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Mafic-ultramafic rocks and alkaline-carbonatitic magmatism and associated hydrothermal mineralization: A special issue (Part-I) dedicated to Piero Comin-Chiaramonti

Editorial

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Introduction

We have much pleasure in presenting this Special Issue of Central European Journal of Geosciences containing a collection of papers to celebrate the life and work of Professor Piero Comin-Chiaramonti – a reputed emeritus Italian scientist and scholar of carbonatites and alkaline rocks. The research themes cover many of the subjects which most interested him, especially processes related to geological causes that control the migration of fluids and their interference with the surrounding rocks. The increasing demand for precious metals and strategic elements from the global market has seen a focus from geoscientists around the globe on unravelling the development of mafic-ultramafic and associated alkaline and carbonatitic rocks for their outstanding potential as exploration targets for these commodities. The exploration of new deposits and the diversification of sources are mainly based on an understanding of fluid migration and evolution at both mantle and crustal levels. In addition, many reported alkaline complexes are being reviewed and examined in terms of tectonics, magmatic and mantle texture, metallogenesis and hydrothermal alteration. Many papers concentrate on these relationships, which is the main focus of this special volume dedicated to Piero Comin-Chiaramonti. This special volume collects contributions from senior researchers who have accumulated experience in various regions of the world which are famous for their alkaline complexes such as Brazil, India, Italy and Malawi. Their papers open a working hypothesis that may connect the global carbonatitic and alkaline rocks to the crucial supply of minerals containing Nb, REEs and other useful elements. The development of genetic models for strategic mineralisation in different environments is complex, but it is important to test a wide range of potential resources and demonstrate a capacity of certain geological features to reveal a deposit's propensity to exploitation. This special volume presents a variety of occurrences and conditions of

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formation of typical Nb-Ta, REE and Zr-bearing minerals and other strategic metals associated with the multifaceted world of alkaline rocks. The examples presented range from large intrusive complexes of both mafic and felsic alkaline rocks, to smaller and widespread swarms of subvolcanic rocks or even large strato-volcanoes or small diatreme-maar systems.

Contributions

The Fernando de Noronha archipelago in the Southern Atlantic Ocean displays a typical volcanic and subvolcanic range of alkaline rocks as described by Lopes *et al.* [1]. These classic carbonatitic-alkaline mafic districts, or ultra-alkaline districts, are dotted with exotic rock-types associated with minerals so extremely rich in rare elements as to be considered by some as a metasomatic product. Ring complexes having the classical pyroxenite-ijolite-carbonatite association may display elevated abundances of bastnäsite-(Ce), which may be the final product of magma differentiation patterns that lead to the extreme concentration of light and incompatible elements. The bastnäsite-(Ce) occurrence in the Sung Valley, India, is described by Sadiq *et al.* [2], and the occurrence at Kangankunde, Malawi, is described by Duraiswami and Shaikh [3]. In many cases, late, pervasive veins of pegmatoid REE-Nb-Ta rich rocks suggest the intervention of hydrous fluids separated at relatively low temperature from bodies of carbonatite that are also late in the ring complex emplacement. On the other hand, late-stage fluids derived from alkaline felsic complexes can parallel those in ultramafic complexes as suggested in the paper by Singh *et al.* [4], who studied bastnäsite-(Ce) from the Kanigiri alkaline felsic complex of Andhra Pradesh, South India. Hydrous fluids from less alkaline mafic-ultramafic complexes seem different and are more specific for tellurium and PGE concentration as suggested by the papers of Dora *et al.* [5], who studied the mineralisation of Gondpipri, Central India, and the paper by Devaraju *et al.* [6], which describes the Channagiri complex, India. Even small volcanic or subvolcanic outcrops may have undergone the intense action of magmatic fluids as observed in the small melilitolitic sub-volcanics in Central Italy described by Stoppa and Schiazza [7], or the regional swarm of ultramafic dykes described by Comin-Chiaramoti *et al.* [8] from Planalto da Serra, Brazil, which show several generations of late-stage minerals. These two localities have a kamafugitic affinity and are related by the authors to a metasomatised mantle source enriched in K and radiogenic Sr. Deep into the mantle, or superficially in the crust, potassic metasomatism is a key feature for the formation of alkaline carbonatitic complexes and their late-stage fluids that lead to the formation of useful minerals. The large ultramafic complex of Finero in northern Italy described by Giovanardi *et al.* [9] displays field and petrologic features that suggest they were formed by late melt migration in high T and P conditions. Associated minerals reveal high REEs, Sr, U and Th which suggest that the Finero phlogopite-peridotite underwent intense metasomatism. A case of deep seated, ultra-potassic metasomatism is from Alto Paranaíba, Brazil, where mantle nodules contain characteristic Ti-Zr minerals and priderite, typical of lamproitic and kamafugitic rocks, and produced by the interaction between peridotite and alkaline melt/fluids has been described by Almeida *et al.* [10]. Strategic minerals associated with alkaline complexes are rapidly gaining renewed interest among geologists. It is understood that only comprehensive and comparative study of several different occurrences and their genetic peculiarities can produce a consistent picture of their geological meaning. The CEJG special volume in honour of Piero Comin-Chiaramonti is a good opportunity to open our minds about exotic, but not odd rocks, and associated mineral deposits and the problems with their interpretation in a multicultural worldwide approach.

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Preface

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