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Refining the timing of glacier variations at the Pleistocene/Holocene transition based on 10Be exposure dating

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Glacier advance during the Younger Dryas led to formation of Egesen moraines as confirmed by exposure age data from several Egesen sites throughout the Alps. The coherence of our 10Be exposure age data allow us to examine the fine structure of changes of glacier and rock glacier activity in the central Alps at the Pleistocene/Holocene transition. In some regions the Egesen maximum (I) moraines occur as a doublet or triplet, in suitable locations many minor moraines are preserved in between. This indicates a markedly unstable climate, characterized by a succession of glacier-friendly periods. Results from the Schönferwall site (Tyrol, Austria), and the outer left lateral moraine at Julier Pass (Lagrev Glacier) indicate that Egesen I moraines stabilized between 12,000-12,500 years ago (based on 10Be). At the Julier Lagrev site a second phase is documented by the frontal moraines of the inner moraine which show characteristics transitional between former ice-cored moraine and rock glacier. Thus stabilization of the landform was delayed. This second phase dates to about 11,000 years ago. In some valleys, a moraine set located outside the Little Ice Age limits and much less extensive than Egesen has been recognized. In Kartell Valley (Ferwall group, Austria), this stadial dates to between 10,500 and 11,000 years ago (based on 10Be). The sum of this evidence implies that in the Alps, the end of the Younger Dryas was not characterized by a sudden jump in temperature. In contrast, rock glacier activity and even advances of small glaciers during the early Preboreal were the response to cold and also rather dry conditions that continued for hundreds of years after the Holocene had begun. Recent results from the Larstig site will be

discussed in light of this chronological framework.