In memory of Werner Kaminski (1935 - 2017)

Bridge builder from analogue to digital seismology

Klaus Bonjer[1)], Karl Fuchs[1)], Jim Mechie[2)], Claus Prodehl[1)], Joachim Ritter[1)], Helmut Wilhelm[1)], Walter Zürn[3)]
[1)]KIT Geophysikalisches Institut (GPI), [2)]GeoForschungsZentrum Potsdam (GFZ), [3)]Geowissenschaftliches Gemeinschaftsobservatorium (BFO)

On 15th March 2017 Diplom-Geophysiker Werner Kaminski died suddenly. Miki, as everybody called him, was a member of the German Geophysical Society for 52 years and worked as a geophysicist for more than 30 years at the Geophysical Institute (GPI) of the University of Karlsruhe (TH), now known as Karlsruhe Institute of Technology (KIT).

Miki was born on 5th September 1935 at Hildesheim, Germany. In 1957 he started studying mine surveying at the Bergakademie Clausthal, but soon he changed to geophysics. In 1963 Miki received the diploma degree in geophysics at Clausthal under the supervision of Prof. Heinz Menzel. In his diploma thesis he investigated the ground motions associated with explosions at a limestone factory at Dornap close to Wuppertal.

In December 1963 Miki became the scientific assistant of Prof. Heinz Menzel at Hamburg. His task was to transfer seismic problems onto digital computers which had become recently available. Miki used the first analogue-digital conversion systems to digitize seismograms for further investigations. Within the group "Sea Seismics" he developed the software to digitize and recode the frequency-modulated seismic recordings and to store them on magnetic tapes which could be read by computers.

In February 1973, Prof. Karl Fuchs offered Miki a permanent position at Karlsruhe University. Based on Miki's advice, the Raytheon-704-computer was purchased and operated by him. On „his" Raytheon Miki implemented his data processing system from Hamburg and developed it further to great efficiency. Meanwhile the company Lennartz had developed the MARS-66 stations, and it was not very long before Miki was able to digitize the data recorded by these instruments and store them on computer tapes. This procedure was a fundamental step towards the construction of seismic record sections. Now the seismograms of any individual seismic station could be plotted in any desired form (different normalization factors and reduction velocities etc.) and reproduced at any time on digital plotters.

By 1974, the MARS-66 magnetic-tape recording instruments had been purchased by many research institutions throughout western Europe and, from 1974 onwards, Karlsruhe with its Raytheon and Miki's program package became a center for the urgently needed conversion of analogue field data into computer-readable digital tapes. The international long-range profile through Britain, LISPB-1974, was the first project from which data were processed by Miki on the Raytheon.

The following 12 years became known as the decade of international long-range profiles with recording distances of 1000 km and more. Almost exclusively, the large amount of data from these projects was digitized and further processed at Karlsruhe under the supervision of Miki. In 1975, ALP-75 and a project exploring the deep structure of the Damara-Orogen in Southwest Africa followed. A long-range profile through Israel and the Sinai peninsula in 1977, several profiles within the geothermal project "Urach" in 1978 and the long-range projects "Rhenish Massif" and "Fennolora" (Fennoscandian Long Range Seismic Project – Baltic Sea to North Cape) in 1979 completed the projects of the 70s, digitized and processed in Karlsruhe. In the 80s, the Irish Caledonian Suture Seismic Project in Ireland in 1982, the "Black Zollern Forest" project in SW-Germany in the framework of the KTB-pre-site surveys and a seismic-refraction project in Jordan in 1984 and the first Kenya Rift International Seismic Project (KRISP) in 1985 followed. Finally, data from the central part of the European Geotraverse from Genoa to Kiel in 1986 were digitized and processed in Karlsruhe, this being the last large project where MARS-66 stations were deployed in

large numbers.

With the installation und calibration of an 8-channel PCM-5000 recording instrument of the company Lennartz in 1979 on the Feldberg in the southern Black Forest, the digital recording of local earthquakes in the southern Rhinegraben started as a routine task. In 1982 similar routine recordings started in Romania. Also here, Miki supplied the necessary software to transfer the data from the PCM-5000 recordings to computer-readable digital tapes.

From the very beginning, Miki's competence was needed for the operation of a central digital recording system at the geoscientific Black Forest Observatory (BFO). Following Miki's concept, in 1976 a new Raytheon-500 was installed at Karlsruhe, while the well-tried Raytheon-704 was installed at the BFO. For the peripheral analogue-digital converter of the company DATUS, Miki prepared the concept, in cooperation with an engineer from the company. Miki wrote programs to acquire the data as well as to store and compress them. Already before this time, co-workers and guest scientists had worked at Karlsruhe with Miki's support on data from other sources. An important task was to synchronize the clock of the Raytheon-704 with the time code DCF, which required a change in the hardware of the Raytheon-704 and complex programming on a low interrupt-level. This system was tested by Miki on the Raytheon-500 at Karlsruhe and then implemented on the Raytheon-704 at BFO. The first spectrum of free oscillations of the Earth could be calculated for an earthquake in Colombia (12th December 1979). These data were the basis for several dissertations and diploma theses at GPI. While R. Widmer worked on his Ph.D. thesis, it turned out that the BFO recordings in the eigenfrequency band were among the best worldwide. Several years worth of BFO data from the time of the Raytheon-704-DATUS system are archived at IRIS in Seattle. Miki rendered outstanding services to the BFO.

At the end of the era of analogue seismic recorders and their replacement by digital seismic recorders, the GPI also replaced the Raytheon with the Convex to cope with the increasing demand for the processing of deep seismic reflection data at the institute, in addition to the wide-angle reflection / refraction data. Miki saw to it that before the Raytheon was finally dismantled, all important data from the experiments of the 70s and 80s were copied onto 9 track 800 bpi (bits per inch) tapes and that the Convex had one tape unit which could read such tapes. This then enabled these data to be copied onto ever more advanced media and to their eventually becoming preserved for all time in the data archive of the GeoForschungsZentrum Potsdam (http://www.gfz-potsdam.de/sektion/geophysikalische-tiefensondierung/infrastruktur/geophysikalischer-geraetepool-potsdam-gipp/archiv/). In this data archive, the original raw data are stored in the format developed by Miki for these data and software, also partly written by Miki, is archived with each data set to read the original raw data and convert them to SEGY format. At the beginning of the era of digital seismic recorders when each recorder tended to have its own format, Miki provided valuable assistance in deciphering the various formats and merging the various parts of a data set into one complete, consistent data set in SEGY format. This was particularly the case in the second KRISP project when computer tapes from the USA, France, Ireland and the UK all arrived at the GPI and had to be read in and merged into one complete SEGY data set for further distribution and analysis. Miki always enjoyed the challenge of deciphering what a foreign computer tape contained.

At Karlsruhe Miki was the bridge builder from analogue to digital seismology. He knew as well as anyone else how to apply the tools of digital processing to seismic data, even before the introduction of data formats which nowadays are used worldwide. He maintained a broad overview and was familiar with all the details during this time of rapid changes from analogue to digital seismology. His digitizing and data processing routines which he continuously updated, were the essential background for successful applications of research projects to the German Research Society (DFG) and their subsequent completion in the field and the laboratory and at the BFO Observatory. Miki‘s system formed the basis for many diploma and PhD theses. Due to his unique developments in digital data conversion and processing, Miki became internationally known amongst scientists working on the exploration of the Earth's crust and upper mantle worldwide. Institutions in Europa, North America, Africa, the Middle East and China sent their experts with their data to Karlsruhe for

cooperation.

Miki was a highly respected friend and colleague at the Geophysical Institute of the University of Karlsruhe. He was competent, friendly and always ready to help. Without many words we knew that we could rely on each other. Most of us had the feeling that we obtained more from Miki than we were able to give.

Miki married in 1963. He experienced a happy family life with his wife Ange and his four daughters Susanne, Birgit, Petra und Heike. Miki loved working with his hands and sports, in particular tennis. He travelled regularly by bike the 20 km distance from his home down to the institute at Karlsruhe in the morning and back up in the evening. He loved hiking and skiing in the Alps. For many years he was an active member of the ski club in Ettlingen where, after his retirement, he served as an official.

In September 2000 Miki retired from active service. We will always remember Miki as a wonderful, highly respected and helpful personality.