

## DEVELOPMENT OF GEOTOURISM IN THE NATIONAL GEOPARK RIES, SOUTHERN GERMANY

D. Stöffler<sup>1</sup>, G. Pösges<sup>2</sup>, and R. Barfeld<sup>3</sup>. <sup>1</sup>Natural History Museum, Humboldt-University, D- 10115 Berlin, Germany, [dieter.stoeffler@museum.hu-berlin.de](mailto:dieter.stoeffler@museum.hu-berlin.de); <sup>2</sup>Ries Crater Museum, Eugene-Shoemaker-Platz 1, D-86720 Nördlingen, Bavaria, Germany; ZERIN (Centre for Ries Crater and Impact Research Nördlingen), Vordere Gerbergasse 3, D-86720 Nördlingen, [poesges.gisela@noerdlingen.de](mailto:poesges.gisela@noerdlingen.de); <sup>3</sup>Ing.- Büro Barfeld, Hutergasse 1, D-86720 Noerdlingen, Bavaria, Germany, [ibarfeld@t-online.de](mailto:ibarfeld@t-online.de)

**Introduction.** The Geopark Ries in Southern Germany represents a unique natural and cultural landscape that has its origin in a cosmic event. The Geopark covers an area of 1800 km<sup>2</sup> comprising 5 different counties with a total of 53 communities. Therefore, the Ries is the most densely populated impact crater on Earth. Because of its unique characteristics the “Ries of Nördlingen” has been certified as a National Geopark in May 2006. It is the first Geopark in Bavaria [1, 2, 3].

**The Ries crater:** The „Ries of Nördlingen“, a 25 km sized circular basin, and its satellite crater – the 3.8 km sized Steinheim basin – were formed 14.5 million years ago by the impact of a large asteroid (~ 1.2 km in diameter) which was orbited by a small satellite (~ 200 m in diameter) [4, 5]. The Ries crater is the only so-called complex impact crater worldwide where the crater structure and a large part of the ejecta blanket are well preserved and morphologically still visible. The double crater – Ries and Steinheim - represents a singularity in the natural heritage of Europe as it offers an extraordinary example of an interaction between a special type of landscape and its cultural development. In contrast to all other types of natural environments on Earth impact craters such as the Ries crater are formed as an extreme short and highly dynamic process. The Ries impact during which a transient, ~ 5 km deep and 12 km wide crater collapsed into a flat, 600 m deep crater with a central ring structure and a 25 km wide crater rim, took place within a time frame of only about one minute. During this short crater-forming process several “new” rock types such as “Suevite” and “Bunte Breccia” were formed [6, 7] (Figs. 1 and 2).



Fig. 1: Suevite on top of Bunte Breccia, Aumühle, Ries

In fact, The Ries is the type locality of suevite, an impact breccia named after the Latin word “suevia” (German = Schwaben) and used now for this type of rock worldwide [7]. After the impact the crater contained a lake for about 2 millions years in which post-impact freshwater limestone was formed. These different types of rocks have been used as building stones and also as source products for the cement production located in the Ries. The cathedral of Nördlingen and even relics of Roman buildings consist of suevite.

**Goals of the Geopark:** The park is aimed to highlight this unique region for laymen visitors as well as geological experts by demonstrating its origin and history from its cosmic roots to its terrestrial after-effects. Besides geological outcrops and quarries, there are other attractive sightseeing sites which include relics of the first stone-age settlements (some 40,000 years old) to be found in karst caves, as well as relics of the Celtic, Roman and Alemannic settlements [e.g., 8]. The Geopark is extremely rich in the testimony of Middle age architecture as documented by cities, castles, monasteries and churches.

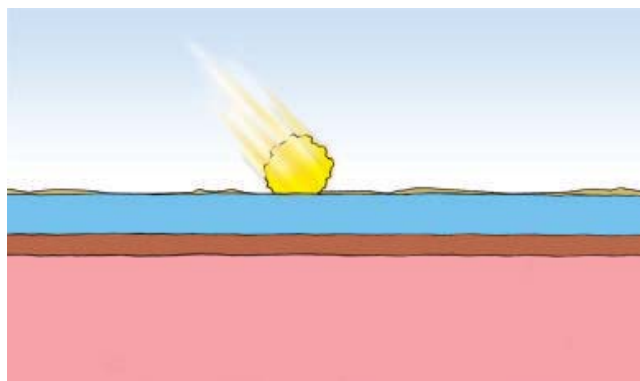
**Project planning and implementation:** As part of the development of the National Geopark Ries a systematic assessment of a total of about 350 geotopes is currently undertaken [3]. The mapping effort and the archiving of relevant data include also deep drilling sites which help to get information about the deep structure and lithological character of the Ries impact crater. Five geotopes within the area of the Geopark Ries belong to the list of “Bavarias most beautiful geotopes” which is an initiative of the Bavarian State Office for Environmental Protection. As a next step after completion of the archiving effort touristically attractive geotopes will be selected and combined into a network of sightseeing tours for Geopark tourists. At this time 16 different sightseeing tours have been defined. They include tours to be made by car (or bus), bicycle and by walking and are planned for short and long duration visits of the Geopark (1-5 days). It is planned to implement about 10 of these tours.

Although the project planning for the Geopark Ries, and its implementation are not yet completed, the park offers already several attractive elements: (1) A

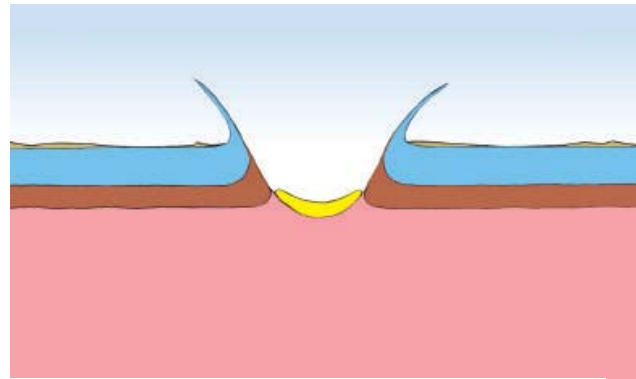
professionally made “Information Center” in the heart of the middle age city of Nördlingen, (2) a first visitor tour through the crater, the so-called “Schäferweg” (“Shepherd Trail”) (3) the Ries Crater Museum at Nördlingen established in 1990 [9] and devoted not only to the Ries but also to impact processes in the Solar System in general, (4) the “Trail of Planets” starting at the cathedral of Nördlingen (Sun) and ending at the crater rim which represents the orbit of Pluto, and (5) the ZERIN (Center for Ries and impact crater research) which archives drill cores and other samples from the Ries and offers facilities for visiting scientists.

**References.** [1] Pösges G., Barfeld R. and Stöffler D. (2008) *Schriftenreihe der Deutschen Geologischen Gesellschaft, Heft 56, 22-25*, Hannover. [2] Stöffler D., Pösges G., Arp G., Kenkmann T., Reimold U. and Wünnemann K. (2008) *3<sup>rd</sup> International UNESCO Conference on Geoparks, 22.06.–26.06. 2008, Osnabrück*. [3] Barfeld R., Pösges G. and Stöffler D. (2008) *Schriftenreihe der Deutschen Geologischen Gesellschaft, Heft 56, 22-25*, Hannover. [4] Stöffler D. et al. (2002) *Meteoritics & Planet. Sci.* 37, 1893-1907. [5] Wünnemann K. et al. (2004) in Kenkmann T. et al. (eds.) *Large meteorite impacts III*, Geological Society of America Special Paper 384, 67-83. [6] Stöffler D. (1966) *Contr. Mineral. and Petrol.* 12, 15-24. [7] Stöffler, D. and Grieve, R. A. F. (2007) in Fettes D. and Desmons J. (eds.) *Metamorphic Rocks: A Classification and Glossary of Terms, Recommendations of the IUGS, 111-125, 126-242*, Cambridge Univ. Press, Cambridge, [8] Krause R. (2004) *Arch. Inf. Baden-Württemberg* 47, Stuttgart. [9] Pösges G. and Schieber M. (1997) *Academy Bulletin Nr. 253, Bavarian Academy for Teacher Training*, Dillingen, Pfeil-Verlag, München.

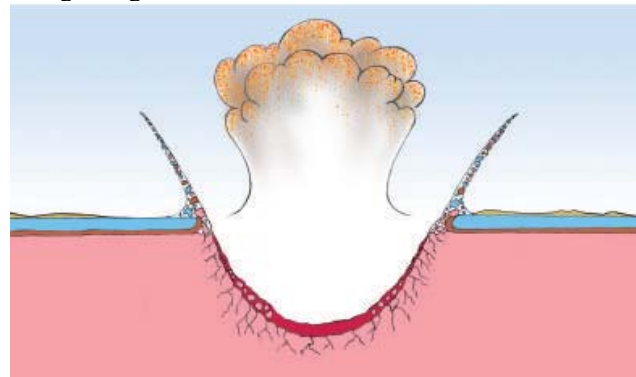
Fig. 2: Formation of the Ries impact crater; yellow = Tertiary, blue = Malmian, brown = Triassic, pink = crystalline rocks; projectile diameter = 1.2 km;



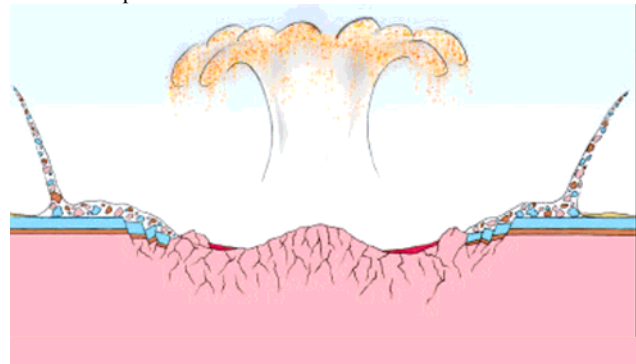
10 milliseconds after impact



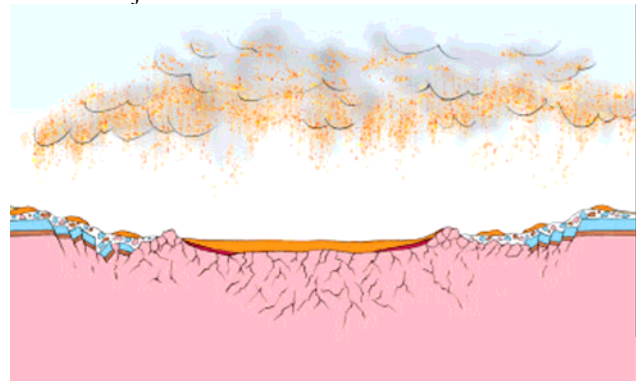
Beginning of crater formation after 60 milliseconds



Deep “transient crater” after about 10 seconds



Collapse of the “transient crater” and deposition of ejected rock masses after 1 minute



Final crater and deposition of fall back suevite after 10 minutes; orange = suevite, red = impact melt rock