to the present distribution of Mesozoic mineral deposits.

1. Introduction

The complex anatomy of Mexico has its origin on the juxtaposition of Atlantic-related and Cordilleran/Pacific-related tectonic histories. Most of the papers published about the tectonic evolution of Mexico agree that 80% of Mexico has experience some allochthony. There is a large variety of models regarding the original location of its pieces, and the processes and timing of accretion. Apparently, only a small part of Chihuahua and Sonora States has remained at its present location, and it is interpreted that the Caborca and Cortés terranes are translated pieces of the North American craton (Fig. 1). After the breakup of the Rodinia supercontinent, Oaxaquia (Fig. 1), a large piece of the Grenville Orogen remained at the continental margin of Gondwana (Ortega-Gutiérrez et al., 1995). As the Iapetus Ocean was consumed, and during the assembling of Pangea, Paleozoic orogenic metamorphic complexes were formed, and at present, they can be found flanking Oaxaquia to the east and to the west, as well as to the north (Maya and Mixteco terranes) (Fig. 1).

Two main processes controlled the Mesozoic tectonic evolution of Mexico: 1) Strike slip faulting and crustal thinning by rifting, both related to the opening of the Gulf of Mexico, which originated felsic and mafic volcanism. 2) Almost continuous subduction along the Pacific margin, which changed throughout time originating migrations of the arc volcanism. This convergent margin had alternate intervals of supra-subduction rifting and contraction, leading to the thickening

E-mail address: elenacentenogarcia@gmail.com.

http://dx.doi.org/10.1016/j.oregeorev.2016.10.010
0169-1368/

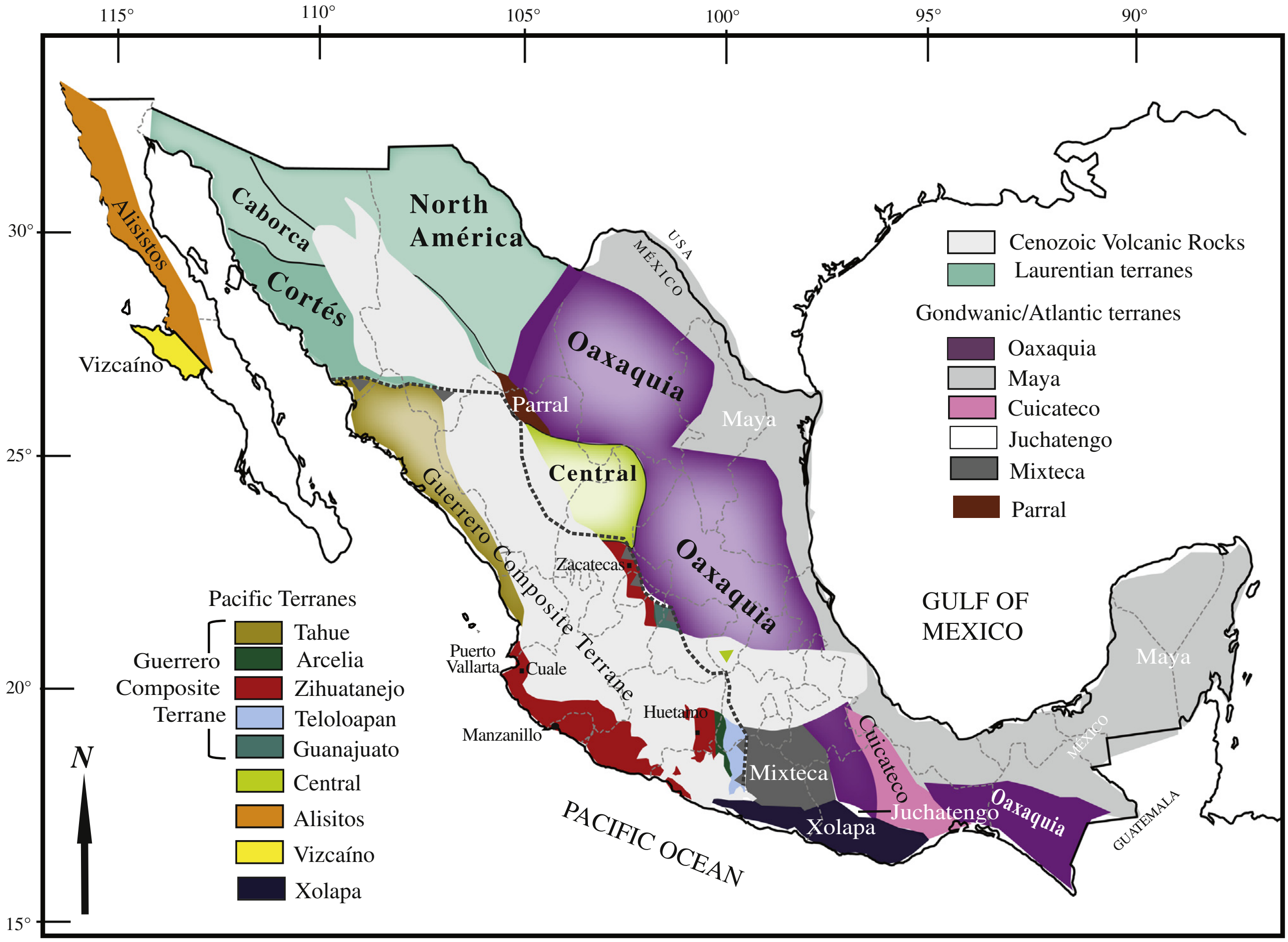

Fig. 1. Tectonostratigraphic terranes of Mexico (modified from Centeno-García, 2005).

and growth of the continental crust by magmatic and tectonic accretion (Centeno-García et al., 2011).

Both processes occurred at the same time, resulting in a complex scenario where it is difficult to trace a line separating rift-related from arc-related volcanism and sedimentation.

The goal of this paper is to synthesize the regional-scale Mesozoic tectonic evolution of Mexico, according to available data on the stratigraphy, depositional environment, sedimentary provenance, paleontology, isotopic geochronology, geochemistry, and structural geology. Its main focus is the regional distribution of volcanic/volcanoclastic and intrusive rocks and a discussion of their possible tectonic setting. The aim of such a review is to give a geologic background to interpret the Mesozoic metallogenesis of Mexico, which is the topic of this volume, and to understand its relationship with the tectono-magmatic and hydrothermal processes that accompanied the development of this portion of North America.

2. Overview of the Mesozoic geology and tectonic evolution of Mexico

As a result of its complex tectonic evolution, the present-day continental Mexico is composed of a mosaic of distinct terranes, which are made up of different tectono-stratigraphic assemblages, and are bounded by major faults (Campa and Coney, 1983; Sedlock et al., 1993, Keppie, 2004). In this work we use the terrane subdivision proposed by Centeno-García (2005) and Centeno-García et al. (2008) (Fig. 1), which constitutes an upgrade of the original subdivision of Campa and Coney (1983). Since the stratigraphy of Mexican terranes is not the main topic of this paper, it will not be described in detail; for more information, the reader is conveyed to the references cited herein.

In some cases, as for the distribution of large-size porphyry copper deposits, the basement composition has been argued to play a major role in their emplacement. Although exposures of basement rocks are scarce and isolated, overall indirect geochemical data suggest that eastern and northwestern Mexico is floored by evolved ancient crust, whereas central and western Mexico is made up of more juvenile material (Ortega-Gutiérrez et al., 1995; Talavera-Mendoza et al., 1995; McDowell et al., 1999; Valencia-Moreno et al., 1999, 2001; Talavera-Mendoza and Guerrero-Suástegui, 2000; Centeno-García, 2005). Based on major differences in isotopic signatures from felsic igneous rocks and surface distribution of basement outcrops, the terranes of Mexico can be classified after their paleogeographic affinity in three general groups:

(1) Laurentian terranes (Fig. 1, Table 1), which have a Precambrian basement, and/or old crustal signatures in the isotopic composition of their younger igneous rocks;
(2) Gondwanic/Atlantic terranes (Fig. 1, Table 1), containing Precambrian high-grade metamorphic basement or lower to mid Paleozoic metamorphic basement (mostly schist complexes);
(3) Pacific terranes (Fig. 1, Table 1), whose oldest rocks are uppermost Paleozoic to Mesozoic in age, and/or contain igneous and metamorphic rocks that show juvenile isotopic signatures.

Paleozoic or Mesozoic to Cenozoic volcanic and sedimentary assemblages unconformably overlie terranes composed of Precambrian to

Please cite this article as: Centeno-García, E., Mesozoic tectono-magmatic evolution of Mexico: An overview, Ore Geol. Rev. (2016), http://dx.doi.org/10.1016/j.oregeorev.2016.10.010