Geophysical Research Abstracts, Vol. 9, 04859, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-04859

Thermal up welling at Lake Neusiedl revised (Northern Burgenland, Austria)

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For centuries, ice-free spots at Lake Neusiedl were described as the result of locally up welling warm water during winter times, thus termed “Kochbrunnen” (meaning “boiling wells”). Even in several papers these “boiling wells” were interpreted as thermal water discharge along the postulated Lake Neusiedl fault. In a tectonic map dating 1958, two spots are marked as methane seepages, however, namely at Podersdorf at the eastern edge, and at Mörbisch, on the western edge of the lake. More recent studies identified an additional “boiling well” near Rust, as methane seepage, too.

As skating, ice sailing and kite surfing are very popular sports when Lake Neusiedl is deeply frozen, especially in February, several accidents were reported when people sunk in the icy cold water although the depth of the lake does not exceed 1.6 metres. This paper deals with the classification of “boiling wells” for the local prediction of hazardous ice-free spots for winter sports on the lake.

In order to find out if “boiling wells” really are lined up along the northeast trending, so called “Neusiedl fault” we started a reconnaissance flight covering the 300 km^2 frozen lake followed up by ground check of selected sites using a hovercraft. In detail we monitored locality and size of ice-free spots, measured water temperature at several depths with data loggers, and collected gas samples for analyses in the laboratory.

During the freezing conditions of February 2005 in total three different types of methane seepages could be identified. When the thickness of the ice reached about 12-15 cm, countless dark ice patches of up to few meters in diameter were visible along the snow-covered edge of the lake. Each circular area contained frozen gas bub-

bles in its centre, which were identified as methane by simple burning. These spots were interpreted as young bioorganic emanations derived from the mud of the lake bottom. A variation was found at several places where circular areas of up to some tens of meters in diameter occurred, each with a small hole in the centre either filled with lake water or frozen (and filled with gas bubbles, too). The size of these circular areas depended on wind induced undulations of the lake water through the ice hole, which shortly melted the surrounding snow cover during sunny days and thus formed circular ice patches, surrounded by snow covered ice.

The third type of ice-free spots is a more stable one regarding its coordinates, and their size is depending on both thickness of the ice, and gas bubbling activity. Such spots were investigated near Rust and Podersdorf, where the gas was identified as older methane (exceeding 40.000 years) by ^{14}C dating. The thicker the ice, the smaller become the open holes.

The short termed study of temperature logging of ice free spots revealed that during day and night time the water temperature in open holes varied from about 2.29˚C in the near subsurface to 2.97˚C close the lake bottom. We interpret the fluctuation of some tenth degrees at each depth during the monitoring time as local temperature changes due to wind induced undulations of the open water surface causing local underwater currents below the ice. The electric conductivity varies between 1.3 and 1.6 mS/cm at all sampling stations without any significant change at gas bubbling sites. From these measurements we conclude that thermal water is not the reason for “boiling wells” during wintertime. In addition, no circular ice free spots could be observed in the central lake along the postulated Neusiedl fault, where limnologists interpret the existence of long cracks paralleling the edge of the northeast oriented lake by heavy winds generally blown perpendicular from northwest.

As the emanation paths for type 3 of “boiling wells” can be assessed as stable, the risk for winter sports is relatively low because its location and size can be predicted regarding the ice thickness. Type 1 and type 2 “boiling wells” are not hazardous whereas wind activity during the melting period causes ice-free patches of unpredictable occurrence and size.