NOTES ON CONTENTS OF ^{10}Be ISOTOPE IN TEKTITES AND MICROTEKTITES OF THE AUSTRALASIAN STREWN FIELD. M. Trnka[1], [1]Lithos Co., Ltd., Durdakova 41, 613 00 Brno, Czech Republic (trnka@lithos.cz).

Introduction: The determination of the contents of cosmogenic radionuclide ^{10}Be in impactites emerges from an effort to closer characterization of their source rocks as well as understanding of the processes how these impact-generated materials formed. Considering ^{10}Be half-life of 1.39 Ma, the method is applicable to relatively young tektites and other impactites. Major part of ^{10}Be forms in the atmosphere (meteoric ^{10}Be), where it is present as ^{10}BeO or ^{10}Be(OH)$_2$ aerosols. The processes responsible for ^{10}Be accumulation in the rocks on the Earth surface include precipitation from these aerosols or sedimentation in dry form [1, 2].

The contents of the ^{10}Be isotope in the Australasian tektites and microtektites have been the subject of interest in several studies ([3-7] et al. etc.). The average content of ^{10}Be isotope in tektites gradually increase from 69×10^6 atom/g in the Indochina region to 136×10^6 atom/g in Australia. Nevertheless, the ranges of ^{10}Be contents for the tektites in individual areas overlap. A similar trend of increasing ^{10}Be contents from Indochina towards the south is observed also for microtektites, although the number of analyses performed is small. It should be noted that the ^{10}Be contents in the microtektites are by about 30×10^6 atom/g higher compared to the tektites from the closest regions [7].

The territory of Indochina is generally considered the most likely region of impact forming all tektites and microtektites of the Australasian strewn field. The above authors explained the trend of increasing average of ^{10}Be contents in tektites from Indochina southwards by decrease in velocity of impact ejecta with their increasing original deposition depth.

More elaborate analysis, however, shows that such an interpretation is inconsistent with a number of facts. Isotope ^{10}Be penetrates into rocks on the Earth surface to a limited depth only. Its content would decrease smoothly with depth assuming a homogeneous and long-term stable environment. Since the expected thickness of a source material does not exceed X0 m most probably, a variable environment influenced the accumulation of ^{10}Be making the described distribution trend of the isotope unlikely. Besides the depth below the surface, ^{10}Be contents are substantially influenced by the sorption potential and the size of the free surface of sediment particles, i.e., mainly by grain size and mineral composition [8-10]. Coarser-grained common clastic sediments are richer in clasts (mostly quartz and feldspars), poorer in clay matrix and carbonate cement, and vice versa. This is reflected in the overall chemistry. Ratio SiO_2/Al_2O_3 or a CaO content may represent an indicator of these differences.

From this point of view, a simple comparison of ^{10}Be contents could provide interpretable results only for tektites and microtektites displaying very close major element composition. However, the so far published results of the ^{10}Be determination have never been supplemented with data on the chemical composition of the studied tektites and microtektites. Consequently, it is only possible to rely on the chemistry of tektites and microtektites in other publications. The SiO_2/Al_2O_3 ratios vary for Muong Nong-type tektites in the range of 10-5, for splash form indochinities 7-4.5, and for microtektites 5.5-1. The average contents of CaO increase from Muong Nong-type tektites in Indochina (1.8 wt.% - [11]; 1.2 wt.% - [12]), over common indochinites (2.0 wt.% - [11, 13]), philippinites (3.1 wt.% - [14]), to australites (3.5 wt.% - [15]). In microtektites of the South China Sea, this value is 2.9 wt.% [16], from Antarctica 4.3 wt.% [17]. Obviously, the variability in SiO_2/Al_2O_3 ratios and CaO contents display comparable trends as the contents of ^{10}Be isotope. Thus, the differences in the major element composition alone can already sufficiently justify the observed variability in the ^{10}Be contents among the tektites and microtektites from different regions without the need to hypothesize on different depth in the target profile from which the tektites were produced.

The lateral dimensions of the target surface rocks converted to tektites could be roughly two orders of magnitude higher than their considered thickness. Therefore, besides the vertical variability in the ^{10}Be contents, it is also necessary to consider the variability in the horizontal direction. Surface geological processes (slope movements, fluvial activity, coastal tsunamis, submarine landslides, etc.) occurring in different environments, result in simultaneous denudation and accumulation of material and hence substantial redistribution of material enriched in ^{10}Be isotope. In the case of tektite formation from a target area of 1 km^2 or more, it appears more logical to assume that the layer of the tektite source materials was not homogeneous but instead it represented local accumulations of variable thickness and fluctuating ^{10}Be contents. The copying of trend of vertical decrease in ^{10}Be contents from a profile of thickness of tens of meters to an area of approximately 10^{10} km^2 does not appear to be feasible consid-

ering the transport of tektite material in the turbulent ejecta cloud over a distance of X000 km.

Even physical models do not provide the firm support for the relationship between the primary depth of deposition and the distance of flight of the tektites and microtektites. Though the ejection velocity decreases in general with the depth, the transport distance of ejecta is not solely the function of the initial velocity but among other parameters it is significantly related to the trajectory of ejecta [18]. In reality, the ejecta initial velocity as well as their flying range can also be influenced by a number of local factors. A more complicated relationship between the depth of the source material and the distance of tektite flight results from the spatial distribution of tektites and microtektites contaminated by meteoritic component. Their main source was terrestrial rocks from the interface with a meteorite, that is the matter immediately from the surface. The tektites with the highest meteoritic contamination were not transported to the most distal areas, but they fell roughly in the center of the strewn field (Java, Borneo, Belitung and the surrounding seas). The way in which the tektites with meteoritic contamination were transported is suggested by a high-resolution impact simulation in [19].

Considering the arguments above, it is unlikely that the geographical variability in ^{10}Be contents of tektites and microtektites is related to the original depth of deposition of their source material. However, there is a need to find another mechanism that would explain the increase in ^{10}Be contents with increasing distance from the impact site. The gases released from the melted rocks may contribute to local acceleration of parts of the ejecta and the length of the transport distance. Production of gases bound in minerals was generally significantly higher in the more fine-grained clastics with a higher proportion of clay matrix and carbonate cement, i.e. rocks with a higher ability to sorb ^{10}Be. The amount of gases released by melting could also be a significant factor affecting the size of the tektite produced.

The contents of ^{10}Be alone indicate that the thicker soil horizons or Quaternary sediments represent a source material of tektites and microtektites of the Australasian strewn field [4]. Such a conclusion is inconsistent with the results of the Rb/Sr studies demonstrating Jurassic age of the source rocks [20-23] only ostensibly. The Jurassic or generally Mesozoic clastics in Indochina are usually weathered in the surface zone to a clayey sandy eluvia and locally redistributed by deluvial and fluvial processes to nearby sedimentary basins without being chemically weathered. These processes could result in the accumulation of unconsolidated sediments of sufficient thickness for the formation of tektites and microtektites. However, the theoretical possibility that the tektite and microtektite material has been enriched in the ^{10}Be content contained in waters of various origins has not yet been considered.

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