Contents

1. Introduction 1

2. Molybdenum 5
Occurrence 6
Metabolism 7
Food Sources 8
Molybdenum—Copper Antagonism 8
Inhibitors/Stimulators 9
Functions in the Body 9
Mechanism of Action 15

3. Selenium 19
Metabolism 20
Food Sources 20
Inhibitors/Stimulators 21
Functions in the Body 22
Relationship to Caries 24
Mechanism of Action 27

4. Vanadium 29
Metabolism 30
Food Sources 32
Vanadium Deficiencies 33
Vanadium Toxicities 33
Relationship to Caries 33
Mechanisms of Action 35

5. Zinc 37
Food Sources 38
Functions in the Body 39
Relationship to Caries 42

6. Manganese 51
Food Sources 52
Inhibitors/Stimulators 53
Functions in the Body 53
Relationship to Caries 56
Mechanism of Action 60

7. Sulfur 61
Metabolism 62
Food Sources 62
Risk Factors and Symptoms of Deficiency 63
Relationship to Caries 63

8. Copper 65
Food Sources 66
Metabolism 66
Inhibitors/Stimulators 67
Functions in the Body 68
Relationship to Caries 71
Mechanism of Action 76

9. Strontium 79
Metabolism 80
Strontium and Calcified Tissues 80
Food Sources 80
Relationship to Caries 81
Mechanism of Action 85
Incorporation in Whole Human Enamel 85
Effects on Enamel Dissolution 87
Effect on Mineralization 87
Changes in Tooth Morphology 87
Interaction with Other Trace Elements 88

10. Barium 91
Metabolism 92

Barium in Human Enamel 93
Relationship to Caries 94

11. Lithium 97
Metabolism 98
Toxicity 99
Relationship to Caries 99
Mechanism of Action 103

12. Titanium 105
Sources and Uses 106
Metabolism 106
Metabolism 107
Relationship to Caries 108
Mechanism of Action 110
Enamel Dissolution Effect 110
Antimicrobial Effect 112

13. Lead 115
Sources of Lead Exposure 117
Relationship to Caries 120
Mechanism of Action 124

14. Cadmium 127
Metabolism 128
Health Effects 129
Relationship to Caries 130

15. Other Essential Trace Elements 135
Boron 136
Aluminum 137
Yttrium 139
Rubidium and Cesium 140
Zirconium 141
Tin 142
Chlorine and Bromine 144

Platinum, Gold, Silver, Beryllium, and Others 145
Palladium 149
Arsenic 149
Other Elements 151

16. Conclusion 157

References 161

Index 169