Chapter 1
Introduction

From about 12,000 to 50,000 years ago, human beings could already adapt stone tools with intentionally produced edges to specific machining tasks by varying the geometry of the cutting edge, as is shown in early tool findings from the Palaeolithic Age (Fig. 1.1).

The discovery of how to extract metals such as copper, tin and iron was a huge milestone in the history of material and manufacturing technology. Since about 700 B.C., tools were almost exclusively made of iron. At the beginning of the 17th century, constant improvements in iron smelting led to the preferred use of iron and steel as construction materials instead of other metals known then and in place of wood, which had predominated until then.

Inspired by the growth of the textile industry and the discovery of the steam engine, there was increased exploration into manufacturing technology at the beginning of the 19th century, leading by the second half of the 19th century to the first systematic investigations into cutting methods and initiating a completely new research area. At the end of the 19th century further research led to the discovery of new cutting tool materials and, at the turn of the century, to the development of high speed steel by F.W. TAYLOR, a significant contribution to the history of manufacturing technology [Tayl07]. In light of these developments, SCHLESINGER said: "The dividends may lie on the cutting edge of steel, but the speed of these cutting edges is a function of the machine moving them, so as wages increase, the cutting machine is a trump card." [Schl11].

Subsequent research followed in this direction, leading to the development of cemented carbide in 1923 by SCHRÖTER [Schr23, DRP25] at the SOCIETY FOR ELECTRIC LIGHTING as well as its use in machining by FRIEDR. KRUPP AG as WIDIA cemented carbide. Following this was the invention of oxide-ceramic cutting tool materials and their application in cutting after 1938 by OSENBERG as well as WENTORF's development and synthesis of the superhard cutting tool material cBN (cubic-crystalline boron nitride) in 1956 [Went57]. The refinement of cutting tools with wear-resistant cemented carbide coats starting in 1968 by the companies Sandvik Coromant and Friedr. Krupp AG was a major contribution to improving productivity and economy [Sche88].

In order to fulfill the constantly increasing requirements made on workpiece quality and to make machining processes more economical, all the influencing

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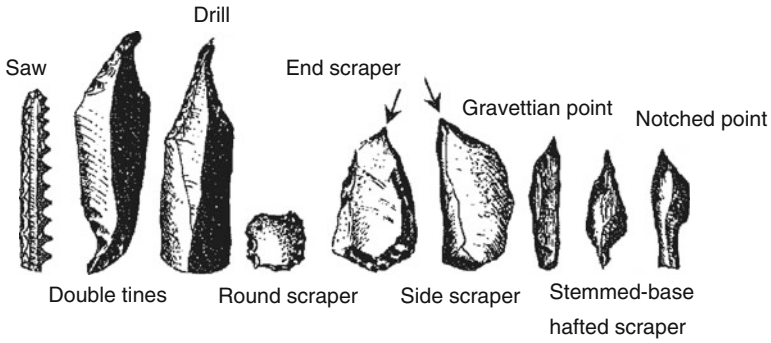

Fig. 1.1 Flint tools, acc. to KERND'L [Kern72]

parameters relevant for productivity and workpiece quality must be considered: cutting edge geometry, process kinematics, cutting parameters, materials, cutting tool materials and their coatings, wear behaviour as well as auxiliary materials. In this pursuit, the following quotation by SCHLESINGER can act as a guideline: "The machine tool must be designed with a view to the place it is used".

As an introduction to the subject matter, the compendium will be preceded by a general chapter providing a survey of the most important attributes of workpieces and their test methods.