Fortschr. Miner.	52	Beiheft 1	103—122	Stuttgart, August 1974

Excursion B 4

Ries meteorite crater, Germany

With 8 figures and 1 table

The following three articles present an introductory description and interpretation of the Ries crater, its impact formations and outcrops which will be visited by the field excursion. The excursion is guided by W. von Engelhardt, E. Preuss and D. Stöffler.

I. The Ries structure and its impact formations

By
W. v. Engelhardt

With 2 figures

The Ries crater, 24 km in diameter, which is 100 km northwest of Munich (Fig. 1) has been the object of many geological investigations, for more than hundred years. Older theories assumed that the structure was produced by volcanic forces, or even by glaciation. The impact theory, tentatively expressed by Werner (1904) and Stutzer (1936), was first confirmed by the detection of coesite in suevite by Shoemaker & Chao (1961). Later geophysical, geological and petrological investigations provided many further contributions to the knowledge of this crater and its formations, formed by an impact 14.8 million years ago. A theoretical approach to describing the Ries impact as a physical process was published by David (1969). Reviews in the older literature about the Ries were given by Löffler (1925), Kranz (1925—1952), Preuss (1964, 1969) and Dehm (1969). Several articles, representing the knowledge up to 1969, are contained in the volume "Das Ries", edited by Preuss & Schmidt-Kaler (1969). A summarizing review was published by Dennis (1971). The following remarks can only deal with the facts of general importance.

Nearly the whole Ries area has been geologically mapped at the 1:25,000 scale (see Preuss 1964, Hüttner, Schmidt-Kaler & Treibs 1969). The mapping was done by several people with different theoretical backgrounds, over a long period of time (since 1925), and before the impact origin of the crater was recognized. Therefore, the maps, although representing extremely careful and reliable observations, do not provide all the information which is desirable from the point of view of the impact theory. A geological map (scale 1:100,000) of the whole Ries area was recently published by Hüttner, Schmidt-Kaler & Treibs (1969). It represents a synopsis of the information available to 1969.

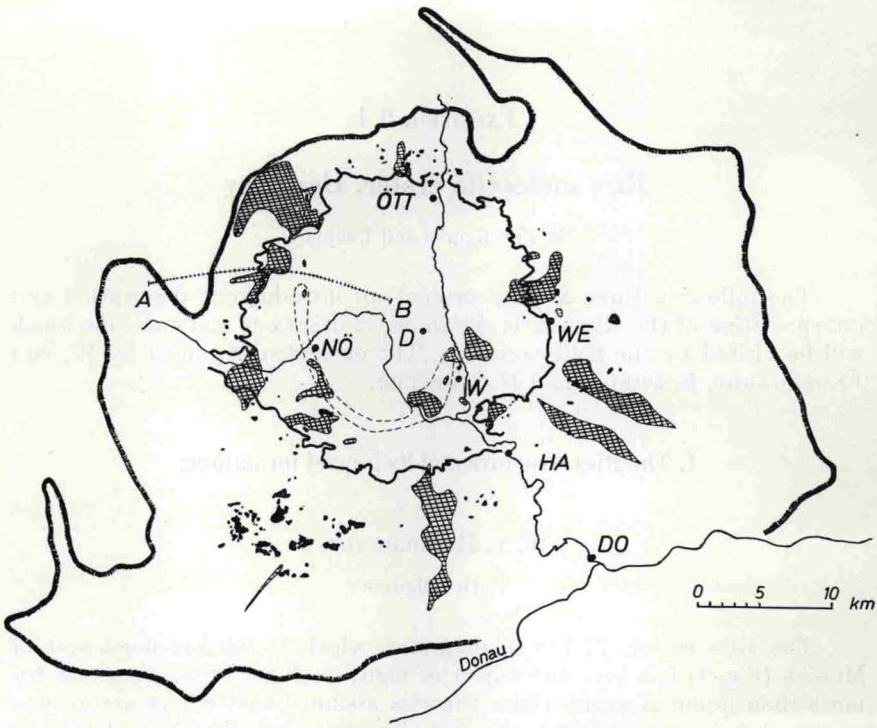

Fig. 1. Ries crater, Germany. D = drill hole of Deiningen W = drill hole of Wörnitzostheim A—B = seismic profile, Fig. 2.

The outermost contour defines the area around the crater covered by multicolored breccia, consisting of fragmental sedimentary rocks. Hatched areas are rich in crystalline rocks excavated from the basement as large uniform blocks or monomict and polymict breccias. Black spots are occurrences of suevite. The morphological crater rim is represented by the 500-m contour line in the southern half and the 460-m contour in the northern half of the structure, respectively. The horseshoe-shaped ring of hills surrounding the central crater is indicated by a dashed line.

In the Ries area the crystalline basement (gneisses, granites, amphibolites of Hercynian age) is overlain by a sequence of Mesozoic sediments, roughly 700 m thick. The sequence consists of about 300 m of Upper Jurassic limestone, about 150 m of Middle and Lower Jurassic sandstones and shales, about 250 m of Upper to Middle Triassic (Keuper) marls, sandstones and shales and Lower Triassic or even Permian sediments of variable thickness. The sediments dip gently to the south. The hard Upper Jurassic limestone forms an escarpment, the Swabian Alb, striking west-southwest. At the time of the impact the escarpment crossed the present Ries plain close to its center.

The flat bottom of the Ries depression has an average elevation of 420 m above sea level. The surrounding hills reach elevations of over 600 m in the south, where they are built up by Upper Jurassic limestone, but only 500 m