

Preface

According to the Roman poet Ovid, the Ages of Man are four: Gold, Silver, Bronze and Iron. In his book ‘Metamorphoses’, he tells about the myth of the four Ages. While the Golden Age and the Silver Age are symbolic and represent spirituality, justice and peace, in the Bronze Age men actually used bronze and during the Iron Age they used iron. These two metals played a cardinal role in the development of mankind. Their importance was evident upon their discovery and their use was immediate.

Saint Jerome gave the chronology of these Ages, placing the Bronze Age between the seventeenth and fifteenth centuries B.C. and the Iron Age from the fifteenth century B.C. to his days, around 400 A.D. In modern history, the Bronze Age started around 5000 B.C. and lasted until about 1000 B.C., when the Iron Age began. It lasted until 1 B.C.

Two millennia later, the twentieth century has witnessed a new “Metallic Age”: the Rare-Earth Age. It is named after a group of metals that, unlike bronze and iron, had to wait 2000 years to be discovered. Unlike the two ancient metals, their importance was not evident upon their discovery and their use was not immediate. Had they been discovered a millennium ago they would probably have been doomed to oblivion. Even after their modern discovery they were considered as an oddity and, like another discovery of the twentieth century—the laser—one could say they were a solution waiting for a problem.

However, they had one big advantage over the ancient metals: They aroused curiosity. And curiosity is the driving force of mankind and of research. They presented a challenge: first, to geologists, who found their ores just by chance, on very rare regions on the earth—hence their name: rare-earths. Then to chemists, who laboured hard to separate them, because they are all so similar chemically. Then to physicists, and in particular to spectroscopists, who found their spectra so difficult to analyze that they called them “complex spectra”.

But the twentieth century was ready for them. The scientists rose to the challenge and the mystery has started to lift. The realization of their importance—exactly due to their exotic characteristics—started to dawn both on the scientific community

and on the industry. Their applications became a plethora. We are now in the middle of a fascinating period of an interplay between theoretical and applied research. The rare-earths attracted the interest of the industry that found them indispensably useful in many areas. Exactly this usefulness incited the researchers to delve even deeper into the structure of the rare-earths and explain the origin of their extraordinary properties. They have also extended their attention to the Actinides—the Rare-Earths heavier, man-made (except thorium and uranium) homologues in the Periodic Table. As a result there has recently been accumulated a vast amount of knowledge and insight into the physical mechanisms that are at the basis of these properties. This book tries to present an up-to-date review of the achievements in this subject, that may inspire future accomplishments.

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