THE GIFT OF THE EARTH TO MEDICINE:

Minerals in Health and Disease

A Source Book for Doctors and Patients
Foreword by Dr. Abram Hoffer

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INTRODUCTION

Scientific and medical researchers have made many fascinating discoveries about trace elements. Many of these elements are essential to life, but some are harmful. Trace minerals discoveries have been recognized at an international level in academic medicine, yet some medical institutions often get so caught up with specific research projects that they miss the significance of the trace element field. Trace elements and minerals should not be trivialized as unimportant or overrated as miracle cures.

The bulk of knowledge on trace minerals is mainly derived from the US and Canada where their clinical application is more common. This is partly due to the fact that everyday medicine and research have more liberty in North America than in Europe where there are many bureaucratic and economic restrictions. When a treatment is proven effective, it is often put to use to help patients and to meet a market niche. Because the American diet is often inadequate and greatly influenced by fast food, many clinical problems present in the population as a result of trace mineral imbalances. Accordingly, a wide array of supplements and trace minerals are available in supermarkets and nutrition stores. However, poor labeling and advertising standards leave consumers and health professionals without adequate knowledge of product constituents and safety. Further, supplement manufacturers and distributors often use excessive marketing techniques. Consumers and physicians need to understand the appropriate uses for trace minerals. This book is designed to serve this purpose.

This book outlines those minerals most commonly used in clinical practice and those minerals that, in given situations, are considered detrimental to our health and well-being. Minerals commonly used in clinical practice include calcium, chromium, copper, iron, iodine, lithium, magnesium, manganese, molybdenum, potassium, selenium, sodium, and zinc. Minerals that can be detrimental to our health and well-being are toxic even in small doses - especially arsenic, cadmium, beryllium, mercury, lead, platinum, tin and thallium.

At the beginning of the last century, only minerals such as calcium that were present in large amounts in the human body could be measured. Many other chemical elements found in nature are present in such small amounts that they were not measurable. It was unknown whether they were present in the body by chance or whether they were essential for life. Naturally, not every element present in the body is required for us to live.

Some of the first elements recognized as 'essential to life'

Iron	**17-18th Century**	**Copper**	**1928**
Magnesium	**1931**	**Zinc**	**1934**
Iodine	**1950**	**Molybdenum**	**1953**
Selenium	**1957**	**Chromium**	**1959**

Besides these "classic" essential trace elements, several others have been identified within the last 20-30 years as being required by humans in trace amounts (e.g. silicon). However, vanadium has not yet been universally confirmed as essential even though 20-40 mg is present in an adult body.

In general, minerals are found in an adult body in amounts exceeding 1 g, whereas anything present in a lesser amount is classified a trace element. For example, the 4 g of iron and the 2-3 g of zinc found in adults are considered minerals whereas iodine and the relatively unknown essential elements selenium and molybdenum, with 10-30 µg each, are examples of trace elements. Throughout medical history, the terms minerals and trace elements arose within a very limited detection system. Today, their distinction is somewhat arbitrary. Due to the arbitrary assignment and unclear distinction between minerals and trace elements, the term 'trace mineral' or 'trace element' seems appropriate. These terms bring forward the collective and synergistic nature of the periodic table of elements. This trace element concept is therefore clinically useful. In this book, to avoid confusion, the terms mineral, element, trace mineral, and trace element have been used interchangeably.

Selenium is an example of a trace element that is necessary for humans and animals, but not necessary plants. This explains why plants can thrive in selenium-deficient soils (in China for example), whereas humans and animals can die under these conditions. On the other hand, harmful substances such as lead, mercury and arsenic are also considered trace elements despite their association with environmental pollution. These poisonous elements have always been found in nature, but only rarely have they been present at considerable concentrations. Today however, modern industrial practices have strained wide regions of land and many resources by loading dangerous amounts of toxins into the ecosystem (including poisonous trace elements as well as radioactive materials and toxic organic compounds). This can lead to widespread pollution as demonstrated by the following two examples.

Radioactive fallout from the Chernobyl nuclear reactor disaster was spread over a huge area extending over half of Europe. The production of acid rain, primarily in mid-Europe, has damaged forests and surrounding bodies of water, and has led to the creation of biologically dead lakes in northern

Europe (especially Sweden and Finland). As our soils (and therefore the plants and animals raised on them) are increasingly being exposed to toxins, a steady intensification of agricultural practices is leading to an increased depletion of trace elements. While nitrogenous fertilizers increase grain yield, soil fertility suffers due to a lack of the essential trace minerals. The rise of processing taking place in the food industry is contributing to a further decline of biologically important, quality food ingredients. This is especially apparent in fast-food products – hamburgers, for example. Unfortunately, many food products are diminishing in biological value. Even if food products leave the factory with nutritional content intact, the important nutrients are often lost during transport despite attempts to supplement foods with vitamins. In addition, these foods frequently contain considerable amounts of additives. Consumers have become overly concerned with the appearance and taste of commercial foods. To appease consumers, many manufacturers add vitamins and minerals to products to compensate for nutrients depleted in processing.

The result of conventional food processing is a deficiency of important substances. The risk of nutrient deficiency increases if you have a restrictive diet, a pre-existing nutrient deficiency, or if you are elderly. Due to the deficiency of nutrients in our food supply, we have extra nutritional requirements especially during:

- childhood growth, pregnancy and nursing periods;
- performance-demanding situations, (perhaps secondary to chronic illness)
- recovery periods after illness or surgery (convalescence)
- illnesses that disable nutrient uptake from the small intestine
- periods of increased nutrient loss.

The consequences of deficient mineral intake (increased frequency of complaints and eventually serious illness) can sometimes take years to appear, as exemplified by the development of osteoporosis.

To study this area further, more than a few general facts are needed. A review of this field is especially important because many sources of information are available today. Many people seek nutritional counseling to help them understand their nutritional requirements. Most nutritional counselors rarely cover issues beyond calories, carbohydrates, protein and fat. Extra nutritional requirements are usually only considered for pregnant women, and in these cases only calcium ("for the bones") and iron ("for the blood") are recommended.

Some countries have addressed nutrient deficiency by supplementing their

food supply with minerals. A successful and cost-effective trace element supplementation program is the iodization of table salt for the prevention of goiter. If the 90% decline in thyroid disease in Switzerland (where only iodized salt is available) were to be extended into (West) Germany, it would correspond to an annual savings of one-half billion US dollars. Similar progress achieved in the former East Germany was lost after reunification due to the introduction of "West German" salt (see Iodine chapter).

Trace minerals are an important component of soil and therefore have a role in gardening and farming practices. Conventional gardening books often describe and recommend various trace elements that are important to plants. In farming practice, salt stones are given to animals to compensate for trace element deficiencies found in the soil. Even the fields of veterinary medicine and sports medicine utilize knowledge of trace elements.

The safety of trace minerals is an important consideration. The potential to do harm exists in any medical intervention including trace mineral supplementation. The authors have attempted to educate the reader on the consequences of toxic mineral doses and the inappropriate use of trace minerals.

The public's perception of trace minerals is dependent on the way advertisers (and media) choose to portray them. It is understandable that advertisers target attention toward their own products rather than alternative or competing products. In doing so, scientific facts are eventually simplified and singled out to a great extent. The consumer is thereby presented with a limited, one-sided view. This type of advertising often gives the impression that a product can help almost anyone with almost any ailment. Many products sold this way are particularly confusing to the layperson.

Before reading the main sections of the book it may be useful to review the following terms: body content, daily requirement, and absorption rate.

"Body content" describes the quantity of the element found in an adult body of average weight (70 kg). For sodium, this would be 100 g and for potassium this would be 140 g. For cadmium, a relatively abundant but poisonous element, the body content of a 50 year old would be 15 mg (30 mg if this person is a smoker).

"Daily requirement" refers to the recommended daily intake of each element. For sodium, this would be 2-3 g (corresponding to 5 g of table salt) and for potassium this would be 3-4 g.

"Rate of absorption" signifies the fraction of the ingested amount that is taken up by the small intestine.

With American state medical exam (ECFMG) qualification and a keen interest in chemistry, Dr. Klaus-Georg Wenzel provides a unique overview of the trace elements. With a BDDT-N board certification in Naturopathic Medicine, and with a focus on nutritional medicine, Raymond Pataracchia

Trace Mineral	Body Content	Daily Requirement	Absorption Rate
Ca (Calcium)	1000 g	800-1200 mg	varies
Mg (Magnesium)	25-35 g	300-400 mg	25-75 %
Si (Silicon)	1 g	20-200 mg	1-4 %
Zn (Zinc)	2-4 g	15 mg	10-40 %
Fe (Iron)	4-5 g	10-15 mg	5-20 (50) %
Mn (Manganese)	10-40 mg	3-5 mg	5-40 %
Cu (Copper)	80-100 mg	2-3 mg	often only 5 %
Mo (Molybdenum)	20 mg	50-250 µg	varies
Cr (Chromium)	2-6 mg	50-200 µg	1-25 %
I (Iodine)	10-30 mg	200 µg	100%
Se (Selenium)	10-30 mg	50-200 µg	50-100 %

provides a further comprehensive component to this book. This book is intended for medical professionals and non-professionals.

To review all aspects of trace elements would not be possible in this book, as it would require reference to an enormous collection of research literature. Due to the explosive growth of knowledge in this field, some parts of this book may already have been supplemented by new discoveries at the time of printing.

This book is organized for easy access to information. Trace minerals are described individually in Section 1. One-page summaries of trace minerals are provided on the first page of each chapter. The reader can also look up a specific disease or symptom by using the index at the back of the book. The reader will find that this book reads more like a story than a text book without losing sight of clinically important details.

Regarding unit measures: 1 µg = 1 mcg = 0.001 mg.