

**THE ROMAN
COMAGMATIC
REGION**

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The Roman comagmatic region by Henry S. Washington

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HENRY S. WASHINGTON

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Geol.

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HENRY S. WASHINGTON



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INTRODUCTION.

The present paper embodies the results of an investigation undertaken under the auspices of the Carnegie Institution of Washington, and is the continuation and completion of some studies which were published several years ago. Since the first publications much additional material has been collected, and, while my collections do not pretend to be exhaustive or complete, the specimens are so numerous and are regarded as so representative of the rocks of the region that they may properly serve as a basis for some general discussion.

One of the objects of the paper is the detailed description of the many rare rock types characterized by the presence of leucite, for which the Italian volcanoes are so famous, and most of which are very inadequately known. It was thought also that a careful chemical study of these, as well as of the accompanying non-leucitic rocks, might throw some light on the magmatic and physical conditions which are involved in and control the formation of this rare and interesting mineral.

Another aim was the description and discussion of the characters of the region as a whole, as an addition to the small but growing list of petrographic provinces which are more or less adequately known in their petrological and petrographical aspects. The study of these would seem to have important bearings on some of the broader problems of petrology, especially the theory of differentiation and the question of the original homogeneity or heterogeneity of the earth. As regards these we are still in the observing and fact-collecting stage of the science, and it was thought that the description of the region from the petrological, as well as from the petrographical, point of view would be of some value.

In this connection attention may be called to the introduction of the term "comagmatic region" to replace the older "petrographical province." It is thought that the latter is unsatisfactory in that it implies only the purely petrographical characters, without reference to the broader petrological characters and relations (of which the petrographical are but one set), the knowledge of which is essential to our understanding of a given area of genetically related rocks as a whole. Furthermore, the term "province" implies that the area is part of a larger one, and, while this may ultimately be found to be true in some instances, it would seem better to employ some term which does not have this connotation and which does not postulate in the term itself any relations to others.

It may be objected to the word "comagmatic" that it begs the question of common genetic origin for the rocks of a given region. But the word is used merely with the idea that the magmas of a certain area have characteristics in common, which is the idea underlying the use of "petrographical province," and whether the occurrence of these common characters is due to processes of magmatic differentiation or to other causes is not asserted or implied in the term.

In the case of the present region, as in many others, it will be found that it is naturally divisible into smaller groups, around clustered or single centers of intru-

sion or eruption. For these the term "district" is used, the individual points from which the igneous rocks were extruded being called "centers."

Advantage was also taken of this opportunity to illustrate some of the practical applications to the study of rocks of the principles of the new classification and nomenclature, and to test their value in petrological investigations. Such an exposition was especially needed in the matter of types and the use of the proposed rock names. In recent literature a number of petrographers have employed the classification so far as to give the magmatic position of the various rocks dealt with. But the system, to be a practical one, as it is intended to be, must go farther than this, and its rock names and other parts of its nomenclature must be capable of use in descriptive literature, just as are those of the prevailing systems.

No apology is therefore offered for the language in which part of the paper is couched, nor for the unfamiliar terms employed throughout. On the contrary, it is hoped that their use here will aid petrographers to a better understanding of the quantitative system, and that the paper will serve in some sort as a working model of its methods and applications. Some of the terms which are not to be found in the original publication of the quantitative system are the result of subsequent conferences and discussions between the joint authors of that, and they, as well as further additions, are expected to appear in the *Journal of Geology* (vol. xiv, 1906).

The whole region whose rocks are the present objects of study is being investigated with enthusiasm, especially from the geological and structural points of view, by many able Italian geologists, whose published results have been made use of largely. Some of the more important of these publications, with those of foreign observers, will be found in the bibliographical list given later. With comparatively limited opportunities to make the many detailed observations in the field which are needed to elucidate all the strictly geological questions involved in the study of the region, I can not venture to treat these adequately on the basis of my own knowledge and must leave their discussion to the geologists of the country, who have shown such zeal in the study of the many interesting problems which their favored peninsula presents. I can only express the hope that my Italian confrères will not deem me an unwelcome intruder into their proper sphere of investigation, but will consider the efforts made here to solve some of the special problems as evidence of the deep interest taken in the geology of their country, whose men of science have always shown themselves most hospitable to those from abroad.

It is a great pleasure to express my thanks to the Trustees of the Carnegie Institution of Washington, who have so generously aided me in these investigations, and have made it possible to bring to completion a long-cherished plan. To my colleagues in the quantitative classification, Doctor Cross, Professor Iddings, and Professor Pirsson, I am deeply indebted for much kind interest, advice, and aid in many ways. As one of the objects of this paper is to serve as an example of the practical application of our ideas, they have been frequently consulted, part of the manuscript has been examined and commented on by them, and the general form in which the descriptions of the types are cast is the result of our joint discussions.

THE ROMAN COMAGMATIC REGION.

GENERAL TOPOGRAPHY AND GEOLOGY.

Introduction.

The volcanoes of the Italian peninsula may be referred to several distinct comagmatic regions (petrographic provinces), the distinctions between them being based largely upon the petrographic and chemical characters of their rocks, though they are also separated by their geologic ages and their topographic and geologic relations. The most prominent of these may be enumerated as follows, and are shown in the map on the following page:

The Venetian Region, comprising the volcanic complexes of the Euganean and Berican Hills.

The Apulian Region, comprising the volcanic complex of Monte Vulture.

The Tuscan Region, comprising the volcanoes of Monte Amiata, Montecatini, Orciatico, Campiglia and Roccastrada, with which may be placed the volcanoes of Tolfa and Cerveteri, and Monti Calvario and San Vito near Bracciano.

The Roman Region, comprising the main line of volcanoes which extend from Lake Bolsena southeast to Vesuvius and the Phlegrean Fields.

All of these vary widely in the characters of their eruptive rocks, and differ as well in regard to their geological ages. The only one which concerns us here is the last mentioned, the Roman Region, so named from the fact that it embraces the chief territory of the ancient Roman Republic, as well as the capital city of modern Italy. These volcanoes are all of Quaternary age, the eruptions of some of them extending into historic and even modern times. Extending in a narrow line between the Apennines and the Tyrrhenian Sea, these volcanoes occupy the sites of old embayments in the Mesozoic and Tertiary sediments which form the backbone of the Italian peninsula.

It will be found convenient to take up the description of the region under the different districts into which it may be subdivided, which surround distinct centers of volcanic activity, and which are more or less clearly separated from one another. These districts are seven in number, and may be thus enumerated, the names bestowed upon them following as far as possible the usages of the Italian geologists:

(1) *Vulsinian District*, comprising the volcanic complex around Lake Bolsena. Named from the ancient tribe of the Vulsinii.

(2) *Ciminian District*, comprising the volcanoes near Viterbo. Named from the Latin appellation of Colli Ciminii.

(3) *Sabatinian District*, comprising the volcanic complex around Lake Bracciano. Named from the Roman name of the lake, Lacus Sabatinus.