

The Permian-Triassic Boundary in the Carnic Alps of Austria (Gartnerkofel Region)		Editors: W.T. Holser & H.P. Schönlaub		
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**The Permian-Triassic
of the Gartnerkofel-1 Core
(Carnic Alps, Austria):
Remarks on the Natural Gamma Ray Log and Density Log**

By RUPERT SCHMÖLLER*

With 2 Text-Figures and 1 Plate (appendix in pocket)

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*Carinthia
Carnic Alps
Permian/Triassic Boundary
Gamma Ray Log
Density Log*

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Zusammenfassung

Dolomite, Kalke und Muschelkalkkonglomerat der Bohrung Gartnerkofel-1 zeigen bei niedrigen Gammawerten meist hohe Dichten. Eingeschaltete tonige Lagen (oberer Teil des Perms bis Skyth) bewirken erhöhte Gammazählraten. Ein niedriger Pegel der natürlichen Gammastrahlung hält von der ursprünglich bei 187,4 m angenommenen Perm/Trias-Grenze bis zu einem plötzlichen Anstieg bei 218 m an. Die letztlich akzeptierte Perm/Trias-Grenze ist offensichtlich durch einen neuerlichen scharfen Abfall zu niedrigen Gammazählraten bei 224,5 m gekennzeichnet.

Abstract

Dolomite, limestone and Muschelkalk conglomerate of well Gartnerkofel-1 show low gamma counts and predominantly high densities. Intercalated shaly beds (upper part of Permian until Scythian) cause high gamma rates. A low gamma level downwards from the originally assumed Permian/Triassic boundary at 197.4 m is followed by a sharp rise at 218 m. The now accepted Permian/Triassic boundary is obviously defined by a sharp drop back again to low gamma counts at 224.5 m.

1. Introduction

As a supplement to the lithostratigraphical and geochemical analysis of the Gartnerkofel-1 core, geophysical down-hole logging was accomplished on completion of the hole. Studies of heat-flow-density measurements for temperature and thermal conductivity which were also planned at the beginning of this project could not be carried out due to loss of water and fractionation of the dry dolomitic sequence.

Down-hole logging was carried out on October 3rd, 1986, using the Japanese OYO Geologger for natural gamma-ray and density logging (Text-Fig. 2).

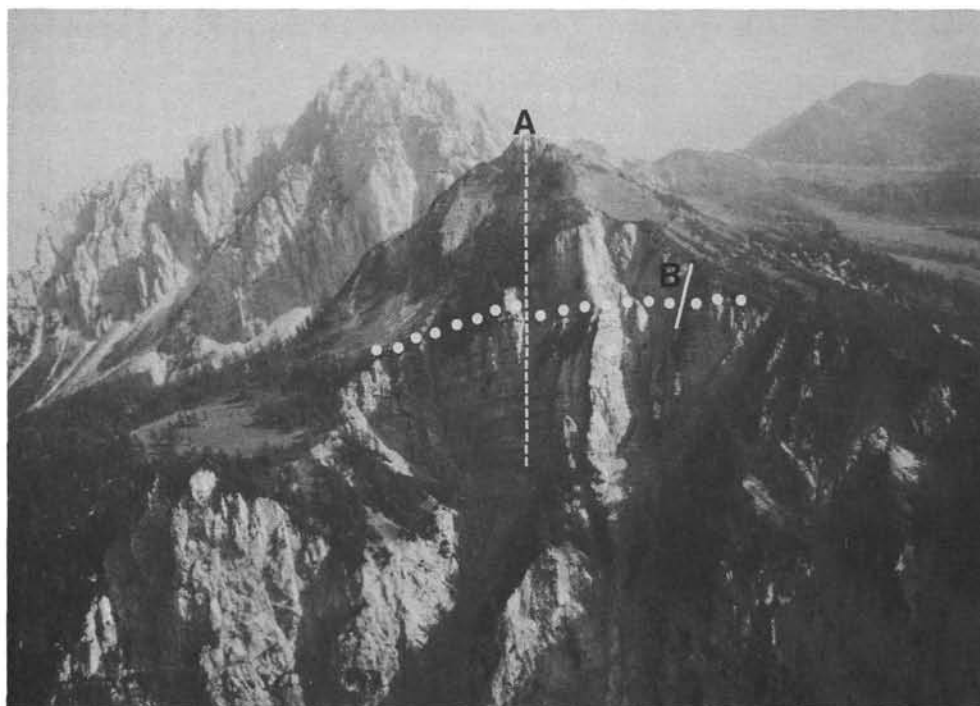
2. Measuring conditions

There were special environmental conditions for well logging purposes: the wellbore was a cased and dry hole.

The gamma ray log is moderately influenced by the casing. A cross plot of natural gamma ray logs in cased holes and in the equivalent open holes is linear, although the relative change in gamma ray counts is less in cased holes due to the attenuation of the gamma rays by the casing.

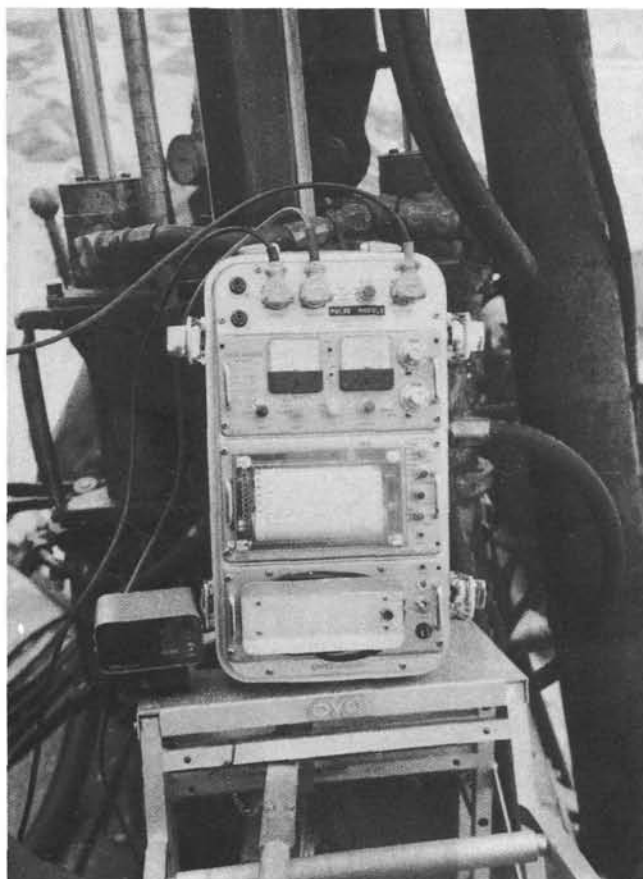
Air instead of some kind of mud in the hole means less attenuation of the gamma rays, and is therefore

*) Authors' address: Univ.-Prof. Dr. RUPERT SCHMÖLLER, Institut für Geophysik, Montanuniversität Leoben, Franz-Josef-Straße 18, A-8700 Leoben.



Text-Fig. 1.
Aerial photograph from the north of the Reppwand with the Gartnerkofel (2195 m) in the background. A: Drill site on Kammeiten (1998 m); B: Top of the outcrop section. Dotted line indicates the Permian-Triassic boundary between the Bellerophon Formation (below) and the Werfen Formation above. Photo: G. FLAJS, Aachen.

favourable for maintaining a high level of ray counts. But there might be some deflections due to cavities (not controllable by a caliper log) and the unknown eccentricity of the sonde. In combination with low density indications reduced gamma ray counts could instead be interpreted as indicative for washouts or cavities.



Text-Fig. 2.
Japanese DYO Geologger used for down-hole logging.

Low gamma readings are normally characteristic for most sandstones, limestones and dolomites, high readings for shales, potassium salts, acid and intermediary magmatic rocks (Gartnerkofel 30–24 m), that is generally all materials containing U, Th or K.

The density log is very much influenced by the casing. As there were two different casing strings (HQ to 220.5 m, NQ to 330 m) corrections had to be made. As the hole was empty (air instead of mud) the calibration might not be quite correct. Density probes are usually calibrated for mud filled holes. Hole size changes have also much influence on the density reading, especially in air filled holes and when running the log through casing. In this case the probe cannot be pressed against the rock wall and might have different distances to the rock depending on the possibly changing eccentric position of the casing in the hole.

So the density log should mainly be regarded as a relative reading of densities, strongly indicative for cavities if values go down to the range of 1.5 to 2 g/cc, or below that level.

3. Interpretation

The geophysical logs are reproduced in Plate 1 (in pocket) along with the well-site lithologic log of the core.

A rough rule of interpretation of the Gartnerkofel-1 logs might be as follows:

Density log	Gamma-ray log	Interpretation
low	low	cavities (faulting?)
high	low	dolomite, limestone, conglomerate
low	high	shales
medium	high	andesitic

The originally assumed P/Tr boundary at 187.4 m is characterized by a distinct reduction of natural gamma

ray readings below that depth, persistent down to the depth of 209.5 m but with a sharp rise at 218 m. The now accepted P/Tr boundary at 224.5 m is obviously defined by the sharp drop of this high gamma level to the low gamma counts in the Bellerophon Formation.

Low gamma ray readings are generally indicative for the Muschelkalk Conglomerate and those sections, where dolomite is predominant. The upper part of the Scythian down to 187.5 m and the Permian from bot-

tom hole up to 218 m show changing radioactivities, obviously reflecting a high incidence of intercalated shaly interbeds.

No clear evidence of a repetition of a geologic section could be found from the logs. But there is a gradational similarity at 224.5 m and 187.5 m: at these depths there is a sharp rise of radioactivity in up-hole direction, indicating regressional events with argillaceous sedimentation.

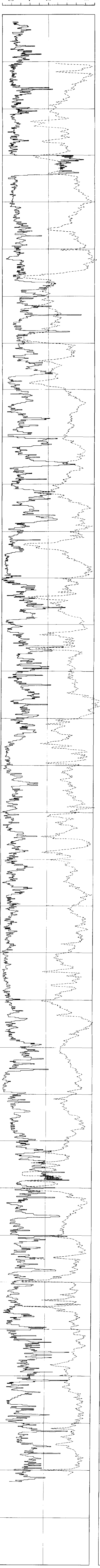
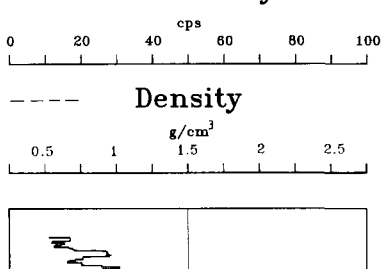
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Well-site

GARTNERKOPFEL - 1

Date: Oct. 1966
Bottom hole depth: 330 m
Hole diameter: 72 mm
Casing diameter: 63 mm
Mud: OYO
Instrument: Scale 1:200
Operator: R. Schmöller

- Color**
- Light gray
 - Medium gray
 - Dark gray
 - Black
 - Greenish
 - Brownish
 - Red or brown
- Lithology**
- Dolomite
 - Limy Dolomite
 - Limestone
 - Shale
 - Marl
 - Siltstone
 - Sandstone
 - Conglomerate
 - Breccia
 - Volcanics
- Notes**
- Ooids
 - Fossils
 - Bioturbation
 - Stylolite
 - Flaser bedding
 - Laminar bedding
 - Tempestitute
 - Faulting
 - Dip
 - Birdeye texture



Lithology
Color
Formation
Age
Period
Depth

Notes

0-10 m: Conglomerate on dm scale dominantly red-brown to pink Campil components, some volcanic and Seis, no Bellerophon or earlier components

10-20 m: Strong pressure solution

20-30 m: Andesitic volcanic member

30-40 m: Strong pressure solution

40-50 m: More gray fragments, including Seis

50-60 m: Gastropod oolite boulder

60-65 m: Fractured and altered faulted contact

65-70 m: Breccia

70-75 m: 23° dip

75-80 m: 35° dip

80-90 m: Shaly partings

90-100 m: Earliest red, silty dolomite

100-110 m: 20° dip

110-120 m: Gastropode oolite facies Shelly beds

120-130 m: Black opaque mineralization

130-140 m: Hematite ?

140-150 m: 35° dip

150-160 m: 25° dip

160-170 m: 20° dip

170-180 m: Shelly beds

180-190 m: Shaly partings

190-200 m: Limy dolomite Gastropod oolite facies

200-210 m: Oolites ?

210-220 m: Marly limy dolomite

220-230 m: Laminar bedding

230-240 m: Sandstone

240-250 m: Shaly partings, shale, dolomitic marl

250-260 m: Only stylolitic bedding

260-270 m: Fault: steep dip, horizontal throw

270-280 m: Shaly partings

280-290 m: Black, structureless clay

290-300 m: Only stylolitic bedding

300-310 m: Only 50% recovery

310-320 m: Birdeye texture

320-330 m: Stylolitic

Sedimentary breccias and poor recovery

Clasts

Interclasts

Cavity fillings

Rauwacke ?

ZOBODAT - www.zobodat.at

Zoologisch-Botanische Datenbank/Zoological-Botanical Database

Digitale Literatur/Digital Literature

Zeitschrift/Journal: [Abhandlungen der Geologischen Bundesanstalt in Wien](#)

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Autor(en)/Author(s): Schmöller R.

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