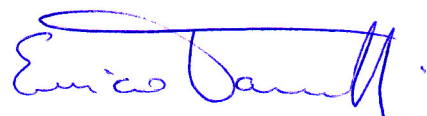
Review report by Enrico Tavarnelli for manuscript n. essd-2022-26 by Francesco Bucci, Michele Santangelo, Lorenzo Fongo, Massimiliano Alvioli, Mauro Cardinali, Laura Melelli and Ivan Marchesini titled: "*A new digital Lithological Map of Italy at 1:100.000 scale for geo-mechanical modelling* ", submitted to Earth System Science Data.

This paper presents the results of the compilation of the first Lithological Map of Italy (LMI). This is achieved through a detailed and genuinely multidisciplinary approach, that integrates field mapping, stratigraphic investigation and structural analysis, coupled with a wealth of data from a wide literature in the considered region. The topic dealt with in the study is of prime aid to anyone that has an interest in understanding the geological evolution of Italy and the resulting distribution of lithologic formations or formational groups. Moreover, the study illustrates an example of applicability of universal concepts of the role of lithologic distribution in the analysis of geomorphological hazard and land management. The study is based on a sound and comprehensive database that may be implemented through time, thus providing a very useful tool to the geological community. The compilation approach relies on grouping of polygons that contain information on the most representative lithologies cropping out in the investigated area. Not only the advantages, but also the limits imposed by grouping of lithologies are listed and discussed. The Authors' interpretations are consistent with the data presented, and the resulting Lithological Map of Italy (LMI) is a very well-concieved and convincing product.

The manuscript is well written and well organised, with English and presentation forms that are overall very good. The illustrations and tables are all clear, legible and very much informative. The quality of the contribution, in all its parts, is overall high-to-very high. Good credit is given to the existing literature, both methodological and regional. However, I believe that the manuscript would benefit from a slight extension of the reference list, with citation of a few papers that are listed separately in this review report. Unfortunately, the suggested missing references happen to arise from my own research, and in general I am reluctant to self-advertise my work. But the submitted manuscript refers to topics where my collaborators and I have long worked and published; thus I believe that a slight extension of the reference list with inclusion of the mentioned contributions would be highly beneficial for the reader.

I found this an extremely stimulating contribution and believe that it will make a very interesting title for a genuinely international and multidisciplinary audience. It is my opinion that the manuscript may be accepted for publication almost as it stands, with only the incorporation of a few sentences (with related references listed below), and the insertion of minor alterations to the text for the sake of an improved legibility. Therefore, I recommend without reservations that this manuscript is accepted for publication on Earth System Science Data only pending on minor suggested revisions, that are listed separately.

I require no anonimity and wish that all my comments are forwarded to the Authors. I hope that my review is received as a constructive and supportive indication, that may assist the Authors to achieve an even more suitable paper, and the Editor in formulating a final, positive decision in the interest of Earth System Science Data and of its wide, international readership.

Siena, Italy, June 21st, 2022

Sincerely,

Enrico Tavarnelli

LIST OF SUGGESTED ALTERATIONS TO THE TEXT:

Page 1, Line 6 - … the preparation of a lithological map of Italy at ~~a~~ the 1:100,000 scale ~~of~~ , obtained …

Page 3, Line 45-46 - … or geological derived maps ~~only are~~ are available at national scale only (Table I, ID 5, 6).

Page 3, Lines 50-51 - … has an incomplete coverage of the ~~entire~~ Italian territory (Table 1, ID 7, 8).

Page 3, Line 52 - Some of the above mentioned maps ~~mentioned above~~ are accessible, …

Page 3, Line 60 - … to produce a homogeneous lithological map of the ~~whole~~ entire country.

Page 4, Line 75 - … (ISPRA – Italian Geological Survey; Servizio…

Page 6, Lines 110-111 - We ~~call~~ refer to the first as to "*Data acquisition errors*" and to the second as to "*Database compilation errors*".

Page 6, Line 117 - … little ~~to~~ or nothing…

Page 7, Line 120 - … will likely resolve ~~criticalities~~ critical informations of geological interpretation, …

Page 9, Line 145 - The procedure ~~adopted~~ used to ~~carry out~~ compile the new Lithological map of Italy (LMI)…

Page 9, Lines 152-153 - … less~~-to-~~not deformed sedimentary and magmatic cover~~s~~ rocks.

Page 9, Line 159 - … and ~~it~~ is based on the…

Page 11, Line 206 - … ~~judgement~~ advice.

Page 11, Lines 211-215 – … we consulted geologic maps available at the 1:100,000 scale (Servizio…) and at the 1:50,000 scale (Servizio …), where available.

Page 12, Line 220 - … Patacca et al., 1991; Calamita et al., 2009; Centamore et al., 2009; Gueguen et al., 2010; Tavarnelli et al., 2003a, b).

Page 12, Line 223 - … it was necessary to use geographic visualization softwares, such as Google Earth and Google Street View, to study and display…

Page 14, Line 258 - … geological maps of Italy at the 1:100,000 scale into lithological classes…

Page 14, Line 260 - …The new *Lithological map of Italy* (LMI, this work), represents…

Page 14, Line 261 - The map scale is ~~at~~ 1:100,000.

Page 16, Line 285 - Fragments of ophiolite structures ~~can be~~ were locally included in the Cm class.
Page 16, Line 288 - The typical~~ly and most frequently~~ encountered evaporite rock ~~was~~ is gypsum, but also anhydrite and halite are present.

Page 17, Lines 312-313 - a wide variety of rocks from ~~fillade~~ phyllite to schist,

Page 19, Line 333 - where the metamorphic rocks ~~at~~ to the N-NW and the sedimentary rocks ~~at~~ to the S-SE are...

Page 19, Line 335 - … ~~consist mainly~~ mainly consist of carbonate rocks.

Page 19, Line 357 - … the reduction of the number of polygons does not change~~s~~ the relative regional variability.

Page 20, Line 368 - have been surveyed in the ~~periods~~ 1901-1940 (EAL, WAL) and 1961-1989 (CAL) time intervals;

Page 20, Line 370 – have been surveyed in the ~~period~~ 1961-1989 time interval, as those of the Sardinian Block (SB);

Page 20, Line 371 - … have been surveyed in the ~~period~~ 1884-1900 time interval.

Page 20, Line 387 - For example, metamorphic rocks were split into two broad classes…

Page 20, Lines 393-394 - The need ~~of~~ for this class ~~derives~~ arises from the…

Page 21, Line 396 - … geo-hydrological and mechanical discontinuities within rocks bodies (e.g. see Peacock et al., 2017), often promoting…

Page 21, Line 397 - ~~As~~ Since our map is designed to be used for landslides…

Page 21, Lines 397-404 – These sentences should refer to work published on landslides and landslide suceptibility by L. Disperati and Regione Toscana, amongst other Authors.

Page 22, Lines 433-434 - … correct at the ~~scale of~~ 1:1,000,000 scale, while elsewhere the cartographic detail remains compatible with the ~~scale~~ 1:100,000 scale.

Page 22, Line 441 - … different generalization~~s~~ strategies, …

Page 22, Line 443 - In ~~their~~ Forte et al. (2019)'s classification, …

Page 25, Line 478 - … lithological map of Italy at the 1:100.000 scale, providing…

Page 25, Line 480 - … Geological Map of Italy at the 1: 100,000 scale and distributed…

Page 25, Line 485 - … using the sheets available at the 1:50,000 scale (where present), and…

Page 25, Line 486-487 - at the ~~boundary~~ boundaries of the original geological sheets.

REFERENCES TO BE INSERTED AND ACKNOWLEDGED:

Peacock, D.C.P., Anderson, M.W., Rotevatn, A., Sanderson, D.J., Tavarnelli, E., 2017. The interdisciplinary use of "overpressure". Journal of Volcanology and Geothermal Research, 341, 1-5.

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Siena, Italy, June 21st, 2022

Enrico Tavarnelli