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Reconstruction of the Earthquake History of Limestone Fault Scarps in Knidos Fault Zone Using in-situ Chlorine-36 Exposure Dating and "R" Programming Language

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Cosmogenic surface exposure dating is based on the production of rare nuclides in exposed rocks, which interact with cosmic rays. Through modelling of measured 36Cl concentrations, we might obtain information of the history of the earthquake activity. Yet, there are several factors which may impact production of rare nuclides such as geometry of the fault, topography, geographic location of the study area, temporal variations of the Earth's magnetic field, self-cover and denudation rate on the scarp. Recently developed models provides a method to infer timing of earthquakes and slip rates on limited scales by taking into account these parameters. Our study area, the Knidos Fault Zone, is located on the Datça Peninsula in Southwestern Anatolia and contains several normal fault scarps formed within the limestone, which are appropriate to generate cosmogenic chlorine-36 (36Cl) dating models. Since it has a well-preserved scarp, we have focused on the Mezarlık Segment of the fault zone, which has an average length of 300 m and height 12-15 m. 128 continuous samples from top to bottom of the fault scarp were collected to carry out analysis of cosmic 36Cl isotopes concentrations. The main purpose of this study is to analyze factors affecting the production rates and amount of cosmogenic 36Cl nuclides concentration. Concentration of Cl36 isotopes are measured by AMS laboratories. Through the local production rates and concentration of the cosmic isotopes, we can calculate exposure ages of the samples. Recent research elucidated each step of the application of this method by the Matlab programming language (e.g. Schlagenhauf et al., 2010). It is vitally helpful to generate models of Quaternary activity of the normal faults. We, however, wanted to build a user-friendly program through an open source programing language "R" (GNU Project) that might be able to help those without knowledge of complex math programming, making calculations as easy and understandable as possible. Through our codes, physical parameters, statistical analysis and graphics production of the fault models can be generated for each platform. This project is supported by the Scientific and Technological Research Council of Turkey (TUBITAK, Grant number: 113Y436) This study was conducted with the Decision of the Council of Ministers with No. 2013/5387 on the date 30.09.2013 and was done with the permission of Knidos Presidency of excavation in accordance with the scope of Knidos Excavation and Research carried out on behalf of Selcuk University and Ministry of Culture and Tourism.

Keywords: Knidos, geomorphology, modelling, cosmogenic surface exposure dating, chlorine36