Enlighten the past:

five years of luminescence analysis using R

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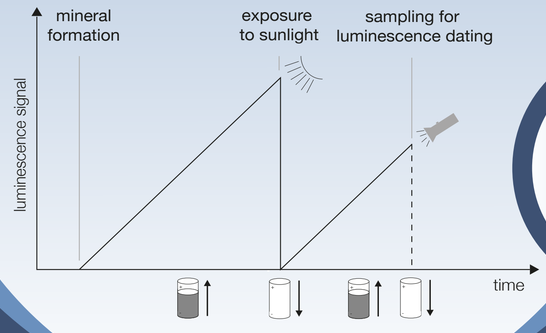
Geochronological research aims at deciphering and constraining prehistoric landscapes and palaeoenvironmental processes. Luminescence dating is the method of choice for establishing chronologies by determining the last event of heating or sunlight exposure of natural mineral grains (e.g., quartz, feldspar). Since 2012, data analysis tools based on **R** were developed to support geochronological research and, in particular, luminescence dating data analysis. Our contribution gives an overview of existing R packages designed to analyse luminescence data. Additionally, we present the S4-object class structure implemented in the **R** package 'Luminescence', which is specifically tailored to provide a solid basis for luminescence data analysis. Our so-called RLum-object system enables a seamless data exchange across linked packages. The objects are carrying raw measurement data, as well as object specific metadata (e.g., the name of the creator function). Furthermore, by using unique identifiers, set at the time the object is created, changes in objects and applied methods can be tracked later on.

2012

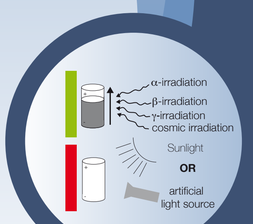
Luminescence — Kreutzer et al., 2012

Dating in the dark

Luminescence dating is a chronological method of leading importance to date the last 250,000 years. Principle: Natural minerals (e.g., feldspar or quartz) act like a rechargeable battery. The battery is charged by ionising irradiation and depleted immediately by exposure to light or heat. The stored energy is released in form of light emissions.



Principle of luminescence dating



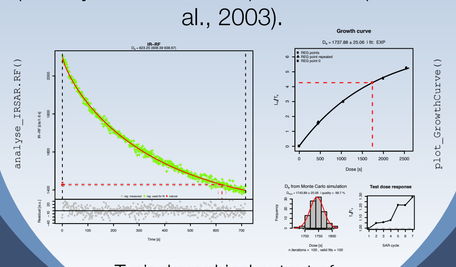
2013

RLumModel — Friedrich et al., 2016

TLDating — Strebler et al., 2016

Analysing cold light

The package 'Luminescence' supports various analyses requested in the framework of luminescence dating, e.g., OSL SAR (Murray & Wintle, 2000) or IRSAR (Erfurt et al., 2003).



Typical graphical output of analysis functions

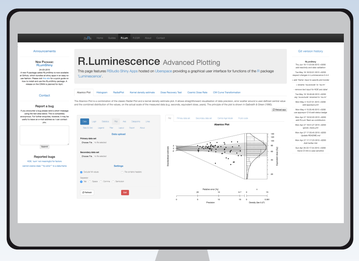
tgcd — Peng et al., 2016

2014

numOSL — Peng et al., 2013

Visualisation: RLumShiny

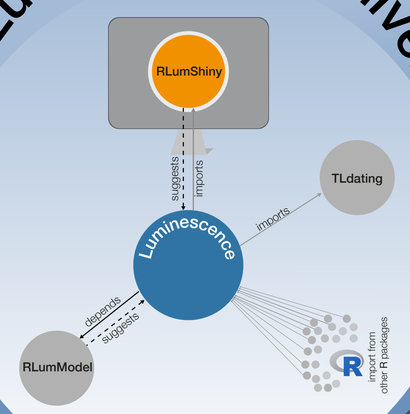
To provide an easy access for users not familiar with **R** the package 'RLumShiny' takes advantage of the **R** web application framework package 'shiny' to generate a powerful GUI. 'RLumShiny' and 'Luminescence' are developed hand-in-hand to make out the most for the users.



2015

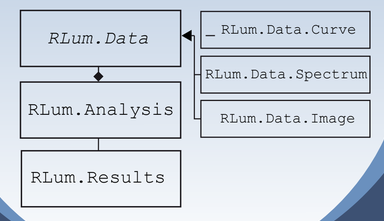
RLumShiny — Burow et al., 2016 (package released 2015)

The Luminescence univeRse



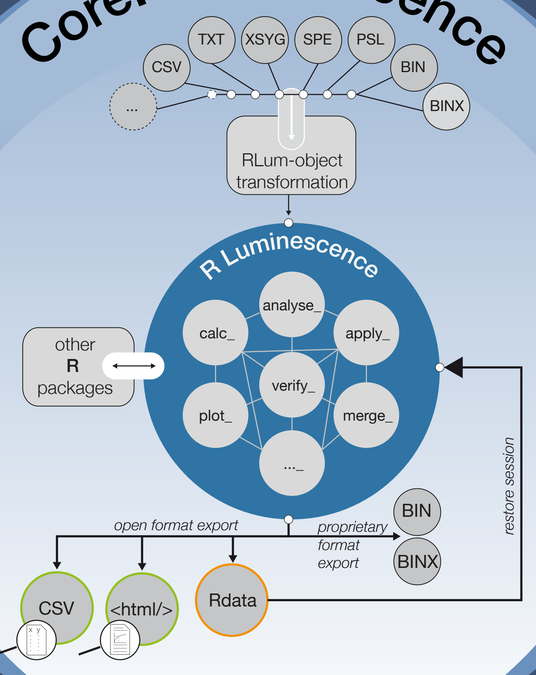
S4-object structure

The data flow is realised by package specific S4-class objects (RLum-class). It keeps the package flexible and easily extensible without causing errors when combining functions written by different developers.



packages released to analyse luminescence data

Core: Luminescence



2017

The RLum Network

2017/2018

upcoming contributions on modelling & Bayesian statistics

References

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DFG Deutsche Forschungsgemeinschaft

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