An Introduction to IGNEOUS AND METAMORPHIC PETROLOGY

John D. Winter

Department of Geology Whitman College

DAI HỘC QUỐC GIA HA NỘI TRUNG TẨM THỐNG TIN THU VIỆN

MO F 100325

Prentice Hall

New York Boston San Francisco
London Toronto Sydney Tokyo Singapore Madrid
Mexico City Munich Paris Cape Town Hong Kong Montreal

BRIEF CONTENTS

PART I Igneous Petrology

Some Fundamental Concepts 2 Chapter 1 Chapter 2 Classification and Nomenclature of Igneous Rocks 23 Chapter 3 Textures of Igneous Rocks 34 Igneous Structures and Field Relationships 54 Chapter 4 An Introduction to Thermodynamics 83 Chapter 5 The Phase Rule and One- and Two-Component Systems 93 Chapter 6 Systems with More Than Two Components 113 Chapter 7 Chemical Petrology I: Major and Minor Elements 135 Chapter 8 Chemical Petrology II: Trace Elements and Isotopes 158 Chapter 9 Chapter 10 Mantle Melting and the Generation of Basaltic Magma 183 Chapter 11 Magma Diversity 202 Chapter 12 Layered Mafic Intrusions 222 Chapter 13 Mid-Ocean Ridge Volcanism 244 Chapter 14 Oceanic Intraplate Volcanism 270 Chapter 15 Continental Flood Basalts 301 Chapter 16 Subduction-Related Igneous Activity, Part I: Island Arcs Chapter 17 Subduction-Related Igneous Activity, Part II: Continental Arcs 352 Chapter 18 Granitoid Rocks 377 Chapter 19 Continental Alkaline Magmatism 397 Chapter 20 Anorthosites 436

PART II Metamorphic Petrology 445

Chapter 21 An Introduction to Metamorphism 446 Chapter 22 A Classification of Metamorphic Rocks 470 Chapter 23 Structures and Textures of Metamorphic Rocks 477 Chapter 24 Stable Mineral Assemblages in Metamorphic Rocks 518 Chapter 25 Metamorphic Facies and Metamorphosed Mafic Rocks 537 Chapter 26 Metamorphic Reactions 558 Chapter 27 Thermodynamics of Metamorphic Reactions 579 Chapter 28 Metamorphism of Pelitic Sediments 607 Chapter 29 Metamorphism of Calcareous and Ultramafic Rocks 635 Chapter 30 Metamorphic Fluids, Mass Transport, and Metasomatism 654

Appendix A: Estimating the Density and Viscosity of Silicate Melts 683 Appendix B: The CIPW Norm 686 Index 693