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A CATALOGUE

OF

PHYSICAL PROPERTIES OF ROCKS

FROM THE SWISS ALPS AND NEARBY AREAS

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in collaboration with Rosset P.

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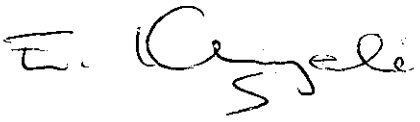
Editor's Preface

The present publication entitled "A catalogue of Physical Properties of Rocks from the Swiss Alps and nearby areas" is Report NR. 33 of the "Contribution to the Geology of Switzerland - Geophysical Series", published by the Swiss Geophysical Commission.
This publication is the accomplishment of many years of work done by the authors and initiated by Prof. J.-J. Wagner, at the University of Geneva. It contains a database written for PC and working under many Windows versions which offer an easy way to retrieve the data.
The Swiss Geophysical Commission is very grateful to Mr J.-J. Wagner, G. Gong, St. Jordi and P. Rosset for having produced this monograph which is an important contribution to the knowledge of the physical property of the most common rocks of Switzerland.
Special thanks are due to the Swiss National Academy of Natural Sciences for its financial support of this publication.

Zurich, August 1999

In the name of the Swiss
Geophysical Commission
The President:



Prof. Emile Klingelé

Abstract

A greater awareness towards the environnement has developed an increasing interest in the knowledge of the deep geological structure of Switzerland in terms of energy resources (oil and geothermal) and also as to the potential of damaging earthquakes. To study those aspects, geophysical research is essential and one of its important elements is the physical properties of the rocks. In order to have a better knowledge of them, a representative collection of the most common hard rocks of the various geological units of Switzerland has been studied.

Laboratory measurements have been carried out on 233 samples to determine their density, porosity, magnetic susceptibility, P-wave velocity and on 88 samples to determine their thermal conductivity. The experimental procedures are described and the detailed data are given in this catalogue. To facilitate the access and the use of these data they have been put on two diskettes for PC computer. This petrophysical database provides earth scientists with basic rock parameters that will be useful for the interpretation of national geophysical maps and profiles.

Résumé

Une prise de conscience accrue de l'environnement a développé un regain d'intérêt pour le soubassement géologique de la Suisse en terme de potentialité de ressources énergétiques (pétrole et géothermie) ainsi que pour la possibilité d'occurrence de tremblements de terre catastrophiques. Pour étudier ces aspects la recherche géophysique est essentielle et l'un de ses éléments essentiels est la connaissance des propriétés physiques du sous-sol. C'est pour mieux les connaître qu'un échantillonnage représentatif de roches des diverses formations géologiques de Suisse a été étudié.

Des mesures en laboratoire ont été faites sur 233 échantillons pour déterminer leur densité, porosité, susceptibilité magnétique et vitesse de propagation des ondes P ainsi que sur 88 échantillons pour en déterminer la conductivité thermique. Les méthodes expérimentales sont décrites et les données détaillées sont fournies dans ce catalogue. Pour faciliter l'accès et l'utilisation de ces données l'information est également disponible sur deux disquettes pour ordinateur PC. Cette banque de données pétrophysiques met à disposition des géophysiciens et géologues des paramètres de base qui devraient faciliter l'interprétation des cartes et profils géophysiques nationaux

1. Introduction

The Petrophysics laboratory of the University of Geneva has been mandated by the Swiss Geophysical Commission to establish a catalogue of the major physical properties of rocks collected from different geological environments throughout the Swiss Alps and where necessary from nearby areas. The aim is to provide earth scientists with basic rock parameters that are useful for the interpretation of national geophysical maps and profiles, such as recently published Bouguer and isostatic anomalies, aeromagnetic anomalies, geothermal flow density maps, reflexion seismic profiles and also for any future geophysical exploration. The main parameters investigated are:

- density and porosity
- magnetic susceptibility and remanent magnetization
- P-wave seismic velocity
- thermal conductivity.

There exist several handbooks which present and/or comment on petrophysical properties for a large variety of rocks from all over the world (e.g. Clark, 1969; Touloukian et al., 1981; Angenheister, 1982 and Schön, 1996). However, when one studies specific areas such as the Alps, it is evident that due to the geological complexity, the data available from these data bases are not appropriate for regional and local interpretations. One of the major problems is due to the variation of physical properties within the same rock type. In this catalogue, we have tried to measure and calculate the different parameters on the same rock samples in order to have a homogeneous data set. To provide the potential user with a convenient data access tool , the information is also contained on two 1.44Mb floppy disks.

2. Geological background

The geology of Switzerland is entirely governed by the Alpine chain which crosses the country in the SW-NE direction producing 5 parallel tectonic stripes.

- The external one (along the north-western border) is a fold and thrust belt affecting a Mesozoic platform carbonate series : the « *Jura mountains* ».
- The « *Molasse Basin* » is a foreland basin comprising of a thick prism of Oligocene and Miocene detrital sediments.

The two following strips form the topographic Alpine domain and occupy the south-eastern half of Switzerland :

- The « *Helvetic belt* » is a stack of cover nappes comprising Jurassic, Cretaceous and Paleogene rocks. Late uplift along the southern border of this strip exhumed the basement « external massifs ». At the northern border, the « *Préalpes* » klippen overlying the Helvetic nappes and the molasse belong to the higher structural Penninic nappes.
- The « *Penninic* and *Austroalpine* » belts represent the crustal accretionary prism resulting from oceanic and continental subduction processes followed by continental collision between the European and Adriatic plates. A stack of basement nappes (Penninic) is overlain by remnants of oceanic ophiolites (Piémont suture) and by the Austroalpine basement-cover lid, more developed at the eastern Swiss border. The central part of this Penninic-Austroalpine Swiss segment (Ticino) underwent late doming and exposed the higher grade alpine metamorphic units (sillimanite zone) and the Bergell granodiorite and tonalite (30Ma).

- The « *Southern Alps* » are separated from the former units by the major alpine discontinuity, the Periadriatic line. They only reach Switzerland in the southern Ticino. The alpine overprint is less intense, but the upper mantle-lower crust boundary of the Adria lithosphere is exposed within the Ivrea zone along the western segment of the Periadriatic line.

3. Sampling strategy

The field sampling first focused on alpine transects of great importance concerning the interpretation of the existing alpine seismic profiles (Penninic belt in the Valais and Graubünden, Ivrea zone, Simplon zone). Then the sampling area (Fig.1) was enlarged in order to provide the rock properties catalogue with the most representative lithologies of the Alpine and extra-Alpine units of Switzerland (Valais, central and eastern Alps, northern Alps, Prealps, Jura, Molasse basin). Appendix I gives the rock type and sampling locations.

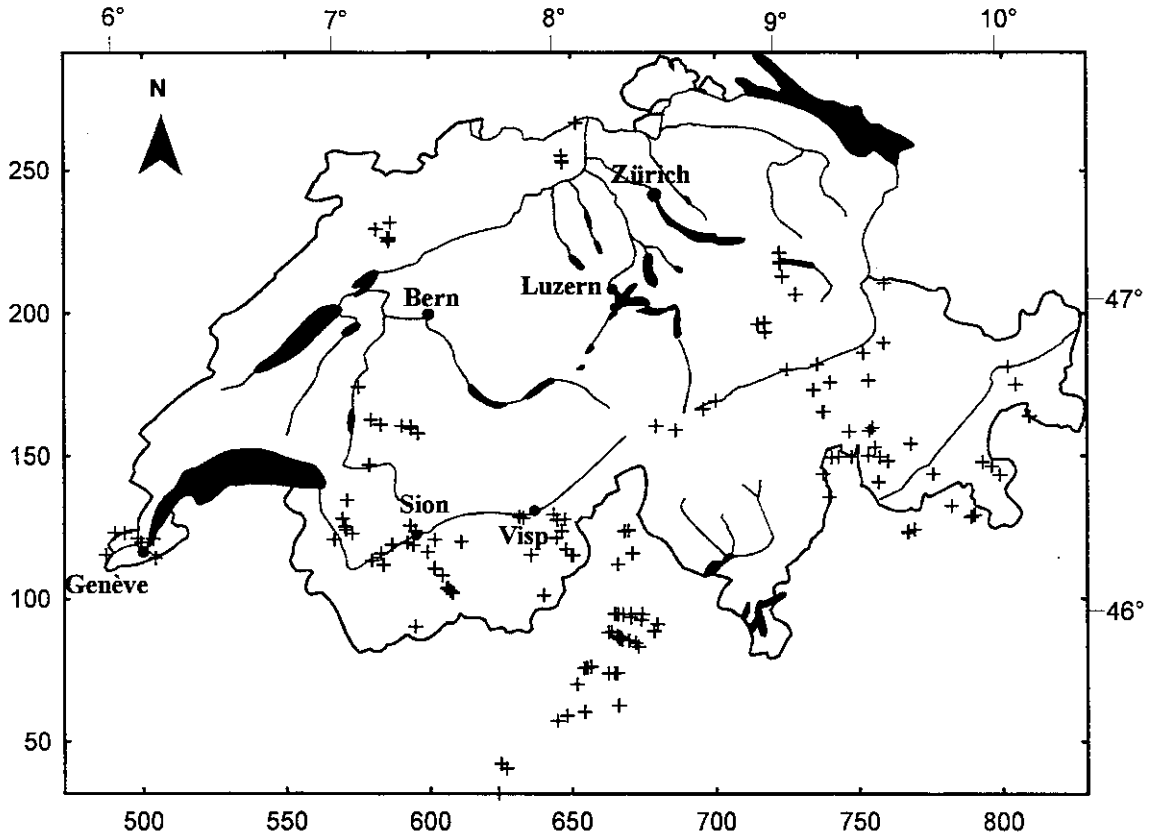


Fig.1 Petrophysical sampling sites (+), Swiss coordinates (km) and geographical coordinates (degree)

The choice of samples was subject to the following constraints:

- limited number of samples avaiable
- samples should be free from weathering
- the size and the compactness of the samples should allow them to be cut it into decimetric parallelepipeds for drilling core sized specimens in the laboratory.

For this last reason, very common lithologies such as shales, marls, schists, calcschists, marly limestones and sandstones, greywacke or fractured rocks were not collected.

Some typical and very constant lithologies were picked up on several tectonic units along Alpine transects (for example: upper Jurassic limestones, Permian sandstones and conglomerates). These samples allow a comparison of the changes in the physical properties of rocks which have undergone various amounts of deformation and metamorphism.

The rock samples were collected as hand samples directly from outcrops or in a few cases on cores from geotechnical or geothermal boreholes. Macrostructures of the samples such as layering or bedding were used to enable the preparation of a sample with a geological reference frame (see Fig.2).

Our routine sample preparation procedure consisted of sawing the hand samples into a rectangular shape for thermal conductivity measurement. Then for density and velocity determination cores 2.54 cm in diameter were drilled in three orthogonal directions in each rock. One normal to foliation, one parallel to foliation and lineation, and one parallel to foliation and perpendicular to lineation where these fabric elements were apparent. The directions of the cores parallel to foliation were arbitrary if the rock was foliated but not lineated and the surface parallel to foliation was chosen as a reference surface. The three orthogonal directions were arbitrary if the rock exhibited no fabric elements. A fourth core specimen in the direction perpendicular to the reference surface was used for the magnetic properties.

4. Generalities

This data base is made up of 233 samples of sedimentary, igneous and metamorphic rocks. Many exhibit internal structures (see Fig.2) which produce anisotropic properties. These could arise from (Schön, 1996):

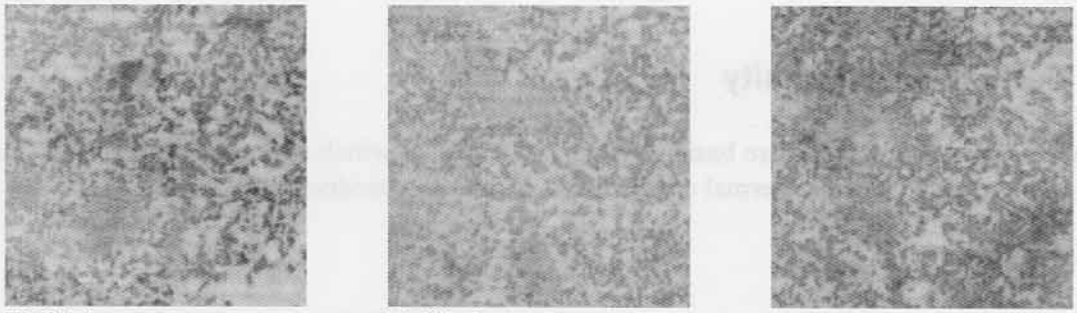
a. crystal anisotropy of the individual rock forming minerals,
b. intrinsic or structural anisotropy resulting from the mineral shapes and their arrangement within the rock,
c. orientation and geometry of cracks, fractures and other defects.

Anisotropy influences magnetic susceptibilities, velocities and thermal conductivities. In the case of the susceptibility anisotropy only the first two effects are relevant. Maximum (max), minimum (min), and where appropriate, intermediate (int) measured values are used in the following way:

$$A = \frac{max - min}{(max + int + min)/3} \qquad \text{(for seismic velocity)}$$

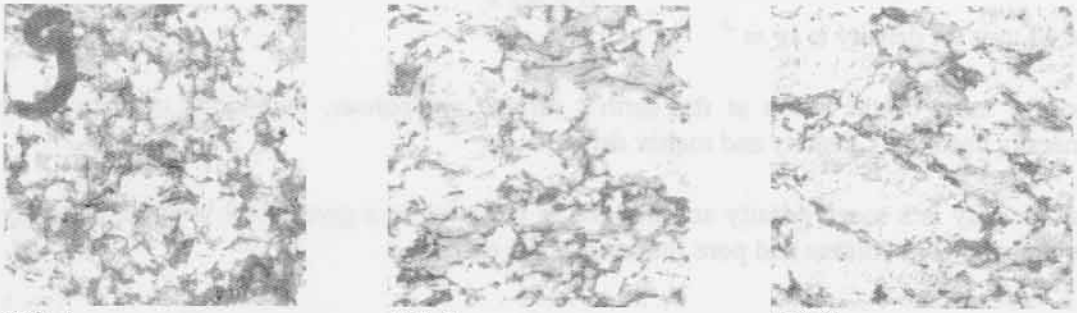
or

$$A = \frac{max - min}{(max + min)/2} \qquad \text{(for thermal conductivity)}$$



TM21_1 TM21_2 TM21_3

Metagabbro, Nappe du Tsaté, La Forclaz, VS.



JB9_1 JB9_2 JB9_3

Granodiorite, Bergell, San Martino, GR.

JB21_1 JB21_2 JB21_3

Gneiss, Silvretta, Zernez, GR

JB29_1 JB29_2 JB29_3

Calcschist, Suretta, Avers Cresta, GR

Fig. 2. Examples of rock structures; each sample is represented by three orthogonal views. Notice the strong anisotropy of sample JB21 and JB29.

5. Density and porosity

Rock density and porosity are basic physical properties on which many other properties, such as seismic wave velocity, thermal conductivity and electric conductivity are dependent.

5.1 Definition

Density is defined as the quotient of the mass m and the volume V of a material.

$$\rho = m / V$$

The SI unit for density is $kg\ m^{-3}$

Because most of the rocks at the earth's surface are porous, two kinds of densities are generally used; bulk density and matrix density.

Bulk density is a mean density and defined as the mass in a given total volume, naturally it contains the void volume and pore fluid inside the rock.

$$\rho_b = m / V_{total} \qquad (1)$$

Suppose there is only the mass of the rock (m may include fluid mass in the pores, for dry rock mass of air in the pores can be neglected.), the volume of the rock consists of both matrix and pores, then

$$V_{total} = V_{matrix} + V_{pore}$$

Matrix density considers only the mass in the matrix volume and the void volume of the pores inside the rock is excluded. Therefore, matrix density is defined as the mass in the matrix volume.

$$\rho_{matrix} = m / V_{matrix} \qquad (2)$$

Porosity Φ is defined as the ratio of volume of pore space V_{pore} to the total volume V_{total} of the rock.

$$\Phi = V_{pore} / V_{total} = 1 - V_{matrix} / V_{total} \qquad (3)$$

From the bulk density d_b and matrix density d_{matrix}, one can obtain porosity as given below

$$\rho_b = (1-\Phi)\, d_{matrix} + \Phi_{pore} \qquad (4)$$

if $d_{pore} << d_{matrix}$, it is possible to assume $d_{pore} = 0$, then equation (4) becomes ,

$$\rho_b = (1-\Phi)\ \rho_{matrix}$$

or,

$$\Phi = 1 - \rho_b / \rho_{matrix} \qquad (5)$$

5.2 Density measurement methods

For the density determination, one needs to measure the mass of the samples and their dry bulk and matrix volumes. As a routine procedure, one dries the rock specimens in a oven. Tests have shown that it is convenient to dry the specimens for 24 hours at a temperature of 90°C. After this treatment, the dry mass of the rock is measured with a **Mettler PM100** precision balance (accuracy of *1 mg*). The matrix volume is measured using a **Quantachrome** gaz pycknometer and the bulk volume by the Archimedes method. As the specimens have a simple geometry, one could also calculate the bulk volume by using the cylindrical dimensions (diameter and length) but experience shows that the previous method is more appropriate due to the geometrical irregularities of the specimens.

The matrix volume measurement is based on Boyle's law and uses a gas to penetrate into the finest pores of the specimen investigated. In the stereopycnometer there are two chambers whose volumes are known, and helium gas is used since its small atomic dimension assures a good penetration into microfissures and pores approaching 10^{-10} m. When the pressurized helium gas flows into the first chamber which holds the rock specimen, and the gas pressure reaches a balance P_1, the second additional chamber is then opened. It takes 10 to 30 minutes to reach the equilibrium pressure P_2. The matrix volume is given by:

$$V_m = V_c + \frac{Va}{1 - \frac{P_1}{P_2}}$$

where V_c is the volume of stereopycnometer chamber, V_a volume of the additional chamber (Barblan, 1990).

The Archimedes method is based on the measurement of the body in air and then immersed in a fluid (for example distilled water). The sample's volume is calculated from the mass in air m, the mass in the distilled water m_w and density of the fluid at room temperature ρ_w, the volume of sample is given by

$$V_{total} = (m - m_w) / \rho_w$$

From the previous equations, bulk density, matrix density and porosity are obtained.

5.3 Results

The statistical distribution of the mean densities based in general on three specimens of 231 rock samples is given in Fig.3. For each main rock type, mean and extreme values of the bulk and matrix density are shown in Fig.4 and Fig.5. The individual values are listed in the Appendix II " Rock type and densities".

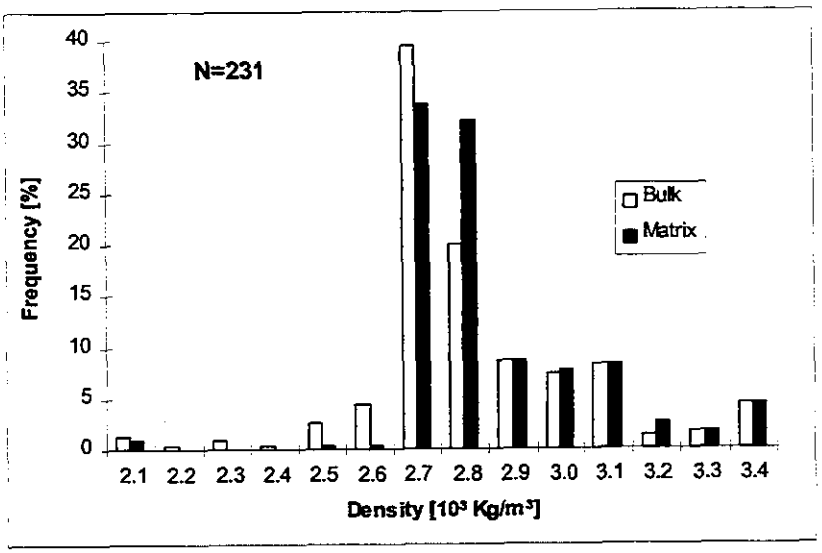


Fig.3 Histogram of the bulk and matrix densities of rock samples from the catalogue

5.4 Discussion

Determination of densities and apparent porosity in the laboratory may give results which are different from that in-situ, because large-scale heterogeneities are usually avoided during preparation of the core sample. The precision of density measurement is believed to be within 1%; for the porosity the precision of measurement is of the order of 5%. Due to the type of rocks sampled the calculated porosities are in general lower than 2% (see the table in Appendix II " Rock type and densities").

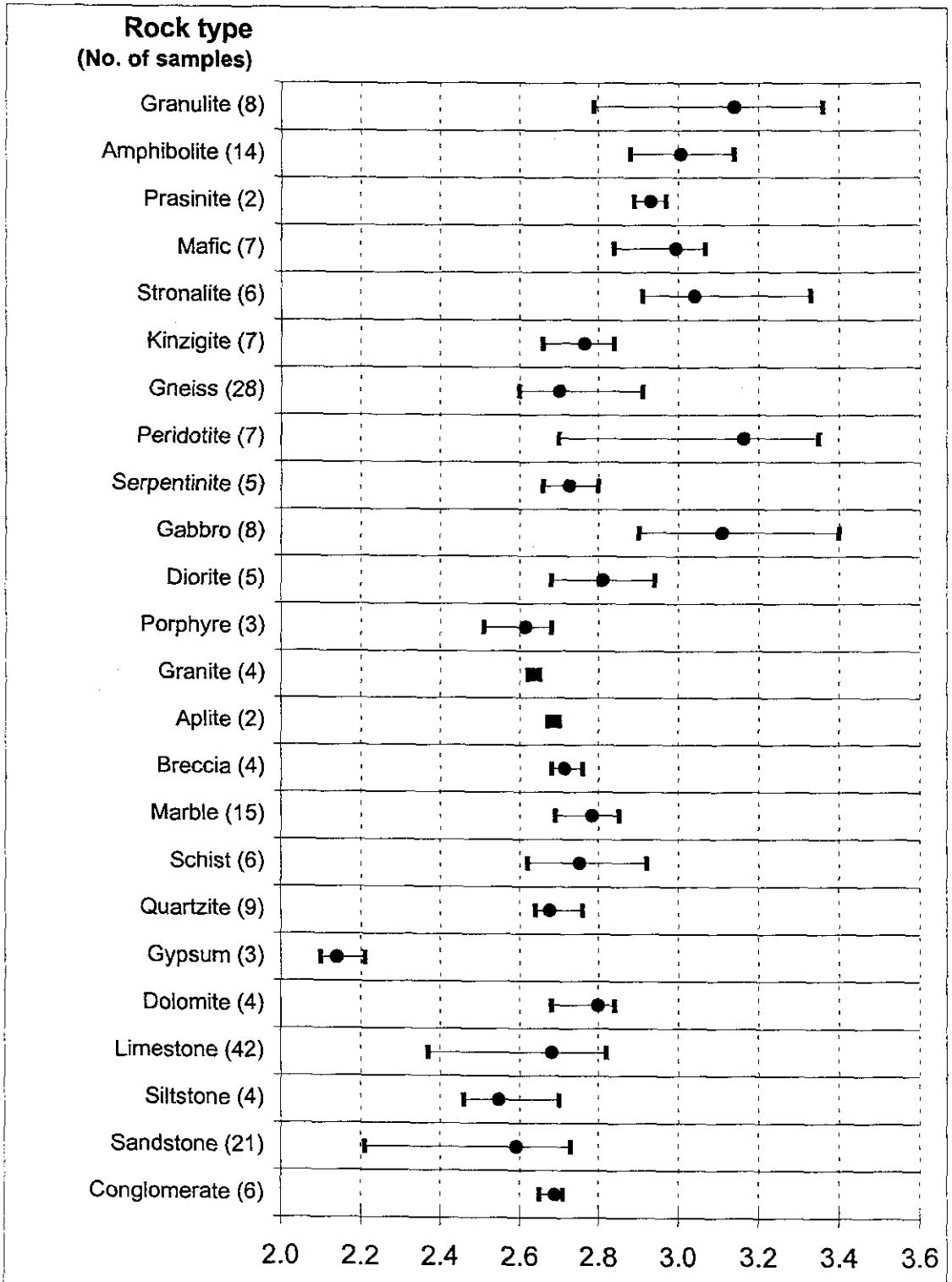


Fig. 4 **Bulk density in 10^3 kg/m^3**
(mean and extreme values)

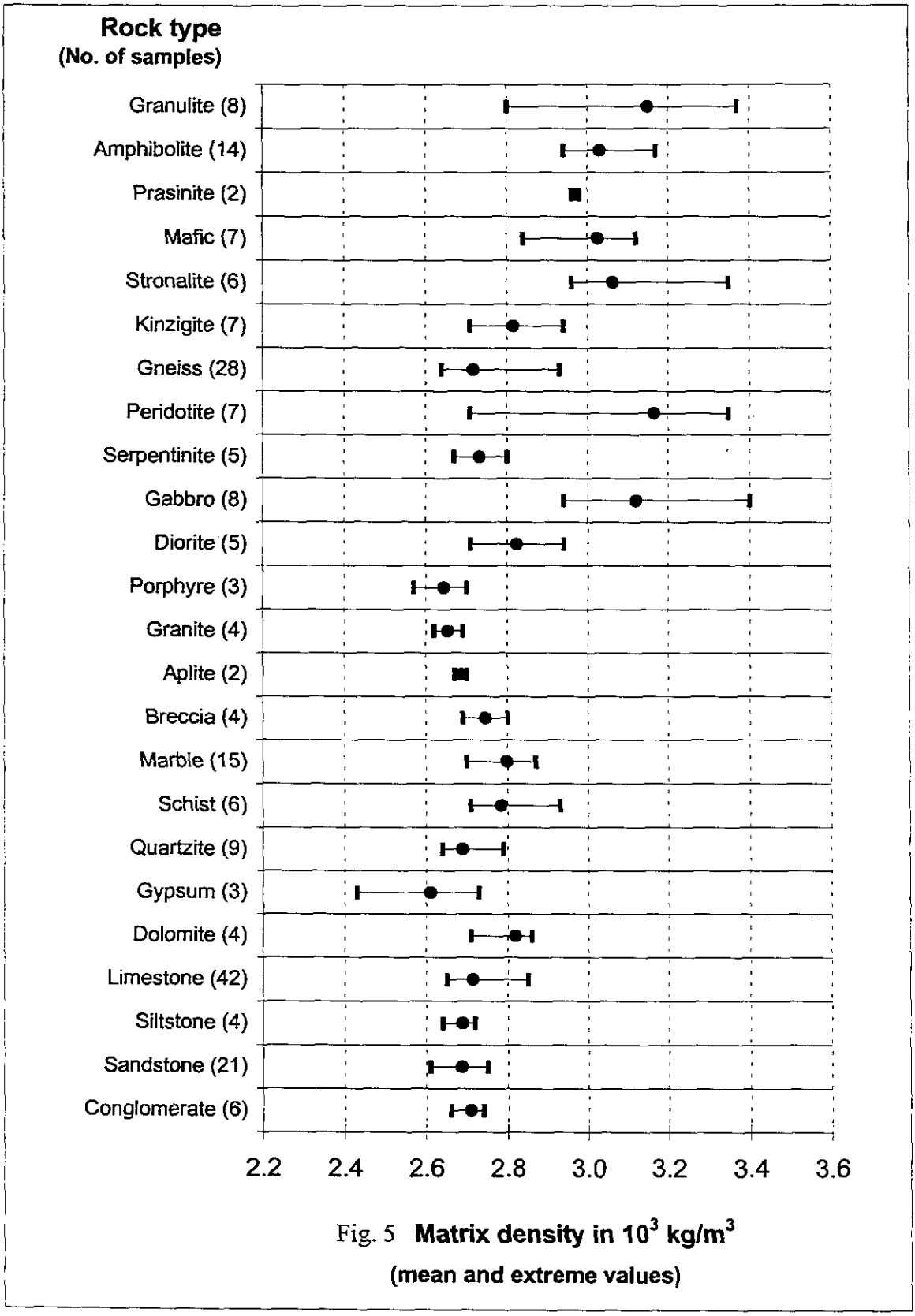


Fig. 5 **Matrix density in 10^3 kg/m^3**
(mean and extreme values)

6. Magnetic properties (Susceptibility and remanent magnetization)

6.1 Definition and units

The observed magnetization of rocks is generally a combination of an induced magnetization J_i and a remanent one J_r. The first one disappears if one removes the inducing field H, which is in our case the earth's magnetic field.

$$J = J_i + J_r$$

where $J_i = \chi \cdot H$ χ = magnetic susceptibility

The major magnetic properties of rocks are controlled by oxide minerals from the ternary system FeO - TiO_2 - Fe_2O_3. The strongest magnetic properties are due to the presence of magnetite Fe_3O_4, maghemite Fe_2O_3 and to some titanomagnetites. Weaker properties can be attributed to hematite alpha Fe_2O_3 and to titanohematites. Iron sulfides such as pyrrhotite FeS_{1+x} (with $0<x<1$) or greigite Fe_3S_4 may also contribute to some magnetic anomalies.

In SI units the volume susceptibility has no units and the remanent magnetization is expressed in A/m.

6.2 Measurements

Initial susceptibilities have been measured with a **Bartington** MS2B dual frequency susceptibility meter (460Hz and 4.6KHz). The calibration of the instrument is controlled with paramagnetic salts.

Remanent magnetization has been obtained with a **Molspin**, Minispin computerized fluxgate spinner magnetometer.

6.3 Results

Appendix III "Rock type and magnetic properties" gives for 170 rock samples the high (HF) and low (LF) frequency susceptibilities and their mean values. For a few of the rocks the natural remanent magnetization has also been measured. The mean and the extreme susceptibility values for each rock type are given in Fig.6.

6.4 Discussion

The difference between the two (LF and HF) susceptibilities is an indicator of the percentage of magnetic grains near the superparamagnetic/single domain boundary. A large difference indicates that a larger fraction of grains lies in the superparamagnetic size range (Worm, 1998).

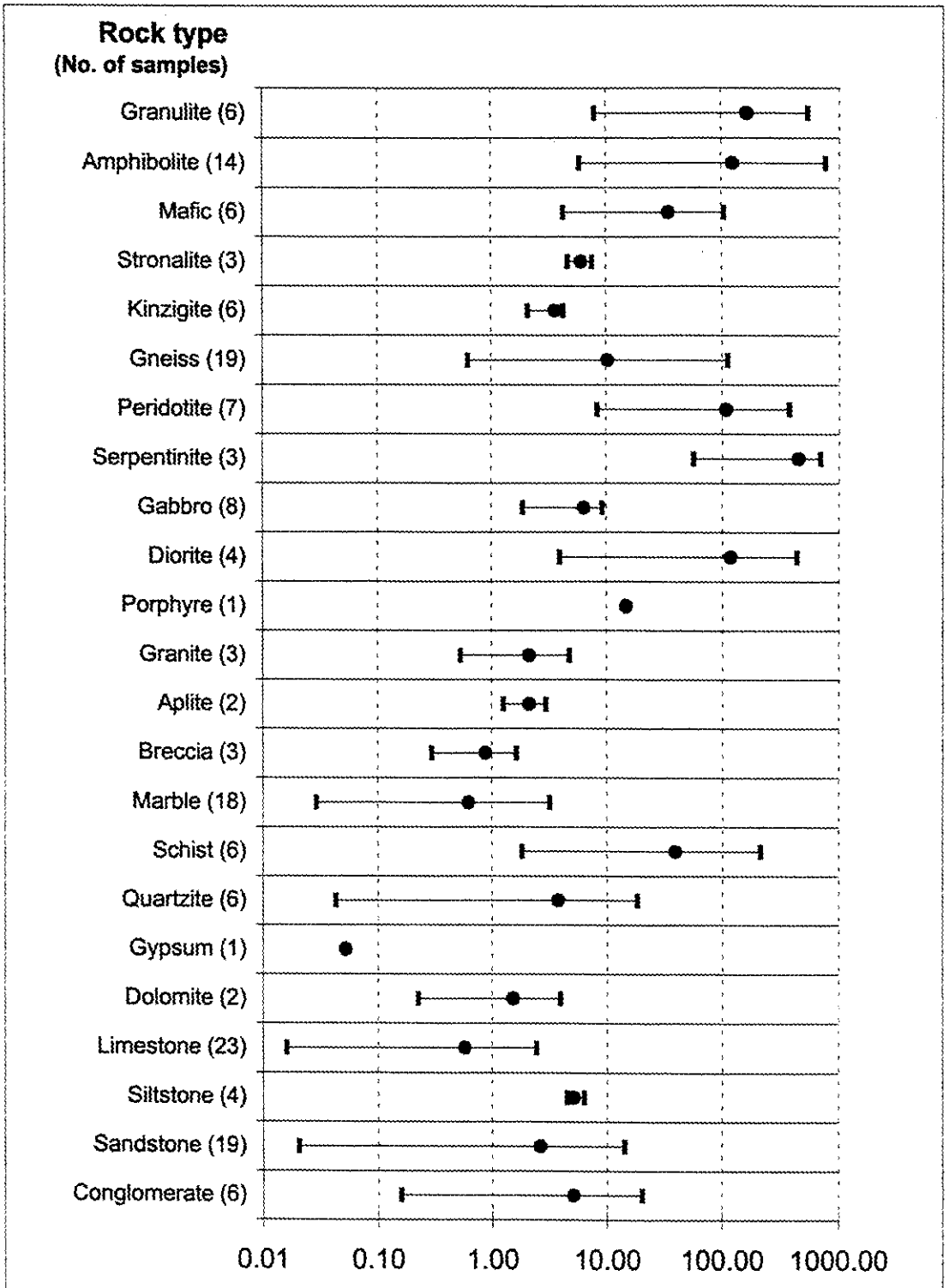


Fig. 6 **Magnetic susceptibility in 10^{-4} SI (mean and extreme values)**

7. Laboratory P-wave velocity

7.1 Definition and units

Seismic wave velocity V in the laboratory measurement is defined as the distance travelled by an elastic wave in unit time. In fact, V is a mean velocity when considering that the wave traverses a rock sample of length l in a time t.

$$V = l / t$$

In SI units, the unit of velocity is *m/s*, for practical reasons one uses *km/s*.

7.2 Measurement method

The simplest and most direct method of obtaining the ultrasonic wave velocity in a rock is to measure the transit time required for a wave to travel through a sample of known length. Birch (1960, 1961) was a pioneer in measuring compression wave velocities with the pulse transmission method for a series of rock samples at pressures up to 1GPa. Since then it has been developed and used world-wide (Simmons, 1964, Christensen, 1966, Kern et al.,1993, 1996). In this method, the essential elements are a pulse generator, transducers, an oscilloscope, and an accurate time base. The transducers are made from piezoelectric Lithium Niobate crystal and serve to convert electrical signal to an acoustic pulse at one end of the sample and the acoustic pulse to an electrical signal at the other end. The time of travel through a given length of a sample is then measured as the time delay between the introduction and the reception of the signal. In our laboratory, the P-wave velocity experimental equipment has been developed by Barblan (1990). Several studies have been carried out (e.g. Barblan, 1990, Sellami, et al., 1990, Gong, et al., 1997).

Velocity in rocks varies with the pressure due to intrinsic structure of voids and rock forming minerals. For this study, P-wave velocities of dried samples were measured at confining pressures up to 400 MPa in steps of 20 MPa. The time delay of P-wave through a rock specimen is displayed on an oscilloscope and the digital wave form is recorded by a computer. Precision of the time measurements depends on time base (0.02 μs to 0.05μs) and the sharpness of first arrival of the transmitted impulse.

An aluminum specimen serves as calibration reference with the same shape as a rock sample (cylinder with diameter 2.5 cm and length 5 cm).

7.3 Results

The specimens individual P-wave velocities under increasing confining pressures are given in the Appendix IV "Rock type and P-wave velocities" for the different types of rocks.

An example of such data for confining pressure going from 20 to 400 MPa for three orthogonal specimens of a limestone sample in a dry state is given in Fig.7.

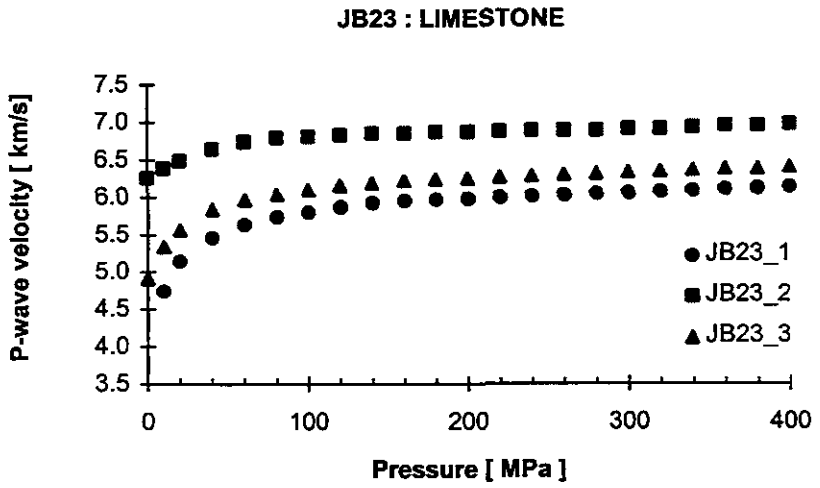


Fig.7 Example of P-wave velocity changes with confining pressure

In general, the rapid increase in velocities for pressure below 100MPa is attributed to the closure of voids related to pores or micro-cracks. It is important to notice that the low microcrack porosity effect affects strongly the velocity changes at lower pressure. Velocity varies non-linearly with pressure even for very low porosity rocks at low pressure, this depends on the shape of microcracks (Bourbié et al., 1987). At higher pressure, from 100 to 400 MPa, the anisotropy is nearly constant and can be considered as the intrinsic anisotropy of a nearly pore or/and crack-free rock. (e.g., Seipold et al., 1998, Christensen, 1966).

This general behavior is clearly illustrated with a limestone sample (Fig.7) with a higher, anisotropy of 10.0% , at low pressure and a lower anisotropy of 4.3% at higher pressure.

P-wave velocity extreme and mean values for the different rock types at low (40 MPa) and high pressure (400 MPa) are summarized in Fig.8 and Fig.9.

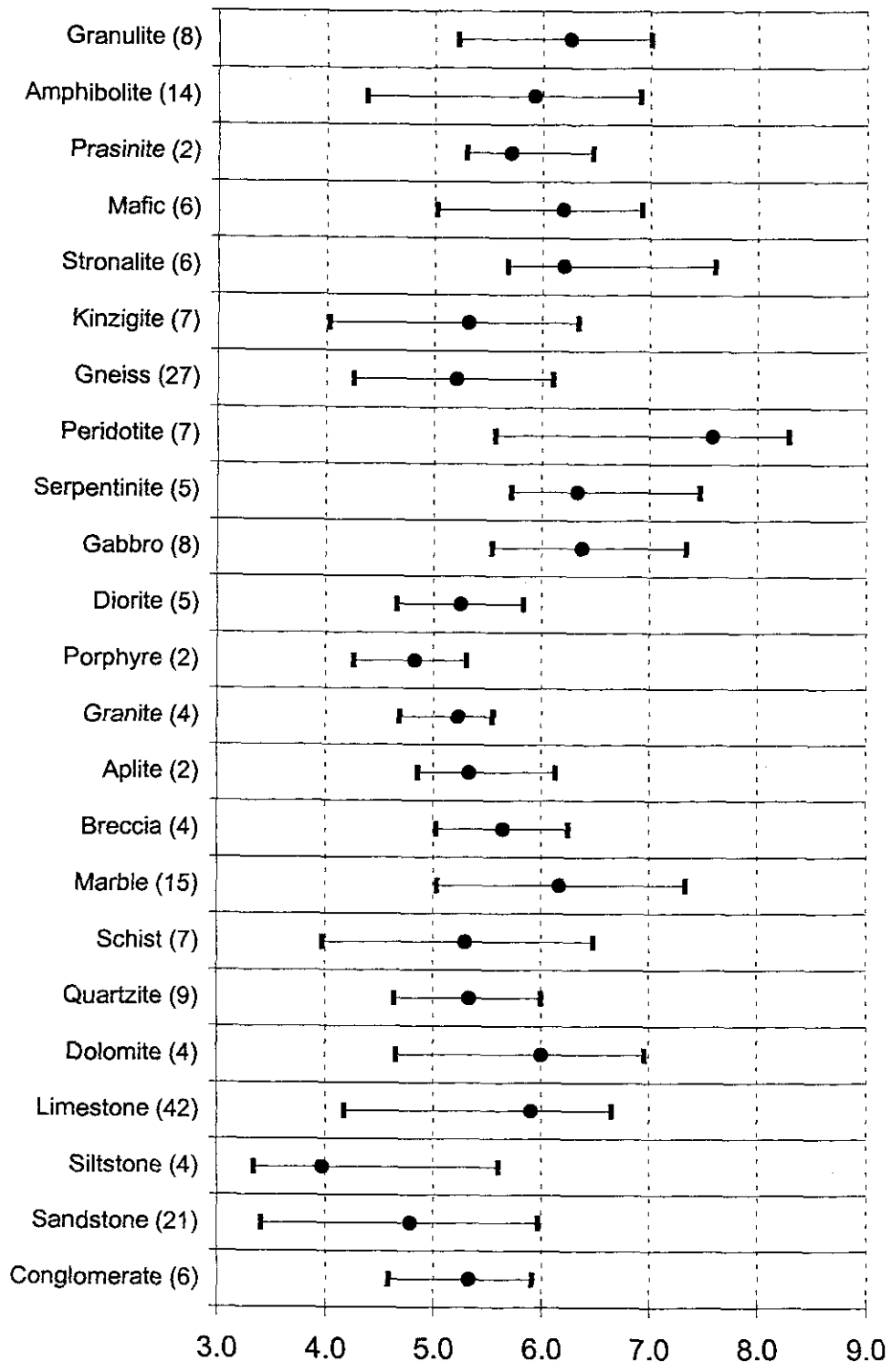


Fig. 8 **P-wave velocity in km/s at 40 MPa pressure**
(mean and extreme values)

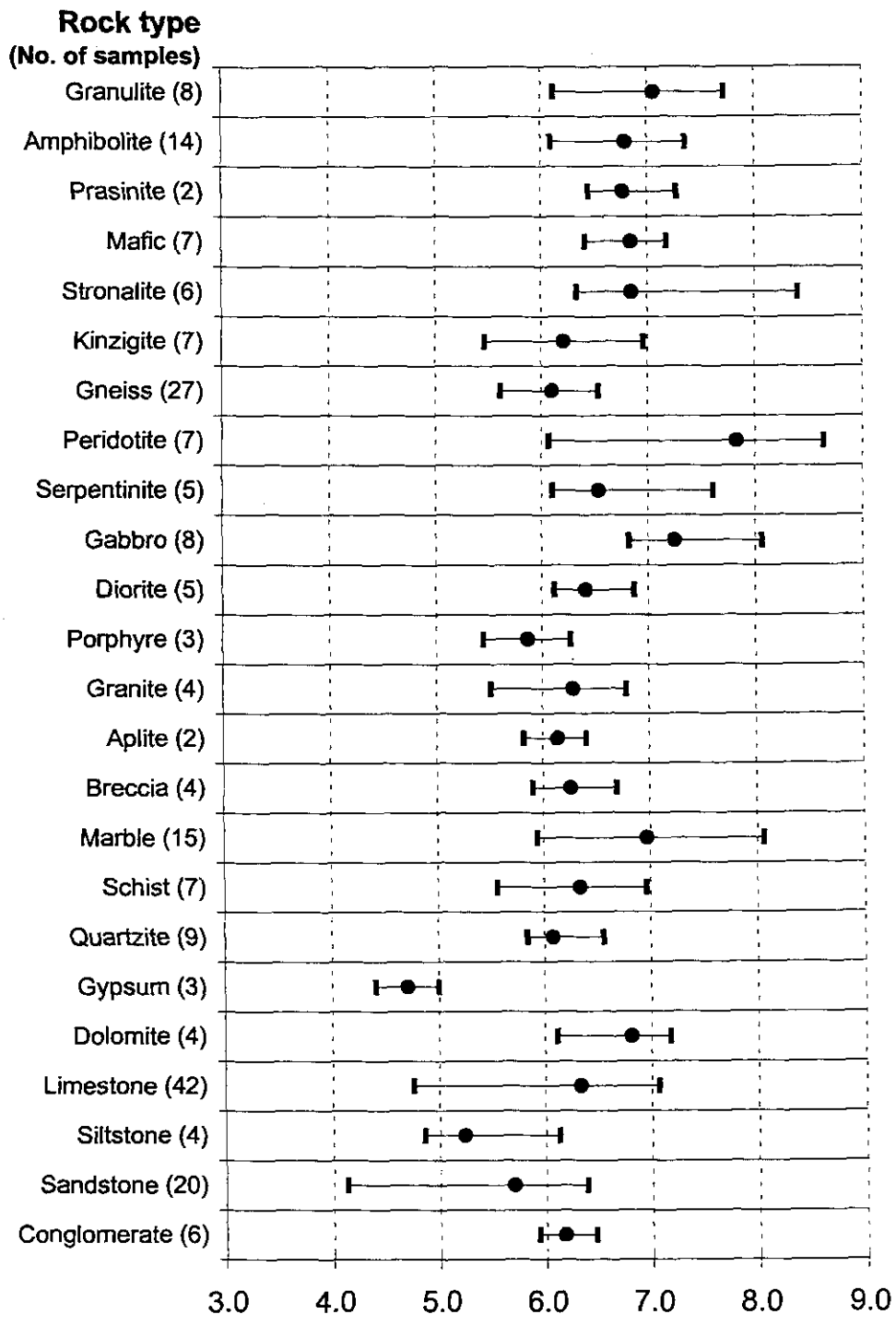


Fig. 9 **P-wave velocity in km/s at 400 MPa pressure**
(mean value extreme values)

7.4 Velocity - density relationship

Velocity-density relations are useful to estimate seismic velocity from density or vice versa and to calculate seismic impedances for the evaluation of reflection coefficients (Sellami, 1994). The velocity-density dependence is illustrated in Fig.10 for sedimentary rocks. The P-wave velocity at 40 MPa increases with increasing bulk density.

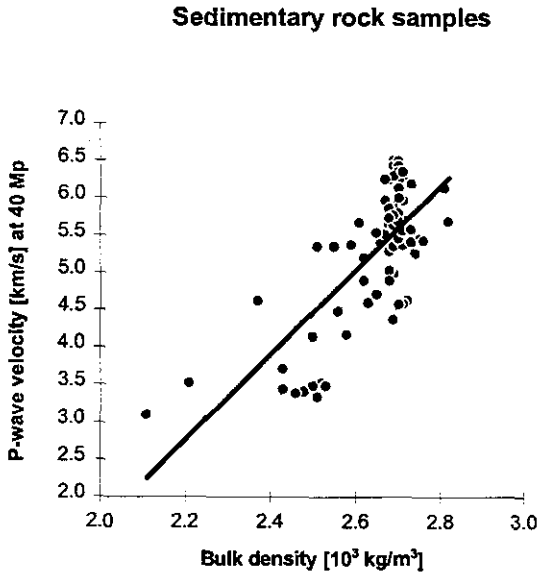


Fig.10 Variation of velocity with bulk density for sedimentary samples at low pressure (40 Mpa)

A least-squares fit gives the following equation with a correlation coefficient $R = 0.73$:

$$V_{p\,40} = 5.677\ \rho_b - 9.729$$

7.5 Discussion

Seismic velocity depends on many factors, such as mineralogical composition, temperature, pressure, and also the direction with respect to bedding or foliation. For this catalogue only the effect of pressure on velocity was investigated.

Regarding velocity variations in the crust and upper mantle, one observes that increasing pressure and temperature have opposite effects on velocities. In magmatic and metamorphic rocks, Schön, (1996) finds in the lower temperature range from about 100 to 150 °C that only small changes in velocity occur; at higher temperatures the changes in velocity are more important. Experimental determination of the pressure and temperature variations in terms of velocities derivatives at confining pressures up to 600 MPa and temperatures up 600 °C have been studied by Kern and Tubia (1993), Kern et al. (1996, 1997). They obtain for the Ronda peridotite P-wave velocity pressure derivative of 1.25 to 4.36 $\times 10^{-4}$ km s^{-1} MPa^{-1} and a temperature derivative from -4.78 to -9.88 $\times 10^{-4}$ km s^{-1} $°C^{-1}$.

8. Thermal conductivity

Heat conduction is one of the three physical processes by which heat is transferred, the other two being convection and radiation. This heat transfer mechanism, associated with crystal lattice interactions (Carslaw and Jaeger, 1959), is the principal one in the lithosphere (Cermak and Rybach, 1982).

8.1 Definition and units

Thermal conductivity is a fundamental property of matter and is defined as the rate at which heat energy will cross a unit area under the driving potential of a unit temperature gradient perpendicular to the area. According to Fourier's law, the density of heat flow q is expressed by the product of thermal conductivity k and temperature gradient ∇T,

$$q = -k\nabla T$$

The minus sign arises from the fact that heat always flows from the hotter to the colder region. Since many rocks are anisotropic, conductivity k is a second order tensor quantity and it depends on direction.

The SI unit of the thermal conductivity is $W/m \cdot K$.

8.2 Measurement method

The methods of measuring thermal conductivity can be divided into two categories, static and dynamic, depending on whether the temperature distribution within the sample is time dependent or not. For both methods, the solution of the thermal equation depends on the geometry of the sample, heat source and sink. In this study only the dynamic method has been used.

In this method, the temperature distribution throughout the sample varies with time, therefore the complete differential equation of heat flow is involved. The controlled power source can provide the heat in periodic manner. For measurement of thermal conductivity of rocks, the heat is generated along a linear wire source by applying a constant electrical voltage. In our case the measurement is carried out with a Quick Thermal Meter (QTM-D3) from Kemtherm, **Kyoto Electronics Manufacturing Co., Ltd.** which uses a probe applied to a flat surface of the sample, which both heats and measures the surface temperature. After automatic processing, the thermal conductivity is displayed numerically. In detail, the sample is only heated in the vicinity of the wire during a short period during which the temperature will rise from about 10 to 20 °C, and the temperature measured with a thermocouple. It should be noted that the thermal conductivity obtained in this way corresponds to that part of the sample where the probe was applied.

The instrument has an auto-mode to allow repeat measurements. Once a measurement is completed, the temperature readings and calculated conductivity are transferred into a data file on a PC via a RS232 port.

A comparison of measurements using the QTM apparatus and the divided-bar method to measure thermal conductivities on pairs of contiguous samples, led Sass et al. (1984) to conclude that both devices have a reproducibility of ±5%.

8.2.1 Measurement theory

The basic principle of this instrument is that the temperature of a heating wire increases exponentially after starting the measurement. Carslaw and Jaeger (1959) showed that when a constant heat flow rate of q per unit length is applied, the temperature T in a solid sample of infinite extent after a time t at a distance r from the heat source is given by:

$$T(r,t) = \frac{q}{4\pi \cdot k} \int_{\frac{r^2}{4at}}^{\infty} \frac{e^{-u}}{u} du = -\frac{q}{4\pi \cdot k} Ei(-\frac{r^2}{4at})$$

where $a = k / c\rho$ the thermal diffusivity

c the specific heat

ρ the density

and $Ei(-\frac{r^2}{4at})$ the exponential integral.

This equation can be simplified when r is small (≈0.25mm) and time t is short, then $\frac{r^2}{4at} \to 0$, and finally the used equation is

$$T_2 - T_1 = \frac{q}{4\pi \cdot k} ln\left(\frac{t_2}{t_1}\right)$$

where t_1 and t_2 are sampling time (s), with respectively temperatures T_1 and T_2 (°C).

QTM-D3 requires the heat to be applied for only 60 seconds, during which the temperature rise is about 20 °C. It is a very suitable and effective way to measure the thermal conductivity in the range from 0.02 to 10 $W/m \cdot K$ with an accuracy better than 5%.

8.2.2 Calibration

In order to check that the QTM is working correctly, three reference plates of known thermal conductivity are used for calibration. Each reference plate was measured 3 times; the results are as follows:

Reference plates	**Reference values** $W\,m^{-1}\,K^{-1}$	**Measured values** $W\,m^{-1}\,K^{-1}$	**St. Dev** %
Quartz glass	1.4140 at 29 °C	1.4170 at 22°C	0.45
Silicon rubber	0.2360 at 32°C	0.2400 at 22°C	0.05
Polyethylene foam	0.0356 at 28 °C	0.0356 at 23°C	0.14

These reference measurements demonstrate that our QTM instrument was well calibrated.

8.2.3 Measuring procedure

The dimensional requirement of the rock samples is dependent on their thermal conductivity (Fig.11). In this study most of the samples were cut into blocks within a size of 16 cm long, 11 cm wide and 4 cm thick. One notices that with a low thermal conductivity one can use a smaller sample.

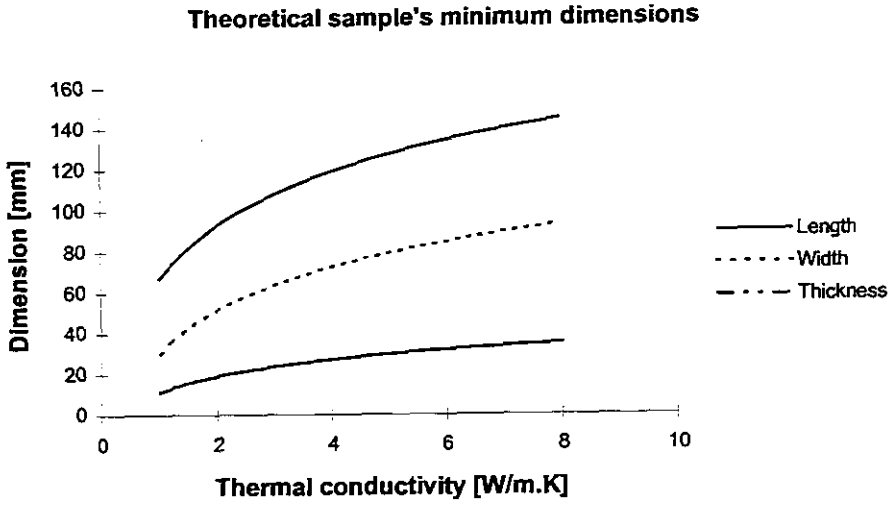


Fig.11 Minimum dimensional requirement of sample

Dry and saturated samples

The thermal conductivity of a rock is dependent on its mineral composition, its porosity, and the fluids in the pores. As it is difficult to determine the conductivity with partially saturated rocks, one prefers to use the two extreme cases; dry and saturated states. To dry the samples they are stored in an oven for 24 hours at 90 °C. To saturate them with a fluid they are immersed in a plastic basin filled with tap water for over one week at room temperature.

Procedure

The measurement begins with a dry sample. To improve the accuracy, each measurement of thermal conductivity is repeated 3 times so as to reduce errors. Although heating takes only 60 seconds, to repeat a measurement the heated sample must first be cooled down to room temperature, therefore each determination of thermal conductivity takes from 45 minutes to 1 hour.

Long measurement times on a water saturated sample could lead to evaporation problems. In our case, the rocks were immersed in water with the measurement surface only 5mm above water level. The plastic foil on the probe prevents evaporation from the surface during measurements.

To evaluate the thermal conductivity anisotropy (see **4.** page 4), the samples were cut into parallelepipeds with the foliation plane (if visible) taken as the reference surface. Measurements were made in the following way on a surface perpendicular to the foliation:

- The thermal conductivity parallel to the foliation k_p is obtained directly by positioning the probe line source perpendicular to foliation direction.

- An apparent thermal conductivity perpendicular to the foliation k_{an} is measured by positioning the probe line source parallel to layering.

If one admits that the conductivity is isotropic in the foliation plane, one is able to calculate the conductivity normal k_n to it, by applying the formula developed by Grubbe et al. (1983)

$$k_n = k_{an}^2 / k_p$$

Were $k_p > k_n$.

8.3 Results

In this first edition of the catalogue 88 rock samples have been measured in both dry and saturated states. The detailed results are listed in appendix V "Rock type and thermal conductivities". All of the rock samples have been measured in dry and wet states.

For most of the samples their size allowed measurements to be made in two orthogonal directions. Fig.12 and Fig.13 give the mean values $(k_p+k_n)/2$ and extreme values for samples in a dry and in a saturated state respectively.

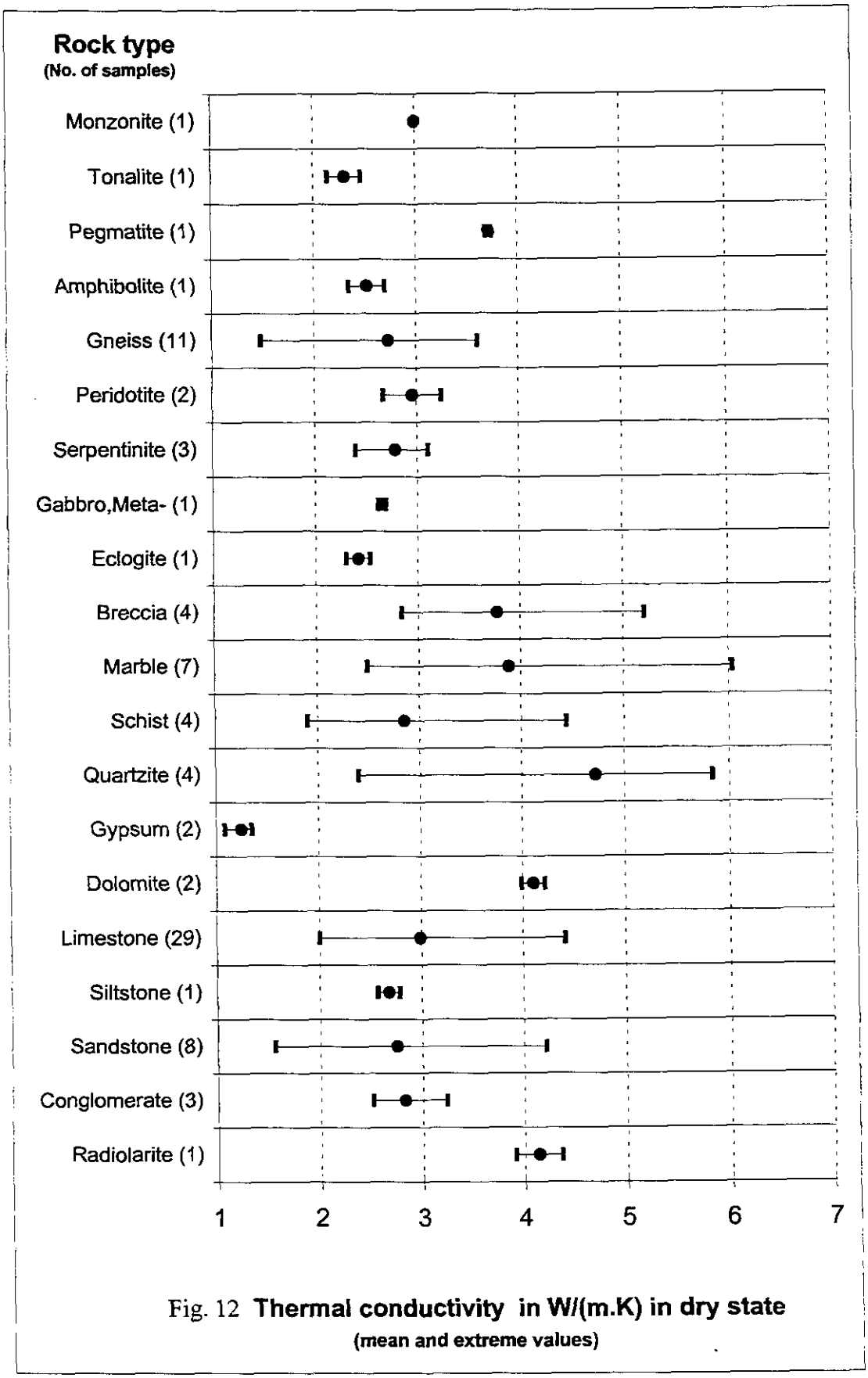


Fig. 12 **Thermal conductivity in W/(m.K) in dry state**
(mean and extreme values)

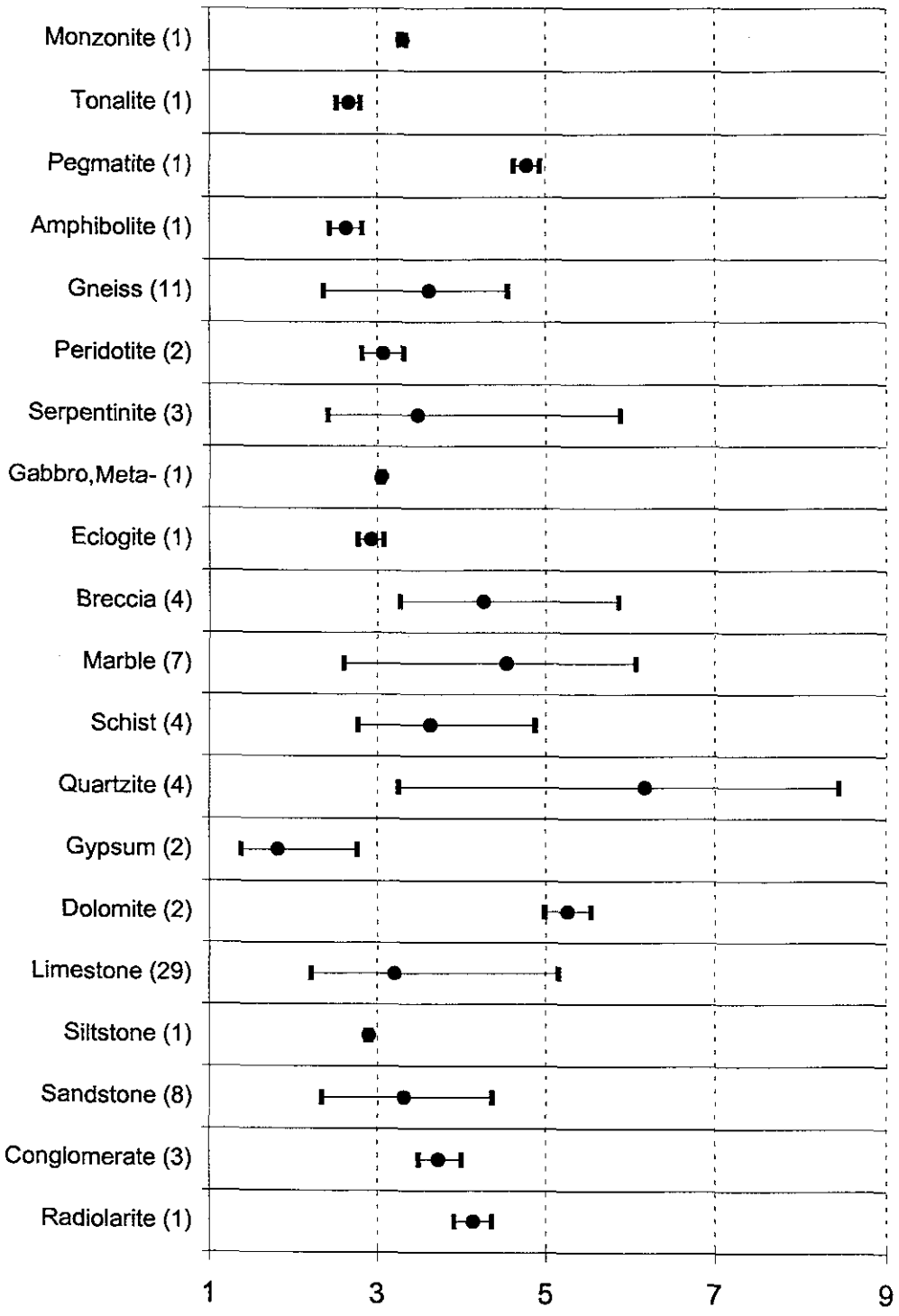


Fig. 13 **Thermal conductivity in W/(m.K) in saturated state**
(mean and extreme values)

The samples measured lead to the following main conclusions:

1. Quartzites have the highest, while gypsums have the lowest thermal conductivity.
2. Filling the pores with water, results in an average increase of the conductivity by 20%.
3. Schists show a strong anisotropy. The thermal conductivity in a direction parallel to layering k_p is much higher than in direction normal to layering k_n.
4. The thermal conductivity increases as the bulk density goes from 2.1 to 2.90×10^3 kg/m^3, this is illustrated in Fig.14 for 48 sedimentary samples. A linear fit of the data gives $k_{nd} = 3.470\ \rho_b - 6.377$, $r = 0.78$, where r is correlation coefficient.

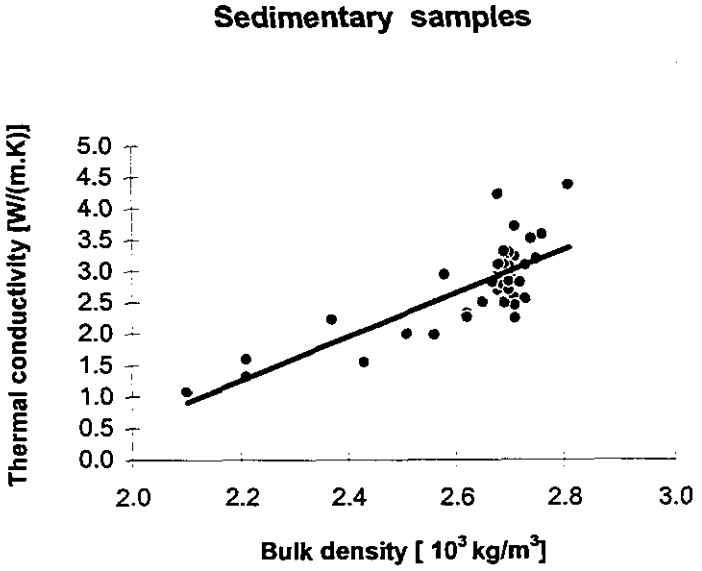


Fig.14 Bulk density versus thermal conductivity

8.4 Discussion

When using the data obtained from laboratory measurements, there are some limitations regarding the effects of temperature, pressure and type of fluid present.
In the lithosphere, the temperature (0 – 1,600 °C) increases as depth increases, and thermal conductivity tends to decrease. The temperature dependence of thermal conductivity for most rocks can be expressed by the simple relation (Cermak and Rybach, 1982, Seipold, 1998):

$$k_T = k_0 / (1 + \alpha T).$$

where k_T *and* k_0 are respectively the thermal conductivities at a temperature T and at the surface of the earth, and α is a constant coefficient. For example, measurement on 36 metabasite samples from KTB (German Continental Drilling Program) have shown such a linear relationship:

$$k_T = 1 / (A + B T).$$

with A=0.334 (m·K/W) and B=0.22 (10^{-3} m/W) fit to the second equation (Buntebarth, 1991).

With increase of pressure, pores and cracks in the rock will close and individual minerals will have better thermal contact, and therefore thermal conductivity will generally increase. At low pressure the conductivity may increase more rapidly than at high pressure. To a first approximation, the pressure dependence of rock thermal conductivity will be described by:

$$k_p = k_0 (1 + \beta p)$$

Where k_p and k_0 are thermal conductivity at pressure p and at the surface respectively, β is a constant. For example, measurements on an amphibolite sample from KTB (German Continental Drilling Program) have shown a linear relationship between thermal conductivity and pressure coefficient with $\beta=(0.75\pm0.41)\times10^{-1}$ GPa^{-1} in the pressure range from 50 up to 100 MPa (Seipold & Huenges, 1998; Seipold et al. 1998).

In the presence of a fluid, the rock may be partially or fully saturated and this will result in a change in the thermal conductivity. Walsh and Decker. (1966) have estimated the effect of saturated fluid on thermal conductivity by the upper and lower bound for rocks with low porosity. In a dry state, the heat conducts through the rock matrix and the air in the pores, but in a saturated state the heat conducts through rock matrix and water in the pores. As the thermal conductivity of water is about 20 times higher than that of air, the thermal conductivity in a saturated state is greater than that in the dry state even for a rock of low porosity.

Furthermore, with respect to depth, temperature has a greater influence on thermal conductivity than pressure (Seipold, 1992).

9. The catalogue

9.1 Introduction

The Catalogue application lets the user browse the contents of the Swiss Petrophysical rock properties database.
It offers an easy way to navigate within the database, to add, to modify or to suppress data entries, as well as printing the contents of the catalogue.

8.2 Installation

To install the Catalogue application into a PC running Windows95, Windows98, Windows NT 4.5 or 5.0, just double-click on the Setup icon and follow the instructions on the screen.

Browsing

- Catalogue displays the physical properties by groups.
  Just click on the appropriate buttons to display the properties you want.
  Samples are indexed (sorted) by their Sample Code (Code Echantillon) field.

  1) Generic/Généralités:
     Rock type, sample code, rock age, location.
  2) Magnetic properties:
     Rock types, sample code, susceptibilities (average, high frequency, low frequency, Curie temperature).
     The [SI] columns display the power of 10 of the value
     For example: 8.61E -6 means 8.61*10-6

  3) Densities:
     Rock types, sample code, matrix density, raw and saturated.

  4) P-wave velocities:
     Sample codes, velocities at the displayed pressures
  Note: velocities are measured along the 3 axes X (1), Y (2) and Z (3).

Navigation

Navigating in the database is easy. Just use the navigation buttons.
|< Jump to the first sample (top)
< Previous sample
> Next sample
>| Jump to the last sample (bottom)
+ Add a new sample. (This opens a new empty window where the user enters the values of all properties.)
- Delete the selected sample

Modification

Values can be modified in two different ways:

- Directly by double-clicking on it and typing in the new value
- Click on the "Editer les propriétés d'échantillons" button which will open a new window with all the properties displayed at once. Click on the "V" button to validate the modification.

Deleting samples

The "-" button suppresses the selected sample. Once the deletion is confirmed the sample is definitely suppressed and can't be restored later.

Adding samples

Click on the "+" button to add a new sample into the database.
This will display a new window with all the fields of all the properties. All fields left empty will be empty in the database.
Click on the "V" button to validate the modification.

The new sample will be inserted in its correct place accordingly to its sample code.

Printing

Catalogue offers several ways of printing the database:

- All (printer button) will print the entire catalogue.
- Selectively: print only the generic information, the magnetic properties, velocities, etc...

A "print preview" mode is available when the "?" button is pressed. In that case, Catalogue will first display the page on screen. You still can print it by clicking on the printer button.

N.B.

- Catalogue only works on a PC running Windows95, Windows98, Windows NT 4.x or 5.0
- Macintosh users can't use the application but still can read the database into FileMaker or FileMaker Pro, by opening the catalog.dbf file.
- Printing problems happen erratically on the HP LaserJet laser printer models.
  If the printer doesn't have enough memory (2Mb), the pages will not be completely printed.
  If the printer is an HP LaserJet 6P, it will reduce the page to 25% of its size. This is a known bug of the printing tool and should be fixed soon.
- For more information on navigating and using the application, please read the on-line help file by clicking on the "Aide" button.
  Just click on the appropriate buttons to display the properties you want.
  Samples are indexed (sorted) by Sample code.

10. Acknowledgments

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APPENDIX I

Rock type and sampling locations

Generality

CODE	Type of rock	Location	Geological Unit	Longitude(°E)	Latitude(°N)	Altitude(m)
BA16	Amphibolite	Lourtier-Flonnay	Socle Siviez-Misch.	–	–	–
IV36	Amphibolite	Strona (après)	Zone d'Ivrée	8.313	45.908	580
IV37	Amphibolite	Route de Forno(p113)	Zone d'Ivrée	8.309	45.911	650
IV40A	Amphibolite	Rosarolo, rivière	Zone d'Ivrée	8.290	45.920	740
IV40B	Amphibolite	Rosarolo, rivière	Zone d'Ivrée	8.290	45.920	740
JB20	Amphibolite	Zernez	Silvretta, socle	10.052	46.782	1480
ST07	Amphibolite		N. de Berisal	8.040	46.255	1400
ST13	Amphibolite	Stèle A. Zurbriggen	Z. du Portjengrat	7.957	46.050	1940
ST14	Amphibolite à grenat	Glacier Matmark	Z. Zermatt-Saas	–	–	–
IV29	Amphibolite mylonit., rétrogr.	Loro	Zone d'Ivrée	8.280	45.990	240
IV41	Amphibolite mylonitisée	Rosarolo rivière	Zone d'Ivrée	8.290	45.920	740
IV55	Amphibolite mylonitisée	Grampi	Zone d'Ivrée	8.300	45.910	780
IV42	Amphibolite tecton., rétrogr.	Rosarolo rivière	Zone d'Ivrée	8.290	45.920	740
ST17	Amphibolite, rétrogradée		Z. Zermatt-Saas	–	–	–
SL1	Andésite	Bachetto Sessera		8.063	45.666	1380
IV12	Aplite	Civiasco (après)	Strona-Ceneri	8.289	45.802	640
IV13	Aplite légèrement foliée	Civiasco (après)	Strona-Ceneri	8.279	45.801	580
TM02	Brèche calcaro-dolomitique	Gravelone(Sion)	Sion-Courmayeur	7.337	46.218	480
CS73	Brèche,-Micro, dolomitique	Manneberg	Nappe de la Brèche	7.385	46.568	990
CS79	Brèche,-Micro, dolomitique	Charmey	Préalp. médianes pla	7.173	46.611	870
JB24	Brèche, Micro-	Thusis	Tomül flysch	9.424	46.737	750
BA07	Calcaire	Le Châble	Sion-Courmayeur	–	–	–
CS69	Calcaire	Carrière Audonces	Nappe de la Simme	7.005	46.228	405
CS86	Calcaire	Rondchâte	Jura, Portlandien	7.253	47.194	610
JB23	Calcaire	Surs	Platta	9.616	46.534	1538
JB33	Calcaire	Vals, Piedm Strasse	Ultrahélvetique	9.252	46.731	780
PF5	Calcaire		Tschepp, jurassique	9.497	47.048	–
ST09	Calcaire	Anc. rte du Simplon	Sion-Courmayeur	8.018	46.290	1280
TH1	Calcaire	Thônex, forage	Aptien-Barr. (urg.)	6.200	46.170	428
TH2	Calcaire	Thônex, forage	Aptien-Barr. (urg.)	6.200	46.170	428
TH3	Calcaire	Thônex, forage	Aptien-Barr. (urg.)	6.200	46.170	428
TH4	Calcaire	Thônex, forage	Aptien-Barr. (urg.)	6.200	46.170	428
TH5	Calcaire	Thônex, forage	Aptien-Barr. (urg.)	6.200	46.170	428
TH6	Calcaire	Thônex, forage	Aptien-Barr. (urg.)	6.200	46.170	428
TH7	Calcaire	Thônex, forage	Portlandien	6.200	46.170	428

Generality

CODE	Type of rock	Location	Geological Unit	Longitude(°E)	Latitude(°N)	Altitude(m)
TH8	Calcaire	Thônex, forage	Portlandien	6.200	46.170	428
JB17	Calcaire à lumachelles	Bernina	Err-Bernina, Trias	9.982	46.462	2100
TM27	Calcaire bioclastique	Magnot	Nappe du Wildhorn	7.267	46.211	620
CS53	Calcaire biodétritique	Asp	Jura, Trias	8.041	47.457	545
CS82	Calcaire calcarénite	Rondchâte	Jura, Callovien	7.250	47.182	595
BA01	Calcaire dolomitique	Sembrancher	Helvétique, Trias	–	–	–
CS71	Calcaire dolomitique	Gérignoz	Préalp. médianes rig	7.162	46.467	970
JB19	Calcaire fin	Livigno	Scarl	10.148	46.622	1830
CS77	Calcaire glumeleux	Le Brésil, Jaun	Préalp. médianes pla	7.216	46.596	910
CS66	Calcaire Marneux	Pontenet	Molasse, USM	7.260	47.242	730
CAL01	Calcaire massif	CERN, près Genève	Barrémien	6.016	46.250	450
CS61	Calcaire massif biodétritique	Nestal	Nappe de Glaris	9.038	47.069	460
CS62	Calcaire micritique	Obersee-Strasse	Nappe de Säntis	9.028	47.116	730
CS78	Calcaire micritique	Le Brésil, Jaun	Préalp. médianes pla	7.214	46.597	910
CS85	Calcaire micritique	Rondchâte	Jura, Kimmeridgien	7.246	47.193	610
TM33	Calcaire micritique	Prabé	Nappe du Wildhorn	7.349	46.272	470
CS55	Calcaire micritique schisteux	Tierfeld	Parautochtone Aar	8.960	46.892	810
CS50	Calcaire oolithique	Staffelegg	Jura, Dogger	8.045	47.435	500
CS83	Calcaire oolitique	Rondchâte	Jura, Oxfordien	7.255	47.193	600
CS76	Calcaire pélagique	Jaunpass N	Préalp. médianes rig	7.312	46.592	1420
CS74	Calcaire pélagique à silex	Ried /Jaunpass	Nappe de la Simme	7.354	46.584	1205
CS84	Calcaire récifal	Rondchâte	Jura, Oxfordien	7.255	47.190	600
CS63	Calcaire silíceux	Obersee-Strasse	Nappe de Säntis	9.027	47.111	640
TM26	Calcaire silíceux bioclastique	L'Ardève, Leytron	Nappe de Morcles	7.216	46.184	560
CS58	Calcaire sombre siliceux	Klausen-Strasse	Nappe d'Axen	8.926	46.918	1330
CS68	Calcaire spathique	Carrière Chiètres	Parautocht. Aig.Rge.	7.003	46.228	490
BA05	Calcaire spathique gréseux	Sembr.-Le Châble	Helvétique, Lias	–	–	–
PF6	Calcaire, jurassique		Glaris, jurassique	9.289	46.492	–
JB29	Calcschiste	Avers Cresta	Suretta	9.513	46.479	1900
ST03	Calcschiste quarztzitique		N. de Lebendun	8.092	46.178	1160
D6	Conglomérat	Dorénaz	Aig. Rge. Stéph.Inf.	7.086	46.247	480
JB25	Conglomérat	Sufers	Tomül flysch	9.337	46.573	1500
JB35	Conglomérat	Oberalppass	Urseren zone	8.677	46.646	1880
CS64	Conglomérat (molasse)	Niederurnen	Molasse subalpine	9.024	47.145	440
JB32	Conglomérat calcaire	Vals-Strasse	Piz Terri-Lunschania	9.176	46.706	1050
CS59	Conglomérat grossier	Route d'Elm	Nappe de Glaris	9.096	47.012	705

CODE	Type of rock	Location	Geological Unit	Longitude(°E)	Latitude(°N)	Altitude(m)
SL3	Diorite	Vico (Carrière)		7.788	45.497	730
SL4	Diorite	Traversella		7.763	45.512	820
IV16A	Diorite à biotite	Varallo, sortie W		8.250	45.800	450
IV16B	Diorite à biotite	Varallo, sortie W		8.250	45.800	450
JB16	Dolomie	Bernina	Err-Bernina,Hptdol.T	9.982	46.462	2100
PF15	Dolomie		Tschepp	9.401	46.826	–
ST12	Dolomie		Autochtone M.A.,Tr.	7.847	46.301	720
TM25	Dolomie	Drône, Savièse	Autochtone M.A., Tr	7.373	46.255	840
JB30	Eclogite	Avers Cresta	Suretta	9.454	46.522	1900
IV23	Gabbro	Balmuccia (Gualfola)	Zone d'Ivrée	8.153	45.818	555
IV22	Gabbro clair	Balmuccia (Gualfola)	Zone d'Ivrée	8.153	45.818	555
IV21	Gabbro fracturé, rétrogradé	Balmuccia (rivière)	Zone d'Ivrée	8.142	45.817	555
IV02	Gabbro rétrogradé	Loro (église)	Zone d'Ivrée	8.279	45.991	240
TM21	Gabbro, méta-	La Forclaz	Nappe du Tsaté	7.521	46.073	1725
ST18	Gabbro, Méta- (Isotrope)		Z. Zermatt-Saas	–	–	–
ST19	Gabbro, Méta-, éclogitique		Z. Zermatt-Saas	–	–	–
IV01	Gabbro, Rétrogradé	Loro (église)	Zone d'Ivrée	8.279	45.991	240
BA14	Gneiss	Lourtier		–	–	–
JB26	Gneiss	Ausserferrera	Suretta (socle)	9.427	46.575	1300
JB34	Gneiss	Sedrun	Tavetsch	8.734	46.672	1500
SC1	Gneiss	Mergozzo (après)	Strona-Ceneri	8.468	45.958	205
JB36	Gneiss (Granite)	Gottardpass	Gottard	8.552	46.579	1970
JB14	Gneiss (Kinzigite)	Chiareggio	Margna	9.799	46.334	1600
ST04	Gneiss (Meta-arkose)		N. de Lebendun	8.085	46.177	1170
ST08	Gneiss (Meta-arkose)		N. Monte Leone	8.054	46.292	1400
D2	Gneiss à biotite	La Balmaz	Alg. Rge.	7.055	46.269	460
D3	Gneiss à biotite	La Balmaz	Alg. Rge.	7.055	46.269	460
D1	Gneiss chloriteux	Evionnaz	Alg. Rge.	7.041	46.294	460
D1A	Gneiss chloriteux	Evionnaz	Alg. Rge.	7.041	46.294	460
PF2	Gneiss déformé		Adula	9.259	46.489	–
PF9	Gneiss déformé		Suretta	9.441	46.586	–
JB01	Gneiss fin très déformé	Val Isorno	Monte Leone	8.358	46.184	1020
JB02	Gneiss grossier	Crevadossola	Monte Leone	8.322	46.254	400
PF17	Gneiss mylonitisé		Misox	9.247	46.363	–
JB21	Gneiss oeillé	Zernez	Silvretta	10.088	46.725	1600
PF7	Gneiss oeillé		Tambo	9.220	46.436	–

CODE	Type of rock	Location	Geological Unit	Longitude(°E)	Latitude(°N)	Altitude(m)
ST11	Gneiss oeillé	Car. Baltschieder	Massif de l'Aar	7.865	46.297	650
PF3	Gneiss oeillé, mylonitisé		Tambo	9.347	46.492	–
JB06	Gneiss schisteux	Premia	Verampio	8.341	46.257	710
JB18	Gneiss schisteux	Bernina	Err-Bernina	10.017	46.434	2335
SS1	Gneiss schisteux	Niederalp (Simplon)		8.016	46.233	1860
JB07	Gneiss sombre à hornblende	San Martino	Bergell	9.605	46.253	1090
SC2	Gneiss, Ortho-	Germagno(route pour)	Strona-Ceneri	8.385	45.886	550
TM23	Gneiss, Ortho-, mylonitique	Ferpècle	N. de la Dent Blanc	7.541	46.058	1730
ST23	Gneiss, Para-	Entre Eisten et Pont	Z. Stalden sup.	7.899	46.179	1230
D5	Granite	Miéville (Carrière)	Aig. Rge.	7.058	46.259	500
PF12	Granite		Aar	9.223	46.636	–
IV11	Granite leucocrate	Carrière Mte.-Orfano	Strona-Ceneri	8.453	45.936	205
D4	Granite mylonitisé	Miéville (Carrière)	Aig. Rge.	7.058	46.259	500
JB09	Granodiorite	San Martino	Bergell	9.631	46.259	1000
IV09A	Granulite	Anzola, carrière	Zone d'Ivrée	8.350	45.990	240
IV06	Granulite à Plg-Ga-Opx	Riale Arca (rivière)	Zone d'Ivrée	8.293	45.989	236
IV45	Granulite à Plg-Ga-Opx	Piana di Forno	Zone d'Ivrée	8.250	45.931	1045
IV25	Granulite à Qz-Plg-Px	Monte Rubello (sous)	Zone d'Ivrée	8.143	45.678	1230
IV07	Granulite basique	Riale Arca (rivière)	Zone d'Ivrée	8.293	45.989	236
IV03	Granulite basique à amphibo.	Riale Arca (rivère)	Zone d'Ivrée	8.293	45.989	236
IV05	Granulite basique à hornblende	Riale Arca (rivière)	Zone d'Ivrée	8.293	45.989	236
IV08	Granulite rétrogradée	Riale Arca (rivière)	Zone d'Ivrée	8.293	45.989	236
BA06	Grès	Le Châble	Racines, Helv. Malm	–	–	–
CS80	Grès	Barrage de Rossens	Molasse sup. subalp.	7.115	46.717	675
CS81	Grès	Rondchâte	Molasse, Jura	7.252	47.183	595
FAL1	Grès	Car. de Tatür, FR	Gurnigel,Thanétien	–	–	–
CS67	Grès calcaire	Tavannes	Molasse, USM	7.195	47.221	780
CS72	Grès calcaire		Nappe des Dranses	7.166	46.466	945
BA04	Grès calcique	Sembr.-Le Châble	Série de Ferret,Lias	–	–	–
CS56	Grès charboneux (flysch)	Klausen-Strasse	Flysch Aar	8.957	46.923	760
CS70	Grès du flysch	Rte. des Mosses	Nappe du Niesen	7.063	46.354	1145
D8	Grès fin	Dorénaz	Aig. Rge.	7.086	46.247	480
M1	Grès fin	Challex, Ain, France	Molasse,Tertiaire	5.975	46.180	485
M2	Grès fin	CERN, près Genève	Molasse,Tertiaire	6.060	46.250	450
MOL6	Grès fin	Cologny, Genève	Molasse,Chattien sup	6.188	46.232	451
MOL7	Grès fin	Cologny, Genève	Chat.sup./base Aqui.	6.119	46.232	450

CODE	Type of rock	Location	Geological Unit	Longitude(°E)	Latitude(°N)	Altitude(m)
MOL9	Grès fin	G. Motta, Genève	Molasse,Chattien inf	6.135	46.219	410
D7	Grès grossier	Dorénaz	Alg. Rge.	7.086	46.247	480
TM03	Grès micacé	Chandoline(Sion)	Zone houillère,int.	7.362	46.210	500
CS54	Grès rouge	Gausingen	Jura	8.108	47.562	450
CS60	Grès rouge	Elm-Strasse	Nappe de Glaris	9.098	47.012	705
BA09	Grès schisteux	Champsec	Z.Houillère ext.Carb	–	–	–
TM01	Grès silici-calcique	Rte. mayens Riddes	Zone Sion-Courmayeur	7.227	46.148	1110
MOL1	Grès très fin	Cologny, Genève	Molasse,Chattien inf	6.190	46.230	450
MOL2	Grès très fin	Cologny, Genève	Molasse,Chattien inf	6.190	46.230	450
MOL3	Grès très fin	Cologny, Genève	Molasse,Chattien inf	6.190	46.230	450
BA02	Gypse	Sembrancher	Helvétique, Trias	–	–	–
TM37	Gypse	Drône, Savièse	Nappe du Wildhorn	7.371	46.255	835
CS52	Gypse rubané	Staffelegg	Jura, Trias	8.044	47.440	560
IV04	Hornblendite	Riale Arca (rivière)	Zone d'Ivrée	8.293	45.989	236
IV34	Kinzigite	Ponte Orchera	Zone d'Ivrée	8.372	45.898	430
IV39	Kinzigite	Grampi	Zone d'Ivrée	8.304	45.915	780
IV48	Kinzigite	Madonna del Boden	Zone d'Ivrée	8.397	45.971	390
IV53	Kinzigite	Grampi (rivière)	Zone d'Ivrée	8.296	45.917	670
IV54	Kinzigite	Grampi (rivière)	Zone d'Ivrée	8.296	45.917	670
IV27A	Kinzigite mylonitisée,rétrogr.	Loro (sous l'église)	Zone d'Ivrée	8.280	45.990	240
IV28	Kinzigite mylonitisée,rétrogr.	Loro	Zone d'Ivrée	8.280	45.990	240
IV50	Mafique faciès amph./gra. myl.	Anzola carrière	Zone d'Ivrée	8.350	45.980	240
IV51	Mafique faciès amph./gra. myl.	Anzola carrière	Zone d'Ivrée	8.350	45.980	240
IV49	Mafique faciès amphib./granul.	Anzola carrière	Zone d'Ivrée	8.350	45.980	240
IV19	Mafique mylonitisée, rétrogr.	Chioso (pont,après)	Zone d'Ivrée	8.109	45.766	670
IV20	Mafique tectonisée, rétrogr.	Balmuccia (rivière)	Zone d'Ivrée	8.142	45.817	555
IV10A	Mafique, f. à amphibolite sup.	Nibbio	Zone d'Ivrée	8.402	45.990	205
IV10B	Mafique, f. à amphibolite sup.	Nibbio	Zone d'Ivrée	8.402	45.990	205
JB10	Marbre	Malenco,Str.Franscia	Malenco	9.888	46.299	1200
JB27	Marbre	Ausserferrera	Suretta	9.427	46.575	1300
PF13	Marbre		Aul	9.219	46.636	–
PF4	Marbre		Splügen, mésozoïque	9.494	46.858	–
ST21	Marbre		Z. Gornergrat, Trias	–	–	–
TM29	Marbre	La Sarva, Saillon	Nappe de Morcles	7.175	46.161	520
JB03	Marbre blanc cristallisé	Crevadossola	Monte Leone	8.293	46.149	480
ST20	Marbre dolomitique		Z. Gornergrat, Trias	–	–	–

Generality

CODE	Type of rock	Location	Geological Unit	Longitude(°E)	Latitude(°N)	Altitude(m)
ST22	Marbre dolomitique, Trias ?		Z. Gornergrat	–	–	–
PF8	Marbre dolomitisé		Misox	9.470	46.411	–
JB04	Marbre gris bleu, rubané	Crevadossola	Monte Leone	8.293	46.149	480
IV15	*Marbre impur*	Civiasco (après)	Strona-Ceneri	8.279	45.801	580
IV14	Marbre impur mylonitisé	Civiasco (après)	Strona-Ceneri	8.279	45.801	580
TM17	Marbre micacé	Martémo(Evolène)	Nappe du Tsaté	7.494	46.114	1700
CS65	Marbre sombre	Col de la Furka	Zone d'Urseren	8.464	46.592	2090
JB15	Monzonite, peu déformée	Bernina	Err-Bernina	9.938	46.475	1990
SS2	Mylonite, Blasto-	*Simplon village*	*Simplon*	8.059	46.197	1460
IV35	Paragneiss à biotite et plg.	Strona (rivière)	Zone d'Ivrée	8.342	45.906	520
TM13	Pegmatite	Praz-Jean	Nappe de Siviez-M.	7.460	46.136	1150
IV17	Péridotite	Balmuccia (Carrière)	Zone d'Ivrée	8.172	45.822	560
IV18	Péridotite	Balmuccia (Carrière)	Zone d'Ivrée	8.172	45.822	560
IV26	Péridotite	Baldissero(Carrière)	Zone d'Ivrée	7.750	45.417	500
IV31	Péridotite	Rio Inferno(rivière)	Zone d'Ivrée	8.316	45.989	230
JB11	Péridotite	Malenco,Str.Franscia	Malenco	9.888	46.299	1200
JB13	Péridotite	Malenco,Str.Franscia	Malenco	9.902	46.305	1500
IV30	Péridotite, Kéliphyte	Rio Inferno(rivière)	Zone d'Ivrée	8.316	45.989	230
PF16	Porphyre mylonitisé		Suretta	9.423	46.496	–
PF10	Porphyre quartzitique		Suretta	9.057	46.772	–
P2	*Porphyre, type Lugano*	Borgosesia (sort.SW)		8.296	45.698	360
PF14	Prasinite		Aul	9.219	46.636	–
VB	Prasinite	Val de Bagne	Tsaté	7.372	45.950	2180
IV24	Pyroxénite	Balmuccia (Guaifola)	Zone d'Ivrée	8.153	45.818	555
TM06	Quartzite	Rte. d'Annivers,Fang	Nappe de Siviez-M.	7.580	46.221	1150
JB31	*Quartzite conglomératique*	*Illanz*	*Permien*	9.194	46.789	705
TM05	Quartzite conglomératique	Combaneire(Dailley)	Nappe de Siviez-M.	7.460	46.228	1040
BA12	Quartzite massif	Lourtier	N. Pontis,Trias	–	–	–
BA10	Quartzite schisteux	Champsec-Lourtier	Z. Houillère int.Per	–	–	–
BA11	Quartzite schisteux	Champsec-Lourtier	Z. Houillère int.Per	–	–	–
BA13	Quartzite schisteux	Lourtier	*N. Siviez-Mischabel*	–	–	–
JB28	Quartzite, blanche	Avers Crôt	Suretta	9.475	46.492	1720
TM08	Quartzschist	Bevernec (Mase)	Nappe de Siviez-M.	7.427	46.189	1245
CS75	Radiolarite	Jaunpass S	Nappe de la Simme	7.352	46.590	1415
IV38	Roche calcosilicatée	Route de Forno(p113)	Zone d'Ivrée	8.309	45.911	650
BA03	Schiste (Argil., mét.)	Sembrancher	Helvétique, Aalénien			

Generality

CODE	Type of rock	Location	Geological Unit	Longitude(°E)	Latitude(°N)	Altitude(m)
ST10	Schiste noir	Car. Lungwurm	Lias	8.003	46.308	840
TM20	Schiste vert, Greenschist	Les Haudères	Nappe du Tsaté	7.513	46.072	1420
BA15	Schiste, Mica-	Lourtier-Fionnay	Socle Siviez-Misch.	–	–	–
TM10	Schiste, Mica-, à albite	Praz-Jean	Nappe de Siviez-M.	7.459	46.137	1120
JB12	Serpentinite	Rte. de Franscia	Malenco	9.899	46.305	1500
JB22	Serpentinite	Lac de Sils	Platta	9.718	46.437	1800
ST15	Serpentinite		Z. Zermatt-Saas	–	–	–
ST16	Serpentinite		Z. Zermatt-Saas	–	–	–
TM22	Serpentinite		Nappe du Tsaté	7.532	46.064	1690
CS57	Siltite à ciment calc.(flysch)	Klausen-Strasse	Parautochtone Aar	8.959	46.923	760
IV43	Stronalite	Plana di Forno	Zone d'Ivrée	8.250	45.931	1045
IV44	Stronalite	Plana di Forno	Zone d'Ivrée	8.250	45.931	1045
IV52	Stronalite	Plana di Forno	Zone d'Ivrée	8.265	45.933	1045
IV32	Stronalite mylonitisée	Carrière d'Anzola	Zone d'Ivrée	8.350	45.980	240
IV33	Stronalite mylonitisée	Carrière d'Anzola	Zone d'Ivrée	8.350	45.980	240
IV46	Stronalite mylonitisée	Forno (village,sud)	Zone d'Ivrée	–	–	–
SL2	Syénite de Biella	Balma (Carrière)		8.019	45.649	720
JB08	Tonalite	San Martino	Bergell	9.602	46.249	1200

APPENDIX II

Rock type and densities

Density in 10^3 kg/m^3

CODE	Type of rock	Location	Geological Unit	Matrix D	Bulk D	Porosity (%)
BA16	Amphibolite	Lourtier-Fionnay	Socle Siviez-Misch.	3.05	3.04	0.33
IV36	Amphibolite	Strona (après)	Zone d'Ivrée	3.02	2.99	0.99
IV37	Amphibolite	Route de Forno(p113)	Zone d'Ivrée	3.17	3.14	0.95
IV40A	Amphibolite	Rosarolo, rivière	Zone d'Ivrée	3.09	3.08	0.32
IV40B	Amphibolite	Rosarolo, rivière	Zone d'Ivrée	3.10	3.10	0.00
JB20	Amphibolite	Zernez	Silvretta, socle	2.98	2.97	0.34
ST07	Amphibolite		N. de Berisal	2.98	2.97	0.34
ST13	Amphibolite	Stèle A. Zurbriggen	Z. du Portjengrat	2.97	2.96	0.34
ST14	Amphibolite à grenat	Glacier Matmark	Z. Zermatt-Saas	2.95	2.95	0.00
IV29	Amphibolite mylonit., rétrogr.	Loro	Zone d'Ivrée	2.94	2.94	0.00
IV41	Amphibolite mylonitisée	Rosarolo rivière	Zone d'Ivrée	3.14	3.06	2.55
IV55	Amphibolite mylonitisée	Grampi	Zone d'Ivrée	3.11	3.07	1.29
IV42	Amphibolite tecton., rétrogr.	Rosarolo rivière	Zone d'Ivrée	2.97	2.88	3.03
ST17	Amphibolite, rétrogradée		Z. Zermatt-Saas	2.94	2.93	0.34
SL1	Andésite	Bachetto Sessera		2.73	2.72	0.37
IV12	Aplite	Civiasco (après)	Strona-Ceneri	2.70	2.70	0.00
IV13	Aplite légèrement foliée	Civiasco (après)	Strona-Ceneri	2.67	2.67	0.00
TM02	Brèche calcaro-dolomitique	Gravelone(Sion)	Sion-Courmayeur	2.80	2.76	1.43
CS73	Brèche,-Micro, dolomitique	Manneberg	Nappe de la Brèche	2.69	2.68	0.37
CS79	Brèche,-Micro, dolomitique	Charmey	Préalp. médianes pla	2.79	2.73	2.15
JB24	Brèche, Micro-	Thusis	Tomül flysch	2.70	2.68	0.74
BA07	Calcaire	Le Châble	Sion-Courmayeur	2.72	2.71	0.37
CS69	Calcaire	Carrière Audonces	Nappe de la Simme	2.71	2.70	0.37
CS86	Calcaire	Rondchâte	Jura, Portlandien	2.70	2.69	0.37
JB23	Calcaire	Surs	Platta	2.76	2.75	0.36
JB33	Calcaire	Vals, Piedm Strasse	Ultrahélvetique	2.75	2.73	0.73
PF5	Calcaire		Tschepp, jurassique	2.74	2.73	0.36
ST09	Calcaire	Anc. rte du Simplon	Sion-Courmayeur	2.70	2.70	0.00
TH1	Calcaire	Thônex, forage	Aptien-Barr. (urg.)	2.71	2.70	0.37
TH2	Calcaire	Thônex, forage	Aptien-Barr. (urg.)	2.71	2.55	5.90
TH3	Calcaire	Thônex, forage	Aptien-Barr. (urg.)	2.71	2.70	0.37
TH4	Calcaire	Thônex, forage	Aptien-Barr. (urg.)	2.71	2.70	0.37
TH5	Calcaire	Thônex, forage	Aptien-Barr. (urg.)	2.70	2.70	0.00
TH6	Calcaire	Thônex, forage	Aptien-Barr. (urg.)	2.71	2.59	4.43
TH7	Calcaire	Thônex, forage	Portlandien	2.70	2.69	0.37

Density in 10^3 kg/m^3

CODE	Type of rock	Location	Geological Unit	Matrix D	Bulk D	Porosity (%)
TH8	Calcaire	Thônex, forage	Portlandien	2.70	2.67	1.11
JB17	Calcaire à lumachelles	Bernina	Err-Bernina, Trias	2.72	2.71	0.37
TM27	Calcaire bioclastique	Magnot	Nappe du Wildhorn	2.70	2.69	0.37
CS53	Calcaire biodétritique	Asp	Jura, Trias	2.73	2.71	0.73
CS82	Calcaire calcarénite	Rondchâte	Jura, Callovien	2.69	2.62	2.60
BA01	Calcaire dolomitique	Sembrancher	Helvétique, Trias	2.82	2.82	0.00
CS71	Calcaire dolomitique	Gérignoz	Préalp. médianes rig	2.71	2.68	1.11
JB19	Calcaire fin	Livigno	Scarl	2.85	2.81	1.40
CS77	Calcaire glumeleux	Le Brésil, Jaun	Préalp. médianes pla	2.69	2.69	0.00
CS66	Calcaire Marneux	Pontenet	Molasse, USM	2.69	2.51	6.69
CAL01	Calcaire massif	CERN, près Genève	Barrémien	2.69	2.69	0.00
CS61	Calcaire massif biodétritique	Nestal	Nappe de Glaris	2.70	2.69	0.37
CS62	Calcaire micritique	Obersee-Strasse	Nappe de Säntis	2.70	2.70	0.00
CS78	Calcaire micritique	Le Brésil, Jaun	Préalp. médianes pla	2.71	2.70	0.37
CS85	Calcaire micritique	Rondchâte	Jura, Kimmeridgien	2.70	2.68	0.74
TM33	Calcaire micritique	Prabé	Nappe du Wildhorn	2.70	2.68	0.74
CS55	Calcaire micritique schisteux	Tierfeld	Parautochtone Aar	2.71	2.70	0.37
CS50	Calcaire oolithique	Staffelegg	Jura, Dogger	2.69	2.67	0.74
CS83	Calcaire oolitique	Rondchâte	Jura, Oxfordien	2.70	2.37	12.22
CS76	Calcaire pélagique	Jaunpass N	Préalp. médianes rig	2.71	2.69	0.74
CS74	Calcaire pélagique à silex	Ried /Jaunpass	Nappe de la Simme	2.71	2.70	0.37
CS84	Calcaire récifal	Rondchâte	Jura, Oxfordien	2.71	2.70	0.37
CS63	Calcaire siliceux	Obersee-Strasse	Nappe de Säntis	2.70	2.69	0.37
TM26	Calcaire siliceux bioclastique	L'Ardève, Leytron	Nappe de Morcles	2.65	2.58	2.64
CS58	Calcaire sombre siliceux	Klausen-Strasse	Nappe d'Axen	2.77	2.74	1.08
CS68	Calcaire spathique	Carrière Chiètres	Parautocht. Aig.Rge.	2.72	2.70	0.74
BA05	Calcaire spathique gréseux	Sembr.-Le Châble	Helvétique, Lias	2.69	2.69	0.00
PF6	Calcaire, jurassique		Glaris, jurassique	2.67	2.67	0.00
JB29	Calcschiste	Avers Cresta	Suretta	2.74	2.70	1.46
ST03	Calcschiste quarztzitique		N. de Lebendun	2.71	2.62	3.32
D6	Conglomérat	Dorénaz	Aig. Rge. Stéph.Inf.	2.66	2.66	0.00
JB25	Conglomérat	Sufers	Tomül flysch	2.74	2.71	1.09
JB35	Conglomérat	Oberalppass	Urseren zone	2.67	2.65	0.75
CS64	Conglomérat (molasse)	Niederurnen	Molasse subalpine	2.74	2.71	1.09
JB32	Conglomérat calcaire	Vals-Strasse	Piz Terri-Lunschania	2.73	2.71	0.73
CS59	Conglomérat grossier	Route d'Elm	Nappe de Glaris	2.71	2.69	0.74

Density in 10^3 kg/m^3

CODE	Type of rock	Location	Geological Unit	Matrix D	Bulk D	Porosity (%)
SL3	Diorite	Vico (Carrière)		2.77	2.76	0.36
SL4	Diorite	Traversella		2.76	2.74	0.72
IV16A	Diorite à biotite	Varallo, sortie W		2.93	2.93	0.00
IV16B	Diorite à biotite	Varallo, sortie W		2.94	2.94	0.00
JB16	Dolomie	Bernina	Err-Bernina,Hptdol.T	2.85	2.84	0.35
PF15	Dolomie		Tschepp	2.86	2.83	1.05
ST12	Dolomie		Autochtone M.A.,Tr.	2.84	2.81	1.06
TM25	Dolomie	Drône, Savièse	Autochtone M.A., Tri	2.83	2.83	0.00
JB30	Eclogite	Avers Cresta	Suretta	3.02	3.00	0.66
IV23	Gabbro	Balmuccia (Gualfola)	Zone d'Ivrée	3.24	3.24	0.00
IV22	Gabbro clair	Balmuccia (Gualfola)	Zone d'Ivrée	2.94	2.90	1.36
IV21	Gabbro fracturé, rétrogradé	Balmuccia (rivière)	Zone d'Ivrée	3.10	3.09	0.32
IV02	Gabbro rétrogradé	Loro (église)	Zone d'Ivrée	3.12	3.11	0.32
TM21	Gabbro, méta-	La Forclaz	Nappe du Tsaté	3.02	3.02	0.00
ST18	Gabbro, Méta- (isotrope)		Z. Zermatt-Saas	3.07	3.06	0.33
ST19	Gabbro, Méta-, éclogitique		Z. Zermatt-Saas	3.40	3.40	0.00
IV01	Gabbro, Rétrogradé	Loro (église)	Zone d'Ivrée	3.06	3.05	0.33
BA14	Gneiss	Lourtier		2.73	2.70	1.10
JB26	Gneiss	Ausserferrera	Suretta (socle)	2.70	2.68	0.74
JB34	Gneiss	Sedrun	Tavetsch	2.79	2.78	0.36
SC1	Gneiss	Mergozzo (après)	Strona-Ceneri	2.71	2.67	1.48
JB36	Gneiss (Granite)	Gottardpass	Gottard	2.68	2.65	1.12
JB14	Gneiss (Kinzigite)	Chiareggio	Margna	2.93	2.91	0.68
ST04	Gneiss (Meta-arkose)		N. de Lebendun	2.64	2.63	0.38
ST08	Gneiss (Meta-arkose)		N. Monte Leone	2.64	2.64	0.00
D2	Gneiss à biotite	La Balmaz	Aig. Rge.	2.68	2.68	0.00
D3	Gneiss à biotite	La Balmaz	Aig. Rge.	2.75	2.75	0.00
D1	Gneiss chloriteux	Evionnaz	Aig. Rge.	2.66	2.66	0.00
D1A	Gneiss chloriteux	Evionnaz	Aig. Rge.	2.68	2.67	0.37
PF2	Gneiss déformé		Adula	2.64	2.64	0.00
PF9	Gneiss déformé		Suretta	2.78	2.78	0.00
JB01	Gneiss fin très déformé	Val Isorno	Monte Leone	2.66	2.60	2.26
JB02	Gneiss grossier	Crevadossola	Monte Leone	2.65	2.63	0.75
PF17	Gneiss mylonitisé		Misox	2.67	2.67	0.00
JB21	Gneiss oeillé	Zernez	Silvretta	2.67	2.65	0.75
PF7	Gneiss oeillé		Tambo	2.72	2.71	0.37

Density in 10^3 kg/m^3

CODE	Type of rock	Location	Geological Unit	Matrix D	Bulk D	Porosity (%)
ST11	Gneiss oeillé	Car. Baltschieder	Massif de l'Aar	2.68	2.67	0.37
PF3	Gneiss oeillé, mylonitisé		Tambo	2.82	2.82	0.00
JB06	Gneiss schisteux	Premia	Verampio	2.71	2.68	1.11
JB18	Gneiss schisteux	Bernina	Err-Bernina	2.75	2.72	1.09
SS1	Gneiss schisteux	Niederalp (Simplon)		2.68	2.66	0.75
JB07	Gneiss sombre à hornblende	San Martino	Bergell	2.81	2.80	0.36
SC2	Gneiss, Ortho-	Germagno(route pour)	Strona-Ceneri	–	–	–
TM23	Gneiss, Ortho-, mylonitique	Ferpècle	N. de la Dent Blanc	2.71	2.67	1.48
ST23	Gneiss, Para-	Entre Elsten et Pont	Z. Stalden sup.	2.75	2.73	0.73
D5	Granite	Miéville (Carrière)	Aig. Rge.	2.65	2.65	0.00
PF12	Granite		Aar	2.62	2.62	0.00
IV11	Granite leucocrate	Carrière Mte.-Orfano	Strona-Ceneri	2.65	2.63	0.75
D4	Granite mylonitisé	Miéville (Carrière)	Aig. Rge.	2.69	2.63	2.23
JB09	Granodiorite	San Martino	Bergell	2.71	2.68	1.11
IV09A	Granulite	Anzola, carrière	Zone d'Ivrée	3.10	3.09	0.32
IV06	Granulite à Plg-Ga-Opx	Riale Arca (rivière)	Zone d'Ivrée	3.37	3.36	0.30
IV45	Granulite à Plg-Ga-Opx	Piana di Forno	Zone d'Ivrée	3.14	3.12	0.64
IV25	Granulite à Qz-Plg-Px	Monte Rubello (sous)	Zone d'Ivrée	2.80	2.79	0.36
IV07	Granulite basique	Riale Arca (rivière)	Zone d'Ivrée	3.34	3.34	0.00
IV03	Granulite basique à amphibo.	Riale Arca (rivère)	Zone d'Ivrée	3.06	3.05	0.33
IV05	Granulite basique à hornblende	Riale Arca (rivière)	Zone d'Ivrée	3.08	3.07	0.32
IV08	Granulite rétrogradée	Riale Arca (rivière)	Zone d'Ivrée	3.30	3.30	0.00
BA06	Grès	Le Châble	Racines, Helv. Malm	2.63	2.63	0.00
CS80	Grès	Barrage de Rossens	Molasse sup. subalp.	2.69	2.43	9.67
CS81	Grès	Rondchâte	Molasse, Jura	2.66	2.62	1.50
FAL1	Grès	Car. de Tatür, FR	Gurnigel,Thanétien	2.67	2.61	2.25
CS67	Grès calcaire	Tavannes	Molasse, USM	2.69	2.56	4.83
CS72	Grès calcaire		Nappe des Dranses	2.70	2.70	0.00
BA04	Grès calcique	Sembr.-Le Châble	Série de Ferret,Lias	2.68	2.68	0.00
CS56	Grès charboneux (flysch)	Klausen-Strasse	Flysch Aar	2.73	2.71	0.73
CS70	Grès du flysch	Rte. des Mosses	Nappe du Niesen	2.69	2.69	0.00
D8	Grès fin	Dorénaz	Aig. Rge.	2.65	2.65	0.00
M1	Grès fin	Challex, Ain, France	Molasse,Tertiaire	2.71	2.48	8.49
M2	Grès fin	CERN, près Genève	Molasse,Tertiaire	2.61	2.50	4.21
MOL6	Grès fin	Cologny, Genève	Molasse,Chattien sup	2.69	2.50	7.06
MOL7	Grès fin	Cologny, Genève	Chat.sup./base Aqui.	2.65	2.53	4.53

Density in 10^3 kg/m^3

CODE	Type of rock	Location	Geological Unit	Matrix D	Bulk D	Porosity (%)
MOL9	Grès fin	G. Motta, Genève	Molasse,Chattien inf	2.67	2.43	8.99
D7	Grès grossier	Dorénaz	Alg. Rge.	2.67	2.67	0.00
TM03	Grès micacé	Chandoline(Sion)	Zone houillère,int.	2.75	2.73	0.73
CS54	Grès rouge	Gausingen	Jura	2.71	2.21	18.45
CS60	Grès rouge	Elm-Strasse	Nappe de Glaris	2.75	2.72	1.09
BA09	Grès schisteux	Champsec	Z.Houillère ext.Carb	2.70	2.69	0.37
TM01	Grès silici-calcique	Rte. mayens Riddes	Zone Sion-Courmayeur	2.70	2.68	0.74
MOL1	Grès très fin	Cologny, Genève	Molasse,Chattien inf	2.64	2.46	6.82
MOL2	Grès très fin	Cologny, Genève	Molasse,Chattien inf	2.68	2.52	5.97
MOL3	Grès très fin	Cologny, Genève	Molasse,Chattien inf	2.72	2.51	7.72
BA02	Gypse	Sembrancher	Helvétique, Trias	2.43	2.11	13.17
TM37	Gypse	Drône, Savièse	Nappe du Wildhorn	2.67	2.10	21.35
CS52	Gypse rubané	Staffelegg	Jura, Trias	2.73	2.21	19.05
IV04	Hornblendite	Riale Arca (rivière)	Zone d'Ivrée	3.32	3.32	0.00
IV34	Kinzigite	Ponte Orchera	Zone d'Ivrée	2.75	2.74	0.36
IV39	Kinzigite	Grampi	Zone d'Ivrée	2.81	2.80	0.36
IV48	Kinzigite	Madonna del Boden	Zone d'Ivrée	2.79	2.78	0.36
IV53	Kinzigite	Grampi (rivière)	Zone d'Ivrée	2.71	2.66	1.85
IV54	Kinzigite	Grampi (rivière)	Zone d'Ivrée	2.86	2.79	2.45
IV27A	Kinzigite mylonitisée,rétrogr.	Loro (sous l'église)	Zone d'Ivrée	2.94	2.84	3.40
IV28	Kinzigite mylonitisée,rétrogr.	Loro	Zone d'Ivrée	2.85	2.75	3.51
IV50	Mafique faciès amph./gra. myl.	Anzola carrière	Zone d'Ivrée	3.10	3.04	1.94
IV51	Mafique faciès amph./gra. myl.	Anzola carrière	Zone d'Ivrée	3.05	3.01	1.31
IV49	Mafique faciès amphib./granul.	Anzola carrière	Zone d'Ivrée	3.12	3.07	1.60
IV19	Mafique mylonitisée, rétrogr.	Chioso (pont,après)	Zone d'Ivrée	2.96	2.95	0.34
IV20	Mafique tectonisée, rétrogr.	Balmuccia (rivière)	Zone d'Ivrée	2.84	2.84	0.00
IV10A	Mafique, f. à amphibolite sup.	Nibbio	Zone d'Ivrée	3.05	3.03	0.66
IV10B	Mafique, f. à amphibolite sup.	Nibbio	Zone d'Ivrée	3.05	3.02	0.98
JB10	Marbre	Malenco,Str.Franscia	Malenco	2.85	2.84	0.35
JB27	Marbre	Ausserferrera	Suretta	2.87	2.84	1.05
PF13	Marbre		Aul	2.70	2.70	0.00
PF4	Marbre		Splügen, mésozoïque	2.70	2.69	0.37
ST21	Marbre		Z. Gornergrat, Trias	2.80	2.80	0.00
TM29	Marbre	La Sarva, Saillon	Nappe de Morcles	2.72	2.71	0.37
JB03	Marbre blanc cristallisé	Crevadossola	Monte Leone	2.87	2.85	0.70
ST20	Marbre dolomitique		Z. Gornergrat, Trias	2.84	2.82	0.70

Density in 10^3 kg/m^3

CODE	Type of rock	Location	Geological Unit	Matrix D	Bulk D	Porosity (%)
ST22	Marbre dolomitique, Trias ?		Z. Gornergrat	2.84	2.84	0.00
PF8	Marbre dolomitisé		Misox	2.86	2.83	1.05
JB04	Marbre gris bleu, rubané	Crevadossola	Monte Leone	2.86	2.85	0.35
IV15	Marbre impur	Civiasco (après)	Strona-Ceneri	2.77	2.77	0.00
IV14	Marbre impur mylonitisé	Civiasco (après)	Strona-Ceneri	2.80	2.79	0.36
TM17	Marbre micacé	Martèmo(Evolène)	Nappe du Tsaté	2.75	2.70	1.82
CS65	Marbre sombre	Col de la Furka	Zone d'Urseren	2.73	2.72	0.37
JB15	Monzonite, peu déformée	Bernina	Err-Bernina	2.73	2.71	0.73
SS2	Mylonite, Blasto-	Simplon village	Simplon	2.71	2.68	1.11
IV35	Paragneiss à biotite et plg.	Strona (rivière)	Zone d'Ivrée	2.79	2.78	0.36
TM13	Pegmatite	Praz-Jean	Nappe de Siviez-M.	2.67	2.67	0.00
IV17	Péridotite	Balmuccia (Carrière)	Zone d'Ivrée	3.31	3.31	0.00
IV18	Péridotite	Balmuccia (Carrière)	Zone d'Ivrée	3.35	3.35	0.00
IV26	Péridotite	Baldissero(Carrière)	Zone d'Ivrée	3.31	3.31	0.00
IV31	Péridotite	Rio Inferno(rivière)	Zone d'Ivrée	3.29	3.29	0.00
JB11	Péridotite	Malenco,Str.Franscia	Malenco	2.71	2.70	0.37
JB13	Péridotite	Malenco,Str.Franscia	Malenco	2.88	2.87	0.35
IV30	Péridotite, Kéliphyte	Rio Inferno(rivière)	Zone d'Ivrée	3.31	3.31	0.00
PF16	Porphyre mylonitisé		Suretta	2.66	2.65	0.38
PF10	Porphyre quartzitique		Suretta	2.70	2.68	0.74
P2	Porphyre, type Lugano	Borgosesia (sort.SW)		2.57	2.51	2.33
PF14	Prasinite		Aul	2.96	2.89	2.36
VB	Prasinite	Val de Bagne	Tsaté	2.98	2.97	0.34
IV24	Pyroxénite	Balmuccia (Guaifola)	Zone d'Ivrée	3.36	3.32	1.19
TM06	Quartzite	Rte. d'Annivers,Fang	Nappe de Siviez-M.	2.66	2.66	0.00
JB31	Quartzite conglomératique	Illanz	Permien	2.76	2.73	1.09
TM05	Quartzite conglomératique	Combaneire(Dailley)	Nappe de Siviez-M.	2.69	2.66	1.12
BA12	Quartzite massif	Lourtier	N. Pontis,Trias	2.66	2.65	0.38
BA10	Quartzite schisteux	Champsec-Lourtier	Z. Houillère int.Per	2.65	2.65	0.00
BA11	Quartzite schisteux	Champsec-Lourtier	Z. Houillère int.Per	2.64	2.64	0.00
BA13	Quartzite schisteux	Lourtier	N. Siviez-Mischabel	2.70	2.69	0.37
JB28	Quartzite, blanche	Avers Crôt	Suretta	2.65	2.64	0.38
TM08	Quartzschist	Bevernec (Mase)	Nappe de Siviez-M.	2.79	2.76	1.08
CS75	Radiolarite	Jaunpass S	Nappe de la Simme	2.68	2.68	0.00
IV38	Roche calcosilicatée	Route de Forno(p113)	Zone d'Ivrée	3.22	3.22	0.00
BA03	Schiste (Argil., mét.)	Sembrancher	Helvétique, Aalénien	–	–	–

Density in 10^3 kg/m^3

CODE	Type of rock	Location	Geological Unit	Matrix D	Bulk D	Porosity (%)
ST10	Schiste noir	Car. Lungwurm	Lias	2.76	2.76	0.00
TM20	Schiste vert, Greenschist	Les Haudères	Nappe du Tsaté	2.93	2.92	0.34
BA15	Schiste, Mica-	Lourtier-Fionnay	Socle Siviez-Misch.	2.77	2.74	1.08
TM10	Schiste, Mica-, à albite	Praz-Jean	Nappe de Siviez-M.	2.79	2.77	0.72
JB12	Serpentinite	Rte. de Franscia	Malenco	2.70	2.70	0.00
JB22	Serpentinite	Lac de Sils	Platta	2.67	2.66	0.37
ST15	Serpentinite		Z. Zermatt-Saas	2.80	2.80	0.00
ST16	Serpentinite		Z. Zermatt-Saas	2.78	2.78	0.00
TM22	Serpentinite		Nappe du Tsaté	2.71	2.69	0.74
CS57	Siltite à ciment calc.(flysch)	Klausen-Strasse	Parautochtone Aar	2.71	2.70	0.37
IV43	Stronalite	Piana di Forno	Zone d'Ivrée	3.01	2.97	1.33
IV44	Stronalite	Piana di Forno	Zone d'Ivrée	3.35	3.33	0.60
IV52	Stronalite	Piana di Forno	Zone d'Ivrée	3.05	3.04	0.33
IV32	Stronalite mylonitisée	Carrière d'Anzola	Zone d'Ivrée	3.03	3.03	0.00
IV33	Stronalite mylonitisée	Carrière d'Anzola	Zone d'Ivrée	2.96	2.91	1.69
IV46	Stronalite mylonitisée	Forno (village,sud)	Zone d'Ivrée	2.97	2.97	0.00
SL2	Syénite de Biella	Balma (Carrière)		2.73	2.72	0.37
JB08	Tonalite	San Martino	Bergell	2.71	2.68	1.11

APPENDIX III

Rock type and magnetic properties

Magnetic susceptibility and remenant magnetization

CODE	TYPE OF ROCK	LOCATION	GEOLOGICAL UNIT	Sus. Mag. [SI]	SUS_LF	SUS_HF	Rem. Mag. [A/m]
BA16	Amphibolite	Lourtier-Fionnay	Socle Siviez-Misch.	1.41E-03	1.41E-03	1.41E-03	–
IV36	Amphibolite	Strona (après)	Zone d'Ivrée	8.27E-04	8.31E-04	8.22E-04	–
IV37	Amphibolite	Route de Forno(p113)	Zone d'Ivrée	9.64E-04	9.67E-04	9.60E-04	–
IV40A	Amphibolite	Rosarolo, rivière	Zone d'Ivrée	7.61E-02	7.61E-02	7.61E-02	–
IV40B	Amphibolite	Rosarolo, rivière	Zone d'Ivrée	6.07E-02	6.07E-02	6.07E-02	–
JB20	Amphibolite	Zernez	Silvretta, socle	6.06E-03	6.07E-03	6.05E-03	–
ST07	Amphibolite		N. de Berisal	7.57E-04	7.63E-04	7.51E-04	2.27E-03
ST13	Amphibolite	Stèle A. Zurbriggen	Z. du Portjengrat	5.97E-04	5.98E-04	5.95E-04	1.87E-02
ST14	Amphibolite à grenat	Glacier Matmark	Z. Zermatt-Saas	2.98E-03	2.99E-03	2.98E-03	8.19E-03
IV29	Amphibolite mylonit., rétrogr.	Loro	Zone d'Ivrée	6.60E-04	6.63E-04	6.56E-04	–
IV41	Amphibolite mylonitisée	Rosarolo rivière	Zone d'Ivrée	6.25E-03	6.26E-03	6.24E-03	–
IV55	Amphibolite mylonitisée	Grampi	Zone d'Ivrée	1.51E-02	1.51E-02	1.50E-02	–
IV42	Amphibolite tecton., rétrogr.	Rosarolo rivière	Zone d'Ivrée	5.83E-04	5.84E-04	5.82E-04	–
ST17	Amphibolite, rétrogradée		Z. Zermatt-Saas	1.04E-03	1.04E-03	1.04E-03	1.82E-03
SL1	Andésite	Bachetto Sessera		5.12E-04	5.21E-04	5.03E-04	–
IV12	Aplite	Civiasco (après)	Strona-Ceneri	2.93E-04	2.95E-04	2.90E-04	–
IV13	Aplite légèrement foliée	Civiasco (après)	Strona-Ceneri	1.26E-04	1.27E-04	1.24E-04	–
TM02	Brèche calcaro-dolomitique	Gravelone(Sion)	Sion-Courmayeur	2.93E-05	2.84E-05	3.02E-05	–
CS73	Brèche,-Micro, dolomitique	Manneberg	Nappe de la Brèche	-9.21E-05	-1.82E-04	-2.14E-06	–
CS79	Brèche,-Micro, dolomitique	Charmey	Préalp. médianes pla	7.06E-05	7.06E-05	7.05E-05	–
JB24	Brèche, Micro-	Thusis	Tomül flysch	1.64E-04	1.62E-04	1.66E-04	–
BA07	Calcaire	Le Châble	Sion-Courmayeur	9.40E-06	9.95E-06	8.85E-06	–
CS69	Calcaire	Carrière Audonces	Nappe de la Simme	2.14E-04	2.31E-04	1.97E-04	–
CS86	Calcaire	Rondchâte	Jura, Portlandien	-8.23E-06	-8.68E-06	-7.77E-06	–
JB23	Calcaire	Surs	Platta	1.32E-04	1.32E-04	1.31E-04	–
JB33	Calcaire	Vals, Piedm Strasse	Ultrahélvetique	1.00E-04	1.00E-04	1.00E-04	–
PF5	Calcaire		Tschepp, jurassique	–	–	–	–
ST09	Calcaire	Anc. rte du Simplon	Sion-Courmayeur	9.64E-05	9.64E-05	9.64E-05	–
TH1	Calcaire	Thônex, forage	Aptien-Barr. (urg.)	–	–	–	–
TH2	Calcaire	Thônex, forage	Aptien-Barr. (urg.)	–	–	–	–
TH3	Calcaire	Thônex, forage	Aptien-Barr. (urg.)	–	–	–	–
TH4	Calcaire	Thônex, forage	Aptien-Barr. (urg.)	–	–	–	–
TH5	Calcaire	Thônex, forage	Aptien-Barr. (urg.)	–	–	–	–
TH6	Calcaire	Thônex, forage	Aptien-Barr. (urg.)	–	–	–	–

Magnetic susceptibility and remenant magnetization

CODE	TYPE OF ROCK	LOCATION	GEOLOGICAL UNIT	Sus. Mag. [SI]	SUS_LF	SUS_HF	Rem. Mag. [A/m]
TH7	Calcaire	Thônex, forage	Portlandien	_	_	_	_
TH8	Calcaire	Thônex, forage	Portlandien	_	_	_	_
JB17	Calcaire à lumachelles	Bernina	Err-Bernina, Trias	1.94E-05	2.07E-05	1.81E-05	_
TM27	Calcaire bioclastique	Magnot	Nappe du Wildhorn	1.61E-06	1.93E-06	1.28E-06	_
CS53	Calcaire biodétritique	Asp	Jura, Trias	-5.23E-05	-4.57E-06	-5.88E-06	_
CS82	Calcaire calcarénite	Rondchâte	Jura, Callovien	3.13E-06	3.05E-06	3.21E-06	_
BA01	Calcaire dolomitique	Sembrancher	Helvétique, Trias	8.61E-06	9.17E-06	8.04E-06	_
CS71	Calcaire dolomitique	Gérignoz	Préalp. médianes rig	2.89E-05	3.25E-05	5.23E-05	_
JB19	Calcaire fin	Livigno	Scarl	1.16E-04	1.23E-04	1.09E-04	_
CS77	Calcaire glumeleux	Le Brésil, Jaun	Préalp. médianes pla	7.72E-06	3.13E-06	1.23E-05	_
CS66	Calcaire Marneux	Pontenet	Molasse, USM	2.00E-06	2.33E-06	1.67E-06	_
CAL01	Calcaire massif	CERN, près Genève	Barrémien	-7.60E-06	_	_	1.00E-05
CS61	Calcaire massif biodétritique	Nestal	Nappe de Glaris	-2.46E-05	-2.22E-05	-2.69E-05	_
CS62	Calcaire micritique	Obersee-Strasse	Nappe de Säntis	3.20E-06	5.08E-06	1.31E-06	_
CS78	Calcaire micritique	Le Brésil, Jaun	Préalp. médianes pla	-3.38E-06	-2.80E-06	-3.95E-06	_
CS85	Calcaire micritique	Rondchâte	Jura, Kimmeridgien	-9.52E-06	-9.27E-06	-9.76E-06	_
TM33	Calcaire micritique	Prabé	Nappe du Wildhorn	2.29E-05	2.46E-05	2.12E-05	_
CS55	Calcaire micritique schisteux	Tierfeld	Parautochtone Aar	-7.41E-06	-6.03E-06	-8.51E-06	_
CS50	Calcaire oolithique	Staffelegg	Jura, Dogger	-7.88E-05	-1.55E-04	-2.59E-05	_
CS83	Calcaire oolitique	Rondchâte	Jura, Oxfordien	-1.04E-05	-1.30E-05	-7.82E-06	_
CS76	Calcaire pélagique	Jaunpass N	Préalp. médianes rig	4.69E-05	4.62E-05	4.75E-05	_
CS74	Calcaire pélagique à silex	Ried /Jaunpass	Nappe de la Simme	3.05E-05	3.08E-05	3.01E-05	_
CS84	Calcaire récifal	Rondchâte	Jura, Oxfordien	6.37E-06	6.90E-06	5.84E-06	_
CS63	Calcaire siliceux	Obersee-Strasse	Nappe de Säntis	2.46E-05	2.79E-05	2.13E-05	_
TM26	Calcaire siliceux bioclastique	L'Ardève, Leytron	Nappe de Morcles	9.77E-06	1.15E-06	8.03E-06	_
CS58	Calcaire sombre siliceux	Klausen-Strasse	Nappe d'Axen	2.42E-04	2.49E-04	2.35E-04	_
CS68	Calcaire spathique	Carrière Chiètres	Parautocht. Aig.Rge.	1.80E-04	1.81E-04	1.78E-04	_
BA05	Calcaire spathique gréseux	Sembr.-Le Châble	Helvétique, Lias	8.78E-06	9.08E-06	8.48E-06	_
PF6	Calcaire, jurassique		Glaris, jurassique	_	_	_	_
JB29	Calcschiste	Avers Cresta	Suretta	3.63E-04	3.57E-04	3.68E-04	_
ST03	Calcschiste quarztzitique		N. de Lebendun	1.81E-04	1.78E-04	1.84E-04	7.01E-03
D6	Conglomérat	Dorénaz	Aig. Rge. Stéph.Inf.	7.42E-04	_	_	3.45E-02
JB25	Conglomérat	Sufers	Tomül flysch	2.02E-03	1.99E-03	2.05E-03	_
JB35	Conglomérat	Oberalppass	Urseren zone	1.27E-04	1.25E-04	1.28E-04	_

Magnetic susceptibility and remenant magnetization

CODE	TYPE OF ROCK	LOCATION	GEOLOGICAL UNIT	Sus. Mag. [SI]	SUS_LF	SUS_HF	Rem. Mag. [A/m]
CS64	Conglomérat (molasse)	Niederurnen	Molasse subalpine	1.57E-05	1.84E-05	1.29E-05	–
JB32	Conglomérat calcaire	Vals-Strasse	Piz Terri-Lunschania	3.54E-05	3.55E-05	3.53E-05	–
CS59	Conglomérat grossier	Route d'Elm	Nappe de Glaris	5.64E-05	5.72E-04	5.55E-04	–
SL3	Diorite	Vico (Carrière)		4.33E-02	4.33E-02	4.33E-02	–
SL4	Diorite	Traversella		–	–	–	–
IV16A	Diorite à biotite	Varallo, sortie W		7.30E-04	7.30E-04	7.30E-04	–
IV16B	Diorite à biotite	Varallo, sortie W		2.48E-03	2.48E-03	2.48E-03	–
JB16	Dolomie	Bernina	Err-Bernina,Hptdol.T	-7.00E-05	-1.34E-04	-6.01E-06	–
PF15	Dolomie		Tschepp	–	–	–	–
ST12	Dolomie		Autochtone M.A.,Tr.	4.02E-05	3.67E-05	4.36E-05	1.70E-06
TM25	Dolomie	Drône, Savièse	Autochtone M.A., Tri	2.21E-05	2.28E-05	2.13E-05	–
JB30	Eclogite	Avers Cresta	Suretta	6.55E-04	6.52E-04	6.57E-04	–
IV23	Gabbro	Balmuccia (Gualfola)	Zone d'Ivrée	9.19E-04	9.21E-04	9.17E-04	–
IV22	Gabbro clair	Balmuccia (Gualfola)	Zone d'Ivrée	3.38E-04	3.40E-04	3.36E-04	–
IV21	Gabbro fracturé, rétrogradé	Balmuccia (rivière)	Zone d'Ivrée	8.35E-04	8.36E-04	8.33E-04	–
IV02	Gabbro rétrogradé	Loro (église)	Zone d'Ivrée	7.38E-04	7.40E-04	7.36E-04	–
TM21	Gabbro, méta-	La Forclaz	Nappe du Tsaté	6.26E-04	6.23E-04	6.28E-04	–
ST18	Gabbro, Méta- (Isotrope)		Z. Zermatt-Saas	1.86E-04	1.85E-04	1.87E-04	1.08E-02
ST19	Gabbro, Méta-, éclogitique		Z. Zermatt-Saas	6.40E-04	6.44E-04	6.35E-04	3.40E-04
IV01	Gabbro, Rétrogradé	Loro (église)	Zone d'Ivrée	7.81E-04	7.83E-04	7.79E-04	–
BA14	Gneiss	Lourtier		3.07E-04	3.08E-04	3.06E-04	–
JB26	Gneiss	Ausserferrera	Suretta (socle)	2.04E-04	2.03E-04	2.05E-04	–
JB34	Gneiss	Sedrun	Tavetsch	1.83E-04	1.84E-04	1.82E-04	–
SC1	Gneiss	Mergozzo (après)	Strona-Ceneri	–	–	–	–
JB36	Gneiss (Granite)	Gottardpass	Gottard	9.99E-05	9.87E-05	1.01E-04	–
JB14	Gneiss (Kinzigite)	Chiareggio	Margna	7.25E-04	7.31E-04	7.31E-04	–
ST04	Gneiss (Meta-arkose)		N. de Lebendun	6.46E-04	6.46E-04	6.47E-04	7.10E-03
ST08	Gneiss (Meta-arkose)		N. Monte Leone	9.15E-05	9.24E-05	9.06E-05	3.01E-03
D2	Gneiss à biotite	La Balmaz	Alg. Rge.	2.74E-04	–	–	2.80E-04
D3	Gneiss à biotite	La Balmaz	Alg. Rge.	3.44E-04	3.49E-04	3.38E-04	7.40E-04
D1	Gneiss chloriteux	Evionnaz	Alg. Rge.	2.71E-04	–	–	8.00E-05
D1A	Gneiss chloriteux	Evionnaz	Alg. Rge.	1.34E-04	1.38E-04	1.31E-04	6.00E-05
PF2	Gneiss déformé		Adula	–	–	–	–
PF9	Gneiss déformé		Suretta	–	–	–	–

Magnetic susceptibility and remenant magnetization

CODE	TYPE OF ROCK	LOCATION	GEOLOGICAL UNIT	Sus. Mag. [SI]	SUS_LF	SUS_HF	Rem. Mag. [A/m]
JB01	Gneiss fin très déformé	Val Isorno	Monte Leone	1.40E-04	1.45E-04	1.35E-04	–
JB02	Gneiss grossier	Crevadossola	Monte Leone	3.13E-03	3.14E-03	3.12E-03	–
PF17	Gneiss mylonitisé		Misox	–	–	–	–
JB21	Gneiss oeillé	Zernez	*Silvretta*	6.27E-05	6.30E-05	6.23E-05	–
PF7	Gneiss oeillé		Tambo	–	–	–	–
ST11	Gneiss oeillé	Car. Baltschieder	Massif de l'Aar	2.52E-04	2.56E-04	2.48E-04	1.63E-02
PF3	Gneiss oeillé, mylonitisé		Tambo	–	–	–	–
JB06	Gneiss schisteux	Premia	Verampio	4.67E-04	4.65E-04	4.69E-04	–
JB18	*Gneiss schisteux*	*Bernina*	*Err-Bernina*	3.11E-04	3.16E-04	3.05E-04	–
SS1	Gneiss schisteux	Niederalp (Simplon)		–	–	–	–
JB07	Gneiss sombre à hornblende	San Martino	Bergell	1.12E-02	1.12E-02	1.12E-02	–
SC2	Gneiss, Ortho-	Germagno(route pour)	Strona-Ceneri	–	–	–	–
TM23	Gneiss, Ortho-, mylonitique	Ferpècle	N. de la Dent Blanc	6.57E-04	6.58E-04	6.56E-04	–
ST23	*Gneiss, Para-*	*Entre Eisten et Pont*	Z. Stalden sup.	–	–	–	6.00E-05
D5	Granite	Miéville (Carrière)	Aig. Rge.	1.06E-04	1.15E-04	9.73E-05	9.00E-05
PF12	Granite		Aar	5.30E-05	5.30E-05	5.30E-05	–
IV11	Granite leucocrate	Carrière Mte.-Orfano	Strona-Ceneri	–	–	–	–
D4	Granite mylonitisé	Miéville (Carrière)	Aig. Rge.	4.71E-04	4.76E-04	4.65E-04	1.98E-03
JB09	*Granodiorite*	San Martino	Bergell	3.90E-04	3.88E-04	3.91E-04	–
IV09A	Granulite	Anzola, carrière	Zone d'Ivrée	–	–	–	–
IV06	Granulite à Plg-Ga-Opx	Riale Arca (rivière)	Zone d'Ivrée	1.20E-03	1.20E-03	1.20E-03	–
IV45	Granulite à Plg-Ga-Opx	Plana di Forno	Zone d'Ivrée	7.93E-04	7.94E-04	7.92E-04	–
IV25	Granulite à Qz-Plg-Px	Monte Rubello (sous)	Zone d'Ivrée	1.32E-02	1.32E-02	1.32E-02	–
IV07	Granulite basique	Riale Arca (rivière)	Zone d'Ivrée	5.38E-02	5.38E-02	5.37E-02	–
IV03	Granulite basique à amphibo.	Riale Arca (rivère)	Zone d'Ivrée	1.82E-03	1.82E-03	1.82E-03	–
IV05	Granulite basique à hornblende	Riale Arca (rivière)	Zone d'Ivrée	2.84E-02	2.84E-02	2.84E-02	–
IV08	Granulite rétrogradée	Riale Arca (rivière)	Zone d'Ivrée	–	–	–	–
BA06	Grès	Le Châble	Racines, Helv. Malm	–	–	–	–
CS80	Grès	Barrage de Rossens	Molasse sup. subalp.	6.15E-04	6.15E-04	6.15E-04	–
CS81	Grès	Rondchâte	Molasse, Jura	2.67E-05	2.78E-05	2.55E-05	–
FAL1	Grès	Car. de Tatür, FR	Gurnigel,Thanétien	–	–	–	–
CS67	Grès calcaire	Tavannes	*Molasse, USM*	8.64E-05	8.57E-05	8.70E-05	–
CS72	Grès calcaire		Nappe des Dranses	6.37E-05	8.34E-05	5.11E-05	–
BA04	Grès calcique	Sembr.-Le Châble	Série de Ferret,Lias	2.06E-06	2.09E-05	2.02E-05	–

Magnetic susceptibility and remenant magnetization

CODE	TYPE OF ROCK	LOCATION	GEOLOGICAL UNIT	Sus. Mag. [SI]	SUS_LF	SUS_HF	Rem. Mag. [A/m]
CS56	Grès charboneux (flysch)	Klausen-Strasse	Flysch Aar	2.93E-04	2.95E-04	2.90E-04	–
CS70	Grès du flysch	Rte. des Mosses	Nappe du Niesen	6.26E-05	6.10E-05	6.42E-05	–
D8	Grès fin	Dorénaz	Alg. Rge.	5.67E-05	5.86E-05	5.48E-05	1.19E-02
M1	Grès fin	Challex, Ain, France	Molasse,Tertiaire	4.11E-04	4.14E-04	4.08E-04	3.60E-03
M2	Grès fin	CERN, près Genève	Molasse,Tertiaire	1.42E-03	1.43E-03	1.41E-03	6.26E-04
MOL6	Grès fin	Cologny, Genève	Molasse,Chattien sup	1.15E-04	1.16E-04	1.14E-04	–
MOL7	Grès fin	Cologny, Genève	Chat.sup./base Aqui.	1.10E-04	1.10E-04	1.10E-04	–
MOL9	Grès fin	G. Motta, Genève	Molasse,Chattien inf	2.68E-04	2.71E-04	2.64E-04	–
D7	Grès grossier	Dorénaz	Alg. Rge.	2.69E-04	–	–	8.99E-03
TM03	Grès micacé	Chandoline(Sion)	Zone houillère,int.	1.22E-04	–	–	–
CS54	Grès rouge	Gausingen	Jura	6.11E-04	6.08E-04	6.14E-04	–
CS60	Grès rouge	Elm-Strasse	Nappe de Glaris	9.10E-05	9.38E-05	8.82E-05	–
BA09	Grès schisteux	Champsec	Z.Houillère ext.Carb	2.39E-04	2.39E-04	2.39E-04	–
TM01	Grès silici-calcique	Rte. mayens Riddes	Zone Sion-Courmayeur	5.46E-05	5.39E-05	5.53E-05	–
MOL1	Grès très fin	Cologny, Genève	Molasse,Chattien inf	4.74E-04	4.75E-04	4.72E-04	–
MOL2	Grès très fin	Cologny, Genève	Molasse,Chattien inf	6.26E-04	6.37E-04	6.15E-04	–
MOL3	Grès très fin	Cologny, Genève	Molasse,Chattien inf	4.65E-04	4.65E-04	4.65E-04	–
BA02	Gypse	Sembrancher	Helvétique, Trias	–	–	–	–
TM37	Gypse	Drône, Savièse	Nappe du Wildhorn	-7.94E-06	-8.33E-06	-7.54E-06	–
CS52	Gypse rubané	Staffelegg	Jura, Trias	5.22E-06	7.18E-06	3.25E-06	–
IV04	Hornblendite	Riale Arca (rivière)	Zone d'Ivrée	–	–	–	–
IV34	Kinzigite	Ponte Orchera	Zone d'Ivrée	3.51E-04	3.52E-04	3.49E-04	–
IV39	Kinzigite	Grampi	Zone d'Ivrée	2.06E-04	2.06E-04	2.05E-04	–
IV48	Kinzigite	Madonna del Boden	Zone d'Ivrée	3.26E-04	3.28E-04	3.23E-04	–
IV53	Kinzigite	Grampi (rivière)	Zone d'Ivrée	–	–	–	–
IV54	Kinzigite	Grampi (rivière)	Zone d'Ivrée	4.21E-04	4.21E-04	4.21E-04	–
IV27A	Kinzigite mylonitisée,rétrogr.	Loro (sous l'église)	Zone d'Ivrée	4.13E-04	4.19E-04	4.07E-04	–
IV28	Kinzigite mylonitisée,rétrogr.	Loro	Zone d'Ivrée	4.11E-04	4.14E-04	4.07E-04	–
IV50	Mafique faciès amph./gra. myl.	Anzola carrière	Zone d'Ivrée	9.02E-04	9.02E-04	9.02E-04	–
IV51	Mafique faciès amph./gra. myl.	Anzola carrière	Zone d'Ivrée	–	–	–	–
IV49	Mafique faciès amphib./granul.	Anzola carrière	Zone d'Ivrée	8.74E-04	8.75E-04	8.72E-04	–
IV19	Mafique mylonitisée, rétrogr.	Chioso (pont,après)	Zone d'Ivrée	4.20E-04	4.21E-04	4.19E-04	–
IV20	Mafique tectonisée, rétrogr.	Balmuccia (rivière)	Zone d'Ivrée	7.74E-04	7.75E-04	7.73E-04	–
IV10A	Mafique, f. à amphibolite sup.	Nibbio	Zone d'Ivrée	1.05E-02	–	–	–

Magnetic susceptibility and remenant magnetization

CODE	TYPE OF ROCK	LOCATION	GEOLOGICAL UNIT	Sus. Mag. [SI]	SUS_LF	SUS_HF	Rem. Mag. [A/m]
IV10B	*Mafique, f. à amphibolite sup.*	Nibbio	Zone d'Ivrée	7.56E-03	–	–	–
JB10	Marbre	Malenco,Str.Franscia	Malenco	2.93E-06	2.76E-06	3.10E-06	–
JB27	*Marbre*	Ausserferrera	Suretta	3.17E-04	2.91E-04	3.42E-04	–
PF13	Marbre		Aul	–	–	–	–
PF4	*Marbre*		Splügen, mésozoïque	–	–	–	–
ST21	Marbre		Z. Gornergrat, Trias	–	–	–	1.10E-04
TM29	*Marbre*	La Sarva, Saillon	Nappe de Morcles	4.66E-06	4.31E-06	5.00E-06	–
JB03	Marbre blanc cristallisé	Crevadossola	Monte Leone	-3.23E-06	-4.54E-06	-1.92E-06	–
ST20	Marbre dolomitique		Z. Gornergrat, Trias	-4.37E-06	-3.49E-06	-5.24E-06	4.40E-04
ST22	Marbre dolomitique, Trias ?		Z. Gornergrat	3.61E-05	3.70E-05	3.52E-05	6.00E-05
PF8	*Marbre dolomitisé*		Misox	–	–	–	–
JB04	Marbre gris bleu, rubané	Crevadossola	Monte Leone	3.00E-05	–	–	–
IV15	Marbre impur	Civiasco (après)	Strona-Ceneri	6.41E-05	6.49E-05	6.33E-05	–
IV14	Marbre impur mylonitisé	Civiasco (après)	Strona-Ceneri	–	–	–	–
TM17	Marbre micacé	Martémo(Evolène)	Nappe du Tsaté	2.86E-05	2.95E-05	2.76E-05	–
CS65	Marbre sombre	Col de la Furka	Zone d'Urseren	1.16E-05	7.69E-05	1.56E-05	–
JB15	Monzonite, peu déformée	Bernina	Err-Bernina	1.72E-04	1.71E-04	1.73E-04	–
SS2	Mylonite, Blasto-	Simplon village	Simplon	–	–	–	–
IV35	Paragneiss à biotite et plg.	Strona (rivière)	Zone d'Ivrée	–	–	–	–
TM13	Pegmatite	Praz-Jean	Nappe de Siviez-M.	8.51E-05	8.48E-05	8.53E-05	–
IV17	Péridotite	Balmuccia (Carrière)	Zone d'Ivrée	1.22E-03	1.23E-03	1.21E-03	–
IV18	Péridotite	Balmuccia (Carrière)	Zone d'Ivrée	4.86E-03	4.86E-03	4.86E-03	–
IV26	Péridotite	Baldissero(Carrière)	Zone d'Ivrée	1.66E-03	1.66E-03	1.66E-03	–
IV31	Péridotite	Rio Inferno(rivière)	Zone d'Ivrée	1.29E-03	1.29E-03	1.28E-03	–
JB11	Péridotite	Malenco,Str.Franscia	Malenco	3.77E-02	3.77E-02	3.77E-02	–
JB13	Péridotite	Malenco,Str.Franscia	Malenco	2.82E-02	2.82E-02	2.81E-02	–
IV30	Péridotite, Kéliphyte	Rio Inferno(rivière)	Zone d'Ivrée	8.36E-04	8.38E-04	8.34E-04	–
PF16	Porphyre mylonitisé		Suretta	–	–	–	–
PF10	Porphyre quartzitique		Suretta	–	–	–	–
P2	Porphyre, type Lugano	Borgosesia (sort.SW)		1.47E-03	1.51E-03	1.42E-03	–
PF14	Prasinite		Aul	–	–	–	–
VB	Prasinite	Val de Bagne	Tsaté	–	–	–	–
IV24	Pyroxénite	Balmuccia (Guaifola)	Zone d'Ivrée	4.36E-03	4.36E-03	4.36E-03	–
TM06	Quartzite	Rte. d'Annivers,Fang	Nappe de Siviez-M.	-2.33E-06	-1.72E-06	-2.93E-06	–

Magnetic susceptibility and remenant magnetization

CODE	TYPE OF ROCK	LOCATION	GEOLOGICAL UNIT	Sus. Mag. [SI]	SUS_LF	SUS_HF	Rem. Mag. [A/m]
JB31	Quartzite conglomératique	Illanz	Permien	1.31E-04	1.28E-04	1.33E-04	_
TM05	Quartzite conglomératique	Combanelre(Dailley)	Nappe de Siviez-M.	1.96E-05	2.16E-05	1.76E-05	_
BA12	Quartzite massif	Lourtier	N. Pontis,Trias	_	_	_	_
BA10	Quartzite schisteux	Champsec-Lourtier	Z. Houillère Int.Per	_	_	_	_
BA11	Quartzite schisteux	Champsec-Lourtier	Z. Houillère Int.Per	4.32E-06	4.73E-06	3.90E-06	_
BA13	Quartzite schisteux	Lourtier	N. Siviez-Mischabel	1.83E-03	1.83E-03	1.83E-03	_
JB28	Quartzite, blanche	Avers Crôt	Suretta	3.50E-05	_	_	_
TM08	Quartzschist	Bevernec (Mase)	Nappe de Siviez-M.	2.09E-04	2.07E-04	2.11E-04	_
CS75	Radiolarite	Jaunpass S	Nappe de la Simme	8.30E-05	8.41E-05	8.18E-05	_
IV38	Roche calcosilicatée	Route de Forno(p113)	Zone d'Ivrée	7.12E-04	7.16E-04	7.07E-04	_
BA03	Schiste (Argil., mét.)	Sembrancher	Helvétique, Aalénien	_	_	_	_
ST10	Schiste noir	Car. Lungwurm	Lias	8.41E-04	8.54E-04	8.28E-04	3.58E-01
TM20	Schiste vert, Greenschist	Les Haudères	Nappe du Tsaté	5.78E-04	5.81E-04	5.74E-04	_
BA15	Schiste, Mica-	Lourtier-Fionnay	Socle Siviez-Misch.	2.13E-02	2.13E-02	2.13E-02	_
TM10	Schiste, Mica-, à albite	Praz-Jean	Nappe de Siviez-M.	2.95E-04	2.83E-04	3.06E-04	_
JB12	Serpentinite	Rte. de Franscia	Malenco	5.90E-02	5.74E-02	6.05E-02	_
JB22	Serpentinite	Lac de Sils	Platta	5.75E-03	5.70E-03	5.80E-03	_
ST15	Serpentinite		Z. Zermatt-Saas	_	_	_	6.21E-01
ST16	Serpentinite		Z. Zermatt-Saas	_	_	_	3.64E+00
TM22	Serpentinite		Nappe du Tsaté	6.84E-02	6.84E-02	6.84E-02	_
CS57	Siltite à ciment calc.(flysch)	Klausen-Strasse	Parautochtone Aar	4.44E-04	4.44E-04	4.43E-04	_
IV43	Stronalite	Piana di Forno	Zone d'Ivrée	_	_	_	_
IV44	Stronalite	Piana di Forno	Zone d'Ivrée	7.55E-04	7.56E-04	7.54E-04	_
IV52	Stronalite	Piana di Forno	Zone d'Ivrée	_	_	_	_
IV32	Stronalite mylonitisée	Carrière d'Anzola	Zone d'Ivrée	5.74E-04	5.75E-04	5.73E-04	_
IV33	Stronalite mylonitisée	Carrière d'Anzola	Zone d'Ivrée	4.61E-04	4.62E-04	4.60E-04	_
IV46	Stronalite mylonitisée	Forno (village,sud)	Zone d'Ivrée	_	_	_	_
SL2	Syénite de Biella	Balma (Carrière)		4.15E-02	4.15E-02	4.15E-02	_
JB08	Tonalite	San Martino	Bergell	2.38E-04	2.37E-04	2.38E-04	_

APPENDIX IV

Rock type and P-wave velocities

P-wave velocity V_1 in km/s

CODE	Type of rock	Location	20Mpa	40Mpa	60Mpa	80Mpa	100Mpa	140MPa	200MPa	300MPa	400MPa
BA16	Amphibolite	Lourtier-Fionnay	5.11	5.45	5.67	5.83	5.95	6.09	6.24	6.35	6.40
IV36	Amphibolite	Strona (après)	5.45	5.62	5.73	5.87	5.97	6.04	6.18	6.27	6.33
IV37	Amphibolite	Route de Forno(p113)	4.63	5.31	5.59	5.88	6.06	6.32	6.58	6.71	6.85
IV40A	Amphibolite	Rosarolo, rivière	5.49	5.68	5.83	5.92	6.02	6.16	6.24	6.36	6.41
IV40B	Amphibolite	Rosarolo, rivière	5.83	–	–	–	6.06	–	6.21	6.30	6.34
JB20	Amphibolite	Zernez	5.52	5.76	5.90	6.02	6.08	6.19	6.26	6.34	6.39
ST07	Amphibolite		4.78	5.04	5.23	5.39	5.53	5.70	5.89	6.02	6.09
ST13	Amphibolite	Stèle A. Zurbriggen	3.90	4.37	4.78	5.05	5.29	5.62	5.92	6.18	6.29
ST14	Amphibolite à grenat	Glacier Matmark	5.03	5.50	5.72	5.88	5.98	6.14	6.25	6.38	6.43
IV29	Amphibolite mylonit., rétrogr.	Loro	5.94	6.11	6.21	6.28	6.33	6.41	6.50	6.57	6.61
IV41	Amphibolite mylonitisée	Rosarolo rivière	5.73	5.92	6.08	6.20	6.25	6.36	6.45	6.51	6.56
IV55	Amphibolite mylonitisée	Grampi	5.83	5.95	6.08	6.16	6.22	6.32	6.40	6.49	6.55
IV42	Amphibolite tecton., rétrogr.	Rosarolo rivière	6.34	6.43	6.48	6.51	6.54	6.57	6.61	6.65	6.68
ST17	Amphibolite, rétrogradée		4.08	4.85	5.35	5.69	5.88	6.17	6.39	6.54	6.61
SL1	Andésite	Bachetto Sessera	–	–	–	–	–	–	–	–	5.99
IV12	Aplite	Civiasco (après)	5.27	5.49	5.62	5.72	5.78	5.94	6.07	6.18	6.26
IV13	Aplite légèrement foliée	Civiasco (après)	4.44	4.86	5.15	5.33	5.45	5.62	5.68	5.78	5.82
TM02	Brèche calcaro-dolomitique	Gravelone(Sion)	5.18	5.43	5.58	5.69	5.79	5.96	6.10	6.29	6.37
CS73	Brèche,-Micro, dolomitique	Manneberg	5.71	5.87	5.94	6.01	6.06	6.12	6.16	6.21	6.24
CS79	Brèche,-Micro, dolomitique	Charmey	5.26	5.43	5.57	5.65	5.71	5.82	5.95	6.06	6.14
JB24	Brèche, Micro-	Thusis	4.57	5.03	5.30	5.46	5.58	5.70	5.79	5.86	5.90
BA07	Calcaire	Le Châble	5.75	5.97	6.06	6.15	6.16	6.23	6.27	6.34	6.39
CS69	Calcaire	Carrière Audonces	6.49	6.50	6.50	6.52	6.52	6.54	6.54	6.55	6.57
CS86	Calcaire	Rondchâte	6.23	6.30	6.37	6.39	6.40	6.44	6.44	6.46	6.48
JB23	Calcaire	Surs	5.14	5.46	5.63	5.73	5.80	5.92	5.98	6.05	6.13
JB33	Calcaire	Vals, Pledm Strasse	5.31	5.58	5.72	5.82	5.90	6.03	6.15	6.24	6.28
PF5	Calcaire		6.15	6.20	6.23	6.28	6.31	6.41	6.36	6.48	6.51
ST09	Calcaire	Anc. rte du Simplon	4.00	4.57	5.01	5.22	5.42	5.63	5.83	5.94	5.97
TH1	Calcaire	Thônex, forage	5.89	6.00	6.12	6.18	6.21	6.30	6.33	6.40	6.45
TH2	Calcaire	Thônex, forage	5.18	5.35	5.42	5.49	5.55	5.60	5.65	5.69	5.74
TH3	Calcaire	Thônex, forage	5.66	5.80	5.92	6.01	6.07	6.20	6.31	6.41	6.46
TH4	Calcaire	Thônex, forage	–	–	–	–	–	–	–	–	–
TH5	Calcaire	Thônex, forage	5.64	5.69	5.78	5.90	6.00	6.16	6.30	6.46	6.48
TH6	Calcaire	Thônex, forage	5.12	5.38	5.52	5.68	5.71	5.78	5.83	5.89	5.94
TH7	Calcaire	Thônex, forage	–	–	–	–	–	–	–	–	–
TH8	Calcaire	Thônex, forage	–	–	–	–	–	–	–	–	–

P-wave velocity V_1 in km/s

CODE	Type of rock	Location	20Mpa	40Mpa	60Mpa	80Mpa	100Mpa	140MPa	200MPa	300MPa	400MPa
JB17	Calcaire à lumachelles	Bernina	6.32	6.36	6.38	6.40	6.42	6.44	6.48	6.50	6.51
TM27	Calcaire bioclastique	Magnot	5.64	5.77	5.87	5.91	5.94	6.00	6.05	6.09	6.12
CS53	Calcaire biodétritique	Asp	6.14	6.27	6.33	6.38	6.41	6.44	6.47	6.49	6.52
CS82	Calcaire calcarénite	Rondchâte	4.97	5.20	5.34	5.42	5.49	5.55	5.64	5.73	5.79
BA01	Calcaire dolomitique	Sembrancher	5.25	5.69	6.01	6.25	6.40	6.65	6.83	6.97	7.07
CS71	Calcaire dolomitique	Gérignoz	5.81	5.85	5.89	5.94	5.98	6.02	6.07	6.13	6.16
JB19	Calcaire fin	Livigno	5.97	6.14	6.26	6.35	6.43	6.59	6.67	6.80	6.84
CS77	Calcaire glumeleux	Le Brésil, Jaun	5.51	5.64	5.75	5.80	5.85	5.93	6.01	6.09	6.15
CS66	Calcaire Marneux	Pontenet	5.27	5.35	5.37	5.39	5.42	5.46	5.51	5.57	5.61
CAL01	Calcaire massif	CERN, près Genève	6.49	6.51	6.51	6.51	6.51	6.51	6.52	–	–
CS61	Calcaire massif biodétritique	Nestal	6.44	6.44	6.46	6.46	6.46	6.47	6.47	6.49	6.50
CS62	Calcaire micritique	Obersee-Strasse	6.10	6.12	6.12	6.14	6.15	6.17	6.19	6.22	6.24
CS78	Calcaire micritique	Le Brésil, Jaun	6.43	6.44	6.46	6.46	6.48	6.48	6.50	6.51	6.53
CS85	Calcaire micritique	Rondchâte	6.24	6.26	6.28	6.29	6.31	6.34	6.36	6.39	6.39
TM33	Calcaire micritique	Prabé	5.68	5.74	5.81	5.85	5.89	5.94	5.98	6.04	6.07
CS55	Calcaire micritique schisteux	Tierfeld	6.31	6.36	6.38	6.39	6.41	6.43	6.44	6.46	6.48
CS50	Calcaire oolithique	Staffelegg	5.89	5.97	6.01	6.04	6.05	6.08	6.10	6.16	6.17
CS83	Calcaire oolitique	Rondchâte	4.51	4.62	4.66	4.68	4.69	4.70	4.71	4.74	4.76
CS76	Calcaire pélagique	Jaunpass N	4.73	4.99	5.20	5.34	5.45	5.59	5.69	5.81	5.87
CS74	Calcaire pélagique à silex	Ried /Jaunpass	6.07	6.14	6.19	6.24	6.28	6.33	6.35	6.39	6.40
CS84	Calcaire récifal	Rondchâte	6.22	6.36	6.41	6.46	6.47	6.49	6.51	6.53	6.54
CS63	Calcaire siliceux	Obersee-Strasse	6.23	6.26	6.27	6.29	6.30	6.33	6.37	6.40	6.41
TM26	Calcaire siliceux bioclastique	L'Ardève, Leytron	3.98	4.17	4.34	4.45	4.53	4.70	4.89	5.09	5.21
CS58	Calcaire sombre silíceux	Klausen-Strasse	5.06	5.26	5.38	5.51	5.57	5.68	5.80	5.91	5.98
CS68	Calcaire spathique	Carrière Chiêtres	6.19	6.25	6.29	6.32	6.34	6.36	6.39	6.42	6.44
BA05	Calcaire spathique gréseux	Sembr.-Le Châble	5.14	5.35	5.53	5.66	5.75	5.87	5.97	6.04	6.09
PF6	Calcaire, jurassique		6.23	6.26	6.28	6.31	6.31	6.34	6.34	6.39	6.41
JB29	Calcschiste	Avers Cresta	3.93	4.76	5.02	5.16	5.29	5.43	5.61	5.71	5.78
ST03	Calcschiste quarztzitique		4.17	4.47	4.72	4.85	4.98	5.11	5.32	5.52	5.60
D6	Conglomérat	Dorénaz	5.09	5.40	5.58	5.69	5.76	5.82	5.89	5.96	5.98
JB25	Conglomérat	Sufers	3.98	4.58	4.89	5.17	5.36	5.60	5.79	5.92	5.98
JB35	Conglomérat	Oberalppass	4.13	4.71	5.05	5.28	5.42	5.66	5.83	6.00	6.07
CS64	Conglomérat (molasse)	Niederurnen	5.58	5.72	5.85	5.90	5.94	6.04	6.13	6.23	6.30
JB32	Conglomérat calcaire	Vals-Strasse	5.30	5.56	5.76	5.90	6.01	6.14	6.25	6.33	6.39
CS59	Conglomérat grossier	Route d'Elm	4.60	5.02	5.27	5.45	5.55	5.66	5.77	5.88	5.93
SL3	Diorite	Vico (Carrière)	–	–	–	–	–	–	–	–	6.24

P-wave velocity V_1 in km/s

CODE	Type of rock	Location	20Mpa	40Mpa	60Mpa	80Mpa	100Mpa	140MPa	200MPa	300MPa	400MPa
SL4	Diorite	Traversella	–	–	–	–	–	–	–	–	6.17
IV16A	Diorite à biotite	Varallo, sortie W	5.79	–	–	–	6.34		6.58	6.67	6.70
IV16B	Diorite à biotite	Varallo, sortie W	4.83	5.27	5.58	5.82	5.88	6.12	6.26	6.34	6.41
JB16	Dolomie	Bernina	6.09	6.35	6.56	6.67	6.76	6.87	6.96	7.06	7.10
PF15	Dolomie		–	–	–	–	–	–	–	–	–
ST12	Dolomie		5.91	6.10	6.22	6.30	6.33	6.41	6.50	0.00	0.00
TM25	Dolomie	Drône, Savièse	5.75	5.94	6.07	6.16	6.23	6.37	6.54	6.72	6.79
JB30	Eclogite	Avers Cresta	4.83	5.39	5.70	5.89	6.01	6.22	6.37	6.49	6.54
IV23	Gabbro	Balmuccia (Gualfola)	5.99	6.25	6.49	6.63	6.75	6.91	7.03	7.14	7.22
IV22	Gabbro clair	Balmuccia (Gualfola)	5.91	6.18	6.36	6.50	6.54	6.66	6.74	6.86	6.92
IV21	Gabbro fracturé, rétrogradé	Balmuccia (rivière)	5.65	5.92	6.12	6.27	6.40	6.59	6.71	6.83	6.91
IV02	Gabbro rétrogradé	Loro (église)	5.66	5.97	6.22	6.40	6.50	6.67	6.78	6.91	6.96
TM21	Gabbro, méta-	La Forclaz	5.27	5.54	5.81	6.00	6.18	6.40	6.64	6.86	6.93
ST18	Gabbro, Méta- (Isotrope)		–	–	–	–	–	–	–	–	–
ST19	Gabbro, Méta-, éclogitique		7.18	7.34	7.45	7.56	7.62	7.74	7.80	7.92	7.92
IV01	Gabbro, Rétrogradé	Loro (église)	6.06	6.23	6.34	6.45	6.47	6.57	6.64	6.75	6.82
BA14	Gneiss	Lourtier	–	–	–	–	–	–	–	–	–
JB26	Gneiss	Ausserferrera	4.27	4.92	5.19	5.33	5.41	5.52	5.61	5.68	5.76
JB34	Gneiss	Sedrun	4.54	4.94	5.18	5.34	5.44	5.59	5.73	5.84	5.91
SC1	Gneiss	Mergozzo (après)	–	–	–	–	–	–	–	–	5.84
JB36	Gneiss (Granite)	Gottardpass	4.20	4.82	5.20	5.44	5.60	5.78	5.90	6.01	6.07
JB14	Gneiss (Kinzigite)	Chiareggio	3.71	4.25	4.68	4.99	5.21	5.51	5.80	6.01	6.11
ST04	Gneiss (Meta-arkose)		3.67	4.31	4.68	4.94	5.13	5.35	5.56	5.72	5.79
ST08	Gneiss (Meta-arkose)		4.57	5.09	5.36	5.48	5.57	5.66	5.73	5.79	5.83
D2	Gneiss à biotite	La Balmaz	4.89	5.09	5.25	5.36	5.42	5.60	5.73	5.87	5.94
D3	Gneiss à biotite	La Balmaz	4.76	4.91	5.06	5.22	5.35	5.55	5.73	5.89	6.00
D1	Gneiss chloriteux	Evionnaz	4.99	5.25	5.36	5.48	5.54	5.66	5.79	5.86	5.93
D1A	Gneiss chloriteux	Evionnaz	5.12	5.34	5.48	5.61	5.69	5.81	5.90	5.99	6.03
PF2	Gneiss déformé		3.95	4.60	4.92	5.09	5.25	5.45	5.67	5.76	5.83
PF9	Gneiss déformé		3.74	4.60	5.05	5.26	5.38	5.43	5.53	5.59	5.65
JB01	Gneiss fin très déformé	Val Isorno	4.35	4.70	4.93	5.02	5.12	5.27	5.42	5.56	5.62
JB02	Gneiss grossier	Crevadossola	4.02	4.56	4.90	5.18	5.37	5.61	5.77	5.94	5.99
PF17	Gneiss mylonitisé		4.44	4.73	5.07	5.29	5.43	5.62	5.78	5.88	5.92
JB21	Gneiss oeillé	Zernez	4.25	4.78	5.07	5.24	5.35	5.53	5.66	5.80	5.85
PF7	Gneiss oeillé		4.19	4.73	5.04	5.22	5.39	5.57	5.73	5.87	5.94
ST11	Gneiss oeillé	Car. Baltschieder	4.12	4.68	5.06	5.27	5.48	5.66	5.79	5.97	6.00

P-wave velocity V_1 in km/s

CODE	Type of rock	Location	20Mpa	40Mpa	60Mpa	80Mpa	100Mpa	140MPa	200MPa	300MPa	400MPa
PF3	Gneiss oeillé, mylonitisé		3.77	4.28	4.62	4.84	5.02	5.20	5.43	5.58	5.68
JB06	Gneiss schisteux	Premia	–	–	–	–	–	–	–	–	–
JB18	Gneiss schisteux	Bernina	4.81	5.17	5.37	5.56	5.64	5.79	5.91	5.99	6.04
SS1	Gneiss schisteux	Niederalp (Simplon)	–	–	–	–	–	–	–	–	6.04
JB07	Gneiss sombre à hornblende	San Martino	5.33	5.67	5.85	5.96	6.02	6.11	6.18	6.26	6.34
SC2	Gneiss, Ortho-	Germagno(route pour)	–	–	–	–	–	–	–	–	0.00
TM23	Gneiss, Ortho-, mylonitique	Ferpècle	4.50	4.88	5.13	5.32	5.45	5.61	5.76	5.87	5.93
ST23	Gneiss, Para-	Entre Eisten et Pont	4.04	4.37	4.63	4.80	4.94	5.15	5.37	5.57	5.68
D5	Granite	Miéville (Carrière)	5.26	5.55	5.75	5.84	5.89	5.97	6.04	6.15	6.24
PF12	Granite		4.82	5.32	5.73	5.83	5.96	6.12	6.22	6.30	6.35
IV11	Granite leucocrate	Carrière Mte.-Orfano	4.28	4.69	4.89	5.06	5.17	5.30	5.43	5.49	5.52
D4	Granite mylonitisé	Miéville (Carrière)	4.12	4.82	5.19	5.44	5.54	5.73	5.84	5.95	6.01
JB09	Granodiorite	San Martino	4.09	4.66	5.03	5.27	5.45	5.69	5.91	6.06	6.12
IV09A	Granulite	Anzola, carrière	4.66	5.22	5.58	5.90	6.01	6.38	6.58	6.84	6.98
IV06	Granulite à Plg-Ga-Opx	Riale Arca (rivière)	5.41	5.63	5.76	5.87	6.01	6.10	6.30	6.43	6.52
IV45	Granulite à Plg-Ga-Opx	Piana di Forno	6.20	6.26	6.38	6.45	6.47	6.59	6.70	6.81	6.86
IV25	Granulite à Qz-Plg-Px	Monte Rubello (sous)	5.37	5.58	5.65	5.72	5.80	5.87	5.97	6.07	6.12
IV07	Granulite basique	Riale Arca (rivière)	6.64	6.75	6.83	6.88	6.93	7.09	7.04	7.17	7.22
IV03	Granulite basique à amphibo.	Riale Arca (rivère)	6.14	6.32	6.38	6.44	6.52	6.56	6.62	6.72	6.77
IV05	Granulite basique à hornblende	Riale Arca (rivière)	6.22	6.60	6.78	6.93	7.01	7.11	7.26	7.37	7.46
IV08	Granulite rétrogradée	Riale Arca (rivière)	6.59	6.67	6.74	6.81	6.86	6.92	7.01	7.09	7.13
BA06	Grès	Le Châble	4.18	4.60	4.84	5.04	5.21	5.44	5.62	5.81	5.89
CS80	Grès	Barrage de Rossens	3.15	3.71	4.16	–	–	–	–	–	–
CS81	Grès	Rondchâte	4.82	4.89	4.94	4.99	5.04	5.12	5.24	5.36	5.45
FAL1	Grès	Car. de Tatür, FR	5.48	5.67	5.80	5.88	5.93	6.02	6.09	6.20	6.24
CS67	Grès calcaire	Tavannes	4.35	4.48	4.57	4.64	4.70	4.79	4.90	5.03	5.12
CS72	Grès calcaire		5.37	5.46	5.55	5.63	5.66	5.74	5.81	5.89	5.92
BA04	Grès calcique	Sembr.-Le Châble	4.88	5.29	5.48	5.62	5.71	5.81	5.94	6.01	6.05
CS56	Grès charboneux (flysch)	Klausen-Strasse	5.14	5.37	5.47	5.75	5.64	5.70	5.80	5.86	5.90
CS70	Grès du flysch	Rte. des Mosses	5.88	5.89	5.90	5.92	5.93	5.96	6.00	6.03	6.06
D8	Grès fin	Dorénaz	5.34	5.54	5.67	5.76	5.81	5.87	5.94	5.98	6.03
M1	Grès fin	Challex, Ain, France	0.00	3.41	3.62	3.80	3.93	4.10	4.30	4.51	4.62
M2	Grès fin	CERN, près Genève	3.69	4.15	4.36	4.52	4.62	4.71	4.78	4.87	4.99
MOL6	Grès fin	Cologny, Genève	2.97	3.49	3.84	4.10	4.28	4.49	4.76	5.07	5.20
MOL7	Grès fin	Cologny, Genève	2.94	3.49	3.79	4.06	4.21	4.41	4.68	4.91	5.04
MOL9	Grès fin	G. Motta, Genève	3.02	3.44	3.70	3.94	4.13	4.31	4.60	4.78	4.97

P-wave velocity V_1 in km/s

CODE	Type of rock	Location	20Mpa	40Mpa	60Mpa	80Mpa	100Mpa	140MPa	200MPa	300MPa	400MPa
D7	Grès grossier	Dorénaz	5.32	5.51	5.60	5.68	5.71	5.78	5.85	5.92	5.96
TM03	Grès micacé	Chandoline(Sion)	4.71	5.41	5.55	5.63	5.65	5.70	5.73	5.78	5.81
CS54	Grès rouge	Gausingen	3.22	3.53	3.67	3.73	3.79	3.87	3.94	4.04	4.13
CS60	Grès rouge	Elm-Strasse	4.24	4.63	4.88	5.04	5.13	5.24	5.38	5.49	5.56
BA09	Grès schisteux	Champsec	3.68	4.37	4.69	4.95	5.14	5.38	5.61	5.75	5.84
TM01	Grès silici-calcique	Rte. mayens Riddes	4.59	4.89	5.09	5.24	5.34	5.55	5.73	5.86	5.95
MOL1	Grès très fin	Cologny, Genève	2.91	3.38	3.70	3.94	4.10	4.31	4.52	4.69	4.90
MOL2	Grès très fin	Cologny, Genève	2.98	3.53	3.75	3.91	4.05	4.24	4.45	4.70	4.86
MOL3	Grès très fin	Cologny, Genève	2.84	3.34	3.68	3.90	4.04	4.26	4.53	4.77	4.96
BA02	Gypse	Sembrancher	2.81	3.10	3.32	3.50	3.62	3.84	4.09	4.45	–
TM37	Gypse	Drône, Savièse	–	–	–	–	–	3.43	3.80	4.24	4.41
CS52	Gypse rubané	Staffelegg	–	–	3.58	3.68	3.84	4.04	4.34	4.67	5.00
IV04	Hornblendite	Riale Arca (rivière)	7.50	–	–	–	7.76	–	7.90	7.98	8.03
IV34	Kinzigite	Ponte Orchera	4.39	4.90	5.14	5.26	5.36	5.52	5.62	5.67	5.75
IV39	Kinzigite	Grampi	4.48	4.96	5.27	5.47	5.55	5.85	5.99	6.25	6.34
IV48	Kinzigite	Madonna del Boden	4.70	5.00	5.22	5.30	5.42	5.66	5.57	5.78	5.84
IV53	Kinzigite	Grampi (rivière)	4.61	5.15	5.43	5.58	5.66	5.84	5.92	6.03	6.11
IV54	Kinzigite	Grampi (rivière)	4.49	4.94	5.30	5.50	5.57	5.81	5.91	6.01	6.09
IV27A	Kinzigite mylonitisée,rétrogr.	Loro (sous l'église)	4.43	4.77	4.94	5.09	5.17	5.36	5.52	5.71	5.84
IV28	Kinzigite mylonitisée,rétrogr.	Loro	3.58	4.03	4.31	4.47	4.62	4.84	5.05	5.32	5.47
IV50	Mafique faciès amph./gra. myl.	Anzola carrière	6.32	6.37	6.40	6.42	6.43	6.51	6.57	6.64	6.69
IV51	Mafique faciès amph./gra. myl.	Anzola carrière	6.44	6.51	6.55	6.63	6.70	6.78	6.85	6.93	6.97
IV49	Mafique faciès amphib./granul.	Anzola carrière	5.95	6.11	6.18	6.22	6.25	6.32	6.36	6.42	6.44
IV19	Mafique mylonitisée, rétrogr.	Chioso (pont,après)	5.11	5.63	5.98	6.14	6.25	6.45	6.56	6.66	6.72
IV20	Mafique tectonisée, rétrogr.	Balmuccia (rivière)	6.16	6.27	6.32	6.37	6.40	6.47	6.50	6.55	6.58
IV10A	Mafique, f. à amphibolite sup.	Nibbio	4.82	–	–	–	6.03	–	6.38	6.55	7.18
IV10B	Mafique, f. à amphibolite sup.	Nibbio	4.56	5.02	5.27	5.50	5.65	5.93	6.16	6.34	6.42
JB10	Marbre	Malenco,Str.Franscia	4.86	5.60	6.01	6.30	6.45	6.66	6.81	6.90	6.98
JB27	Marbre	Ausserferrera	6.55	6.66	6.71	6.76	6.78	6.82	6.86	6.89	6.95
PF13	Marbre		6.24	6.36	6.44	6.52	6.57	6.61	6.66	6.70	6.75
PF4	Marbre		5.11	5.35	5.53	5.65	5.69	5.73	5.81	5.90	5.94
ST21	Marbre		4.68	5.24	5.63	5.94	6.10	6.34	6.50	6.61	6.68
TM29	Marbre	La Sarva, Saillon	6.04	6.07	6.10	6.13	6.16	6.19	6.22	6.25	6.28
JB03	Marbre blanc cristallisé	Crevadossola	5.15	5.92	6.32	6.56	6.70	6.85	6.96	7.02	7.08
ST20	Marbre dolomitique		7.10	7.25	7.36	7.47	7.58	7.69	7.87	7.94	7.94
ST22	Marbre dolomitique, Trias ?		4.32	5.04	5.55	5.95	6.29	6.63	6.85	7.05	7.05

P-wave velocity V_1 in km/s

CODE	Type of rock	Location	20Mpa	40Mpa	60Mpa	80Mpa	100Mpa	140MPa	200MPa	300MPa	400MPa
PF8	Marbre dolomitisé		5.91	6.13	6.29	6.37	6.45	6.58	6.49	6.67	6.76
JB04	*Marbre gris bleu, rubané*	*Crevadossola*	4.47	5.41	5.89	6.13	6.27	6.46	6.61	6.68	6.74
IV15	Marbre impur	Civiasco (après)	5.79	6.32	6.51	6.62	6.68	6.76	6.83	6.87	6.91
IV14	Marbre impur mylonitisé	Civiasco (après)	6.51	6.55	6.58	6.60	6.62	6.65	6.68	6.71	6.72
TM17	Marbre micacé	Martémo(Evolène)	4.71	5.08	5.29	5.44	5.52	5.70	5.81	5.92	5.97
CS65	Marbre sombre	Col de la Furka	5.22	5.42	5.55	5.64	5.73	5.82	5.89	5.98	6.02
JB15	Monzonite, peu déformée	Bernina	4.97	5.30	5.53	5.68	5.81	5.97	6.09	6.20	6.20
SS2	Mylonite, Blasto-	Simplon village	–	–	–	–	–	–	–	–	6.29
IV35	Paragneiss à biotite et plg.	Strona (rivière)	5.34	5.43	5.50	5.57	5.61	5.71	5.80	5.89	5.95
TM13	Pegmatite	Praz-Jean	5.22	5.51	5.75	5.88	5.95	6.05	6.16	6.23	6.29
IV17	Péridotite	Balmuccia (Carrière)	7.68	7.74	7.75	7.79	7.78	7.81	7.83	7.88	7.88
IV18	Péridotite	Balmuccia (Carrière)	7.50	7.59	7.64	7.66	7.68	7.73	7.78	7.80	7.85
IV26	Péridotite	Baldissero(Carrière)	7.72	7.87	7.97	8.02	8.08	8.08	8.13	8.18	8.18
IV31	Péridotite	Rio Inferno(rivière)	7.70	7.78	7.78	7.79	7.80	7.83	7.85	7.87	7.90
JB11	Péridotite	Malenco,Str.Franscia	5.49	5.57	5.66	5.74	5.78	5.83	5.92	6.00	6.07
JB13	Péridotite	Malenco,Str.Franscia	6.27	6.32	6.37	6.40	6.42	6.43	6.45	6.50	6.55
IV30	Péridotite, Kéliphyte	Rio Inferno(rivière)	7.37	7.58	7.73	7.78	7.83	7.88	7.93	7.98	8.01
PF16	Porphyre mylonitisé		0.00	4.26	4.55	4.83	4.95	5.18	5.38	5.56	5.70
PF10	Porphyre quartzitique		3.94	4.64	5.06	5.30	5.44	5.63	5.79	5.89	5.93
P2	Porphyre, type Lugano	Borgosesia (sort.SW)	–	–	–	–	–	–	–	–	5.49
PF14	Prasinite		4.41	5.81	6.05	6.18	6.29	6.42	6.54	6.65	6.72
VB	Prasinite	Val de Bagne	4.95	5.30	5.62	5.85	6.04	6.27	6.48	6.64	6.69
IV24	Pyroxénite	Balmuccia (Guaifola)	7.16	7.26	7.30	7.34	7.35	7.50	7.43	7.53	7.58
TM06	Quartzite	Rte. d'Annivers,Fang	4.70	5.06	5.27	5.43	5.51	5.66	5.77	5.86	5.90
JB31	Quartzite conglomératique	Illanz	4.56	5.02	5.25	5.41	5.49	5.63	5.72	5.78	5.84
TM05	Quartzite conglomératique	Combaneire(Dalilley)	4.87	5.36	5.54	5.66	5.72	5.77	5.82	5.88	5.91
BA12	Quartzite massif	Lourtier	–	–	–	–	–	–	–	–	–
BA10	Quartzite schisteux	Champsec-Lourtier	–	–	–	–	–	–	–	–	–
BA11	Quartzite schisteux	Champsec-Lourtier	5.10	5.42	5.55	5.66	5.68	5.75	5.80	5.87	5.91
BA13	Quartzite schisteux	Lourtier	4.18	4.64	4.99	5.18	5.37	5.59	5.77	5.92	6.01
JB28	Quartzite, blanche	Avers Crôt	4.55	5.23	5.63	5.77	5.88	5.98	6.08	6.15	6.18
TM08	Quartzschist	Bevernec (Mase)	4.26	4.94	5.24	5.37	5.48	5.59	5.70	5.80	5.86
CS75	Radiolarite	Jaunpass S	5.58	5.65	5.70	5.74	5.78	5.82	5.85	5.89	5.92
IV38	Roche calcosilicatée	Route de Forno(p113)	5.74	6.03	6.15	6.27	6.39	6.58	6.70	6.87	6.95
BA03	Schiste (Argil., mét.)	Sembrancher	–	–	–	–	–	–	–	–	–
ST10	Schiste noir	Car. Lungwurm	3.20	3.97	4.46	4.76	4.97	5.24	5.44	5.63	5.72

P-wave velocity V_1 in km/s

CODE	Type of rock	Location	20Mpa	40Mpa	60Mpa	80Mpa	100Mpa	140MPa	200MPa	300MPa	400MPa
TM20	Schiste vert, Greenschist	Les Haudères	3.45	4.12	4.56	4.87	5.15	5.58	5.90	6.16	6.29
BA15	Schiste, Mica-	Lourtier-Flonnay	3.55	4.21	4.59	4.82	4.94	5.13	5.34	5.51	5.56
TM10	Schiste, Mica-, à albite	Praz-Jean	3.39	4.28	4.77	5.04	5.26	5.53	5.66	5.80	5.85
JB12	Serpentinite	Rte. de Franscia	5.40	5.72	5.88	5.95	6.05	6.12	6.21	6.27	6.32
JB22	Serpentinite	Lac de Sils	6.21	6.24	6.26	6.27	6.27	6.29	6.32	6.35	6.38
ST15	Serpentinite		–	–	–	–	–	–	–	–	–
ST16	Serpentinite		6.17	6.25	6.25	6.25	6.29	6.29	6.29	6.33	6.37
TM22	Serpentinite		5.84	5.88	5.91	5.94	5.95	5.98	6.03	6.07	6.10
CS57	Siltite à ciment calc.(flysch)	Klausen-Strasse	5.44	5.60	5.72	5.82	5.87	5.96	6.03	6.10	6.13
IV43	Stronalite	Plana di Forno	5.54	5.71	5.82	5.92	5.97	6.15	6.21	6.33	6.40
IV44	Stronalite	Plana di Forno	5.59	5.89	6.09	6.30	6.38	6.66	6.88	7.01	7.13
IV52	Stronalite	Plana di Forno	5.80	6.07	6.19	6.24	6.36	6.44	6.50	6.57	6.63
IV32	Stronalite mylonitisée	Carrière d'Anzola	5.87	5.99	6.06	6.08	6.13	6.21	6.27	6.36	6.38
IV33	Stronalite mylonitisée	Carrière d'Anzola	5.59	5.71	5.79	5.90	5.95	6.06	6.15	6.26	6.34
IV46	Stronalite mylonitisée	Forno (village,sud)	5.48	5.68	5.79	5.87	5.92	6.06	6.20	6.32	6.37
SL2	Syénite de Biella	Balma (Carrière)	–	–	–	–	–	–	–	–	6.91
JB08	Tonalite	San Martino	4.05	4.78	5.30	5.52	5.72	5.91	6.02	6.14	6.22

P-wave velocity V_2 in km/s

CODE	Type of rock	Location	20Mpa	40Mpa	60Mpa	80Mpa	100Mpa	140MPa	200MPa	300MPa	400MPa
BA16	Amphibolite	Lourtier-Fionnay	6.07	6.25	6.38	6.43	6.48	6.60	6.71	6.80	6.87
IV36	Amphibolite	Strona (après)	6.24	6.38	6.42	6.50	5.59	6.69	6.74	6.83	6.87
IV37	Amphibolite	Route de Forno(p113)	5.44	5.92	6.15	6.34	6.46	6.84	6.67	7.01	7.09
IV40A	Amphibolite	Rosarolo, rivière	5.74	6.04	6.21	6.40	6.45	6.70	6.59	6.77	6.82
IV40B	Amphibolite	Rosarolo, rivière	5.88	–	–	–	6.53	6.80	–	6.86	6.90
JB20	Amphibolite	Zernez	6.12	6.25	6.35	6.43	6.48	6.67	6.56	6.78	6.83
ST07	Amphibolite		5.28	5.48	5.64	5.78	5.85	6.14	6.00	6.25	6.31
ST13	Amphibolite	Stèle A. Zurbriggen	4.66	4.95	5.37	5.66	5.93	6.50	6.21	6.72	6.78
ST14	Amphibolite à grenat	Glacier Matmark	5.70	6.09	6.27	6.40	6.52	6.78	6.64	6.86	6.92
IV29	Amphibolite mylonit., rétrogr.	Loro	6.31	6.41	6.49	6.54	6.62	6.77	6.70	6.87	6.93
IV41	Amphibolite mylonitisée	Rosarolo rivière	–	–	–	–	–	–	–	–	–
IV55	Amphibolite mylonitisée	Grampi	5.96	6.23	6.37	6.49	6.59	6.89	6.77	7.00	7.04
IV42	Amphibolite tecton., rétrogr.	Rosarolo rivière	–	–	–	–	–	–	–	–	–
ST17	Amphibolite, rétrogradée		4.20	4.92	5.43	5.75	5.95	6.46	6.23	6.63	6.70
SL1	Andésite	Bachetto Sessera	–	–	–	–	–	–	–	–	5.89
IV12	Aplite	Civiasco (après)	5.94	6.13	6.17	6.18	6.23	6.29	6.25	6.34	6.41
IV13	Aplite légèrement foliée	Civiasco (après)	4.52	4.92	5.19	5.34	5.47	5.71	5.59	5.82	5.86
TM02	Brèche calcaro-dolomitique	Gravelone(Sion)	6.19	6.25	6.30	6.33	6.36	6.44	6.39	6.48	6.51
CS73	Brèche,-Micro, dolomitique	Manneberg	–	–	–	–	–	–	–	–	–
CS79	Brèche,-Micro, dolomitique	Charmey	–	–	–	–	–	–	–	–	–
JB24	Brèche, Micro-	Thusis	5.19	5.48	5.63	5.73	5.81	5.96	5.89	6.01	6.06
BA07	Calcaire	Le Châble	5.82	6.06	6.18	6.24	6.31	6.39	6.47	6.52	6.52
CS69	Calcaire	Carrière Audonces	–	–	–	–	–	–	–	–	–
CS86	Calcaire	Rondchâte	–	–	–	–	–	–	–	–	–
JB23	Calcaire	Surs	5.57	5.84	5.97	6.04	6.10	6.25	6.19	6.33	6.40
JB33	Calcaire	Vals, Piedm Strasse	5.66	5.81	5.91	5.99	6.05	6.23	6.12	6.31	6.36
PF5	Calcaire		6.48	6.50	6.53	6.55	6.57	6.62	6.58	6.67	6.69
ST09	Calcaire	Anc. rte du Simplon	5.00	5.38	5.69	5.90	5.97	6.23	6.12	6.31	6.35
TH1	Calcaire	Thônex, forage	5.86	6.00	6.09	6.13	6.25	6.31	6.39	6.48	6.49
TH2	Calcaire	Thônex, forage	5.29	5.45	5.63	5.67	5.70	5.76	5.82	5.86	5.90
TH3	Calcaire	Thônex, forage	5.77	5.85	5.92	5.99	6.05	6.15	6.29	6.40	6.45
TH4	Calcaire	Thônex, forage	5.74	5.91	6.01	6.08	6.17	6.28	6.39	6.46	6.49
TH5	Calcaire	Thônex, forage	5.88	6.03	6.11	6.15	6.23	6.31	6.40	6.49	6.54
TH6	Calcaire	Thônex, forage	5.27	5.39	5.51	5.57	5.61	5.67	5.71	5.75	5.80
TH7	Calcaire	Thônex, forage	5.67	5.91	6.03	6.13	6.18	6.22	6.30	6.37	6.41
TH8	Calcaire	Thônex, forage	5.78	5.95	6.07	6.14	6.18	6.24	6.28	6.35	6.36

P-wave velocity V_2 in km/s

CODE	Type of rock	Location	20Mpa	40Mpa	60Mpa	80Mpa	100Mpa	140MPa	200MPa	300MPa	400MPa
JB17	Calcaire à lumachelles	Bernina	6.39	6.42	6.44	6.46	6.46	6.51	6.47	6.52	6.54
TM27	Calcaire bioclastique	Magnot	5.97	6.02	6.06	6.09	6.10	6.18	6.13	6.20	6.23
CS53	Calcaire biodétritique	Asp	–	–	–	–	–	–	–	–	–
CS82	Calcaire calcarénite	Rondchâte	–	–	–	–	–	–	–	–	–
BA01	Calcaire dolomitique	Sembrancher	5.88	6.17	6.39	6.51	6.65	6.77	6.90	7.00	7.06
CS71	Calcaire dolomitique	Gérignoz									
JB19	Calcaire fin	Livigno	5.91	6.08	6.23	6.38	6.48	6.74	6.61	6.85	6.91
CS77	Calcaire glumeleux	Le Brésil, Jaun	–	–	–	–	–	–	–	–	–
CS66	Calcaire Marneux	Pontenet	–	–	–	–	–	–	–	–	–
CAL01	Calcaire massif	CERN, près Genève	6.51	6.52	6.54	6.54	6.54	6.56	6.56	–	–
CS61	Calcaire massif biodétritique	Nestal	–	–	–	–	–	–	–	–	–
CS62	Calcaire micritique	Obersee-Strasse	–	–	–	–	–	–	–	–	–
CS78	Calcaire micritique	Le Brésil, Jaun	–	–	–	–	–	–	–	–	–
CS85	Calcaire micritique	Rondchâte	–	–	–	–	–	–	–	–	–
TM33	Calcaire micritique	Prabé	5.94	6.00	6.03	6.04	6.06	6.13	6.09	6.18	6.20
CS55	Calcaire micritique schisteux	Tierfeld	–	–	–	–	–	–	–	–	–
CS50	Calcaire oolithique	Staffelegg	–	–	–	–	–	–	–	–	–
CS83	Calcaire oolitique	Rondchâte	–	–	–	–	–	–	–	–	–
CS76	Calcaire pélagique	Jaunpass N	–	–	–	–	–	–	–	–	–
CS74	Calcaire pélagique à silex	Ried /Jaunpass	–	–	–	–	–	–	–	–	–
CS84	Calcaire récifal	Rondchâte	–	–	–	–	–	–	–	–	–
CS63	Calcaire siliceux	Obersee-Strasse	–	–	–	–	–	–	–	–	–
TM26	Calcaire siliceux bioclastique	L'Ardève, Leytron	4.69	4.82	4.95	5.05	5.12	5.37	5.23	5.58	5.66
CS58	Calcaire sombre siliceux	Klausen-Strasse	–	–	–	–	–	–	–	–	–
CS68	Calcaire spathique	Carrière Chiètres	–	–	–	–	–	–	–	–	–
BA05	Calcaire spathique gréseux	Sembr.-Le Châble	5.38	5.60	5.74	5.85	5.93	6.02	6.07	6.13	6.15
PF6	Calcaire, jurassique		6.29	6.31	6.31	6.32	6.32	6.37	6.36	6.39	6.42
JB29	Calcschiste	Avers Cresta	5.56	5.85	6.05	6.17	6.27	6.51	6.40	6.60	6.65
ST03	Calcschiste quarztzitique		5.38	5.45	5.56	5.62	5.67	5.87	5.76	6.02	6.07
D6	Conglomérat	Dorénaz	5.38	5.61	5.74	5.82	5.87	5.90	5.96	6.01	6.04
JB25	Conglomérat	Sufers	4.86	5.16	5.42	5.56	5.68	5.95	5.85	6.05	6.09
JB35	Conglomérat	Oberalppass	4.36	4.95	5.32	5.49	5.65	5.98	5.82	6.10	6.15
CS64	Conglomérat (molasse)	Niederurnen	–	–	–	–	–	–	–	–	–
JB32	Conglomérat calcaire	Vals-Strasse	5.43	5.72	5.89	6.01	6.13	6.33	6.24	6.39	6.44
CS59	Conglomérat grossier	Route d'Elm	–	–	–	–	–	–	–	–	–
SL3	Diorite	Vico (Carrière)	–	–	–	–	–	–	–	–	6.21

P-wave velocity V_2 in km/s

CODE	Type of rock	Location	20Mpa	40Mpa	60Mpa	80Mpa	100Mpa	140MPa	200MPa	300MPa	400MPa
SL4	Diorite	Traversella	–	–	–	–	–	–	–	–	6.19
IV16A	Diorite à biotite	Varallo, sortie W	5.82	–	–	–	6.41	6.65	–	6.76	6.80
IV16B	Diorite à biotite	Varallo, sortie W	4.96	5.43	5.72	5.91	6.02	6.38	6.25	6.48	6.51
JB16	Dolomie	Bernina	6.21	6.49	6.61	6.74	6.79	6.98	6.91	7.06	7.12
PF15	Dolomie		5.68	5.92	6.11	6.27	6.36	6.52	6.66	6.83	6.90
ST12	Dolomie		6.26	6.40	6.50	6.59	6.62	6.77	6.69	6.82	6.86
TM25	Dolomie	Drône, Savièse	5.67	5.88	6.02	6.12	6.23	6.55	6.37	6.71	6.82
JB30	Eclogite	Avers Cresta	5.06	5.51	5.77	6.05	6.20	6.58	6.38	6.72	6.78
IV23	Gabbro	Balmuccia (Guaifola)	6.06	6.31	6.50	6.63	6.76	7.07	6.92	7.22	7.27
IV22	Gabbro clair	Balmuccia (Guaifola)	6.06	6.37	6.50	6.59	6.64	6.77	6.72	6.88	6.93
IV21	Gabbro fracturé, rétrogradé	Balmuccia (rivière)	5.79	6.02	6.20	6.35	6.45	6.92	6.71	7.10	7.18
IV02	Gabbro rétrogradé	Loro (église)	5.98	6.33	6.49	6.66	6.76	7.05	6.91	7.15	7.24
TM21	Gabbro, méta-	La Forclaz	5.79	6.03	6.18	6.32	6.41	6.76	6.58	6.93	7.01
ST18	Gabbro, Méta- (Isotrope)		–	–	–	–	–	–	–	–	–
ST19	Gabbro, Méta-, éclogitique		7.10	7.25	7.36	7.47	7.58	7.87	7.69	7.94	7.94
IV01	Gabbro, Rétrogradé	Loro (église)	6.07	6.24	6.40	6.50	6.53	6.73	6.64	6.85	6.89
BA14	Gneiss	Lourtier	–	–	–	–	–	–	–	–	–
JB26	Gneiss	Ausserferrera	4.96	5.37	5.53	5.64	5.68	5.87	5.78	5.96	6.03
JB34	Gneiss	Sedrun	5.15	5.44	5.61	5.72	5.80	6.02	5.91	6.11	6.15
SC1	Gneiss	Mergozzo (après)	–	–	–	–	–	–	–	–	6.26
JB36	Gneiss (Granite)	Gottardpass	4.48	5.03	5.42	5.64	5.75	6.01	5.91	6.12	6.17
JB14	Gneiss (Kinzigite)	Chiareggio	–	–	–	–	–	–	–	–	–
ST04	Gneiss (Meta-arkose)		4.72	5.03	5.32	5.52	5.65	5.96	5.86	6.09	6.14
ST08	Gneiss (Meta-arkose)		4.87	5.42	5.67	5.83	5.87	6.08	6.01	6.12	6.15
D2	Gneiss à biotite	La Balmaz	5.42	5.55	5.62	5.69	5.77	5.92	6.00	6.17	6.17
D3	Gneiss à biotite	La Balmaz	5.37	5.46	5.54	5.62	5.66	5.79	5.89	6.02	6.08
D1	Gneiss chloriteux	Evionnaz	5.34	5.52	5.65	5.71	5.78	5.99	5.99	6.13	6.13
D1A	Gneiss chloriteux	Evionnaz	5.52	5.64	5.74	5.83	5.89	5.99	6.09	6.18	6.23
PF2	Gneiss déformé		4.74	5.10	5.43	5.55	5.68	5.85	6.02	6.13	6.17
PF9	Gneiss déformé		5.50	5.80	5.98	6.07	6.14	6.24	6.30	6.35	6.38
JB01	Gneiss fin très déformé	Val Isorno	4.45	4.80	5.05	5.25	5.36	5.77	5.57	5.91	5.98
JB02	Gneiss grossier	Crevadossola	4.25	4.80	5.21	5.45	5.63	6.08	5.89	6.20	6.23
PF17	Gneiss mylonitisé		5.24	5.46	5.67	5.83	5.97	6.23	6.12	6.32	6.37
JB21	Gneiss oeillé	Zernez	4.85	5.25	5.46	5.69	5.77	6.03	5.90	6.12	6.18
PF7	Gneiss oeillé		4.76	5.05	5.21	5.38	5.50	5.66	5.75	5.89	5.96
ST11	Gneiss oeillé	Car. Baltschieder	3.79	4.67	5.13	5.35	5.56	5.89	5.75	6.03	6.07

P-wave velocity V_2 in km/s

CODE	Type of rock	Location	20Mpa	40Mpa	60Mpa	80Mpa	100Mpa	140MPa	200MPa	300MPa	400MPa
PF3	Gneiss oeillé, mylonitisé		4.90	5.19	5.32	5.53	5.63	5.76	5.86	5.96	6.04
JB06	Gneiss schisteux	Premia	5.99	6.02	6.05	6.08	6.09	6.16	6.11	6.22	6.28
JB18	Gneiss schisteux	Bernina	4.74	5.11	5.34	5.55	5.67	5.95	5.83	6.04	6.10
SS1	Gneiss schisteux	Niederalp (Simplon)	–	–	–	–	–	–	–	–	5.76
JB07	Gneiss sombre à hornblende	San Martino	5.26	5.61	5.85	5.97	6.03	6.20	6.13	6.27	6.34
SC2	Gneiss, Ortho-	Germagno(route pour)	–	–	–	–	–	–	–	–	–
TM23	Gneiss, Ortho-, mylonitique	Ferpècle	4.88	5.19	5.41	5.58	5.69	5.96	5.84	6.05	6.11
ST23	Gneiss, Para-	Entre Eisten et Pont	5.12	5.28	5.39	5.50	5.57	5.86	5.73	6.02	6.10
D5	Granite	Miéville (Carrière)	4.69	5.17	5.51	5.81	5.96	6.13	6.26	6.37	6.40
PF12	Granite		4.84	5.31	5.70	6.01	6.12	6.35	6.52	6.70	6.79
IV11	Granite leucocrate	Carrière Mte.-Orfano	4.66	5.25	5.45	5.65	5.68	5.84	5.81	5.98	5.98
D4	Granite mylonitisé	Miéville (Carrière)	4.62	5.18	5.57	5.79	5.98	6.10	6.21	6.32	6.37
JB09	Granodiorite	San Martino	4.60	5.09	5.39	5.58	5.71	6.06	5.92	6.19	6.26
IV09A	Granulite	Anzola, carrière	4.91	5.47	5.83	6.05	6.23	6.69	6.44	6.91	6.98
IV06	Granulite à Plg-Ga-Opx	Riale Arca (rivière)	5.71	6.19	6.34	6.47	6.63	6.93	6.79	7.10	7.13
IV45	Granulite à Plg-Ga-Opx	Piana di Forno	5.62	5.74	6.00	6.24	6.39	6.65	6.54	6.79	6.85
IV25	Granulite à Qz-Plg-Px	Monte Rubello (sous)	5.47	5.59	5.73	5.80	5.89	6.07	5.96	6.16	6.21
IV07	Granulite basique	Riale Arca (rivière)	6.86	6.96	7.00	7.03	7.05	7.19	7.12	7.28	7.34
IV03	Granulite basique à amphibo.	Riale Arca (rivère)	6.26	6.38	6.44	6.50	6.59	6.78	6.66	6.89	6.93
IV05	Granulite basique à hornblende	Riale Arca (rivière)	6.99	6.98	7.09	7.20	7.30	7.53	7.41	7.67	7.72
IV08	Granulite rétrogradée	Riale Arca (rivière)	6.73	6.83	6.91	6.96	6.99	7.13	7.08	7.26	7.28
BA06	Grès	Le Châble	4.79	5.06	5.26	5.45	5.58	5.77	5.94	6.05	6.10
CS80	Grès	Barrage de Rossens	–	–	–	–	–	–	–	–	–
CS81	Grès	Rondchâte	–	–	–	–	–	–	–	–	–
FAL1	Grès	Car. de Tatür, FR	5.58	5.77	5.88	5.96	6.02	6.19	6.12	6.27	6.33
CS67	Grès calcaire	Tavannes	–	–	–	–	–	–	–	–	–
CS72	Grès calcaire		–	–	–	–	–	–	–	–	–
BA04	Grès calcique	Sembr.-Le Châble	5.35	5.57	5.71	5.79	5.84	5.97	6.06	6.13	6.18
CS56	Grès charboneux (flysch)	Klausen-Strasse	–	–	–	–	–	–	–	–	–
CS70	Grès du flysch	Rte. des Mosses	–	–	–	–	–	–	–	–	–
D8	Grès fin	Dorénaz	5.41	5.62	5.72	5.80	5.86	5.90	5.95	6.01	6.04
M1	Grès fin	Challex, Ain, France	3.30	3.55	3.73	3.89	3.98	4.35	4.14	4.54	4.68
M2	Grès fin	CERN, près Genève	3.93	4.32	4.58	4.75	4.82	5.12	4.97	5.23	5.28
MOL6	Grès fin	Cologny, Genève	3.12	3.64	4.02	4.30	4.47	4.79	5.04	5.33	5.54
MOL7	Grès fin	Cologny, Genève	3.36	3.80	4.12	4.41	4.64	4.91	5.11	5.32	5.44
MOL9	Grès fin	G. Motta, Genève	3.24	3.65	3.89	4.03	4.22	4.34	4.54	4.78	4.94

P-wave velocity V_2 in km/s

CODE	Type of rock	Location	20Mpa	40Mpa	60Mpa	80Mpa	100Mpa	140MPa	200MPa	300MPa	400MPa
D7	Grès grossier	Dorénaz	5.44	5.62	5.74	5.80	5.83	5.90	5.94	6.01	6.06
TM03	Grès micacé	Chandoline(Sion)	5.62	5.88	6.03	6.09	6.14	6.23	6.20	6.28	6.31
CS54	Grès rouge	Gausingen	–	–	–	–	–	–	–	–	–
CS60	Grès rouge	Elm-Strasse	–	–	–	–	–	–	–	–	–
BA09	Grès schisteux	Champsec	4.70	5.13	5.41	5.59	5.70	5.86	5.99	6.12	6.15
TM01	Grès silici-calcique	Rte. mayens Riddes	4.90	5.13	5.30	5.44	5.52	5.86	5.70	6.02	6.09
MOL1	Grès très fin	Cologny, Genève	3.36	3.85	4.11	4.34	4.49	4.68	4.88	5.08	5.22
MOL2	Grès très fin	Cologny, Genève	3.41	3.85	4.12	4.24	4.43	4.53	4.76	4.98	5.16
MOL3	Grès très fin	Cologny, Genève	3.58	3.99	4.23	4.41	4.53	4.70	4.89	5.06	5.22
BA02	Gypse	Sembrancher	–	–	–	–	–	–	–	–	–
TM37	Gypse	Drône, Savièse	–	–	–	–	–	–	–	–	–
CS52	Gypse rubané	Staffelegg	–	–	–	–	–	–	–	–	–
IV04	Hornblendite	Riale Arca (rivière)	6.80	–	–	–	7.17	7.40	–	7.48	7.65
IV34	Kinzigite	Ponte Orchera	5.57	5.71	5.85	6.03	6.05	6.27	6.23	6.37	6.40
IV39	Kinzigite	Grampi	4.53	5.04	5.40	5.65	5.73	5.98	5.85	6.15	6.24
IV48	Kinzigite	Madonna del Boden	5.00	5.31	5.47	5.61	5.71	5.95	5.82	6.09	6.17
IV53	Kinzigite	Grampi (rivière)	4.95	5.33	5.55	5.72	5.80	5.97	5.94	6.04	6.06
IV54	Kinzigite	Grampi (rivière)	4.57	5.01	5.30	5.47	5.57	5.71	5.83	6.00	6.04
IV27A	Kinzigite mylonitisée,rétrogr.	Loro (sous l'église)	5.51	5.63	5.72	5.76	5.81	5.90	5.99	6.11	6.17
IV28	Kinzigite mylonitisée,rétrogr.	Loro	4.81	5.15	5.28	5.46	5.51	5.71	5.81	6.00	6.11
IV50	Mafique faciès amph./gra. myl.	Anzola carrière	6.41	6.55	6.58	6.63	6.65	6.78	6.72	6.84	6.89
IV51	Mafique faciès amph./gra. myl.	Anzola carrière	6.49	6.59	6.65	6.70	6.74	6.88	6.85	6.92	6.99
IV49	Mafique faciès amphib./granul.	Anzola carrière	6.37	6.47	6.52	6.58	6.62	6.68	6.78	6.82	6.88
IV19	Mafique mylonitisée, rétrogr.	Chioso (pont,après)	5.81	5.63	6.29	6.42	6.49	6.73	6.62	6.82	6.88
IV20	Mafique tectonisée, rétrogr.	Balmuccia (rivière)	6.06	6.18	6.26	6.32	6.35	6.45	6.52	6.57	6.62
IV10A	Mafique, f. à amphibolite sup.	Nibbio	5.20	–	–	–	6.43	6.88	–	7.10	7.14
IV10B	Mafique, f. à amphibolite sup.	Nibbio	5.12	5.41	5.67	5.85	5.95	6.53	6.30	6.74	6.84
JB10	Marbre	Malenco,Str.Franscia	5.27	5.87	6.28	6.60	6.74	7.15	6.99	7.25	7.27
JB27	Marbre	Ausserferrera	6.98	7.10	7.14	7.18	7.22	7.28	7.26	7.32	7.34
PF13	Marbre		6.62	6.81	6.95	7.00	7.05	7.10	7.15	7.15	7.20
PF4	Marbre		6.14	6.22	6.26	6.28	6.31	6.39	6.36	6.41	6.43
ST21	Marbre		5.66	5.95	6.21	6.37	6.52	6.85	6.72	7.00	7.06
TM29	Marbre	La Sarva, Saillon	6.34	6.35	6.37	6.37	6.38	6.43	6.40	6.45	6.47
JB03	Marbre blanc cristallisé	Crevadossola	5.53	6.10	6.48	6.71	6.84	7.12	7.00	7.18	7.25
ST20	Marbre dolomitique		7.18	7.34	7.45	7.56	7.62	7.80	7.74	7.92	7.92
ST22	Marbre dolomitique, Trias ?		4.85	5.62	6.11	6.38	6.55	6.96	6.82	7.01	7.06

P-wave velocity V_2 in km/s

CODE	Type of rock	Location	20Mpa	40Mpa	60Mpa	80Mpa	100Mpa	140MPa	200MPa	300MPa	400MPa
PF8	Marbre dolomitisé		6.15	6.42	6.51	6.64	6.68	6.82	6.73	6.96	7.01
JB04	Marbre gris bleu, rubané	Crevadossola	5.28	6.09	6.57	6.84	7.01	7.34	7.24	7.43	7.50
IV15	Marbre impur	Civiasco (après)	–	–	–	–	–	–	–	–	–
IV14	Marbre impur mylonitisé	Civiasco (après)	–	–	–	–	–	–	–	–	–
TM17	Marbre micacé	Martémo(Evolène)	5.43	5.67	5.79	5.91	5.97	6.17	6.08	6.25	6.28
CS65	Marbre sombre	Col de la Furka	–	–	–	–	–	–	–	–	–
JB15	Monzonite, peu déformée	Bernina	5.11	5.41	5.58	5.73	5.80	6.08	5.96	6.15	6.20
SS2	Mylonite, Blasto-	Simplon village	–	–	–	–	–	–	–	–	6.15
IV35	Paragneiss à biotite et plg.	Strona (rivière)	5.78	5.85	5.90	5.93	5.97	6.04	6.16	6.27	6.35
TM13	Pegmatite	Praz-Jean	4.98	5.25	5.53	5.78	5.88	6.19	6.08	6.26	6.31
IV17	Péridotite	Balmuccia (Carrière)	7.78	7.83	7.83	7.86	7.92	7.97	7.95	8.02	8.05
IV18	Péridotite	Balmuccia (Carrière)	7.91	7.97	8.05	8.07	8.09	8.19	8.15	8.25	8.28
IV26	Péridotite	Baldissero(Carrière)	7.85	8.04	8.14	8.16	8.20	8.27	8.22	8.33	8.33
IV31	Péridotite	Rio Inferno(rivière)	7.88	7.91	7.94	7.97	7.98	8.00	8.02	8.03	8.09
JB11	Péridotite	Malenco,Str.Franscia	6.45	6.48	6.52	6.55	6.57	6.65	6.60	6.71	6.74
JB13	Péridotite	Malenco,Str.Franscia	7.06	7.08	7.10	7.12	7.14	7.18	7.16	7.22	7.24
IV30	Péridotite, Kéliphyte	Rio Inferno(rivière)	7.84	7.97	7.99	8.02	8.04	8.09	8.05	8.12	8.15
PF16	Porphyre mylonitisé		4.50	4.99	5.29	5.49	5.60	5.95	5.81	6.07	6.12
PF10	Porphyre quartzitique		4.73	5.27	5.63	5.76	5.90	6.04	6.11	6.19	6.23
P2	Porphyre, type Lugano	Borgosesia (sort.SW)	–	–	–	–	–	–	–	–	5.45
PF14	Prasinite		4.89	5.46	5.74	5.84	5.98	6.09	6.25	6.37	6.45
VB	Prasinite	Val de Bagne	5.21	5.60	5.89	6.06	6.23	6.42	6.59	6.75	6.79
IV24	Pyroxénite	Balmuccia (Gualfola)	7.40	7.48	7.56	7.59	7.62	7.72	7.66	7.70	7.80
TM06	Quartzite	Rte. d'Annivers,Fang	5.32	5.47	5.59	5.67	5.73	5.87	5.78	5.94	5.98
JB31	Quartzite conglomératique	Illanz	4.94	5.29	5.45	5.58	5.63	5.83	5.73	5.90	5.95
TM05	Quartzite conglomératique	Combaneire(Dailley)	5.38	5.66	5.80	5.89	5.94	6.07	6.01	6.12	6.13
BA12	Quartzite massif	Lourtier	5.21	5.47	5.67	5.80	5.88	5.94	6.04	6.09	6.12
BA10	Quartzite schisteux	Champsec-Lourtier	4.67	5.26	5.53	5.70	5.83	5.93	6.00	6.09	6.13
BA11	Quartzite schisteux	Champsec-Lourtier	4.95	5.54	5.70	5.83	5.94	5.97	6.01	6.06	6.13
BA13	Quartzite schisteux	Lourtier	4.13	4.73	5.10	5.28	5.44	5.71	5.89	6.06	6.15
JB28	Quartzite, blanche	Avers Crôt	4.72	5.17	5.44	5.61	5.70	5.86	5.80	5.89	5.93
TM08	Quartzschist	Bevernec (Mase)	5.65	5.85	5.98	6.06	6.11	6.25	6.18	6.31	6.36
CS75	Radiolarite	Jaunpass S	–	–	–	–	–	–	–	–	–
IV38	Roche calcosilicatée	Route de Forno(p113)	6.08	6.29	6.46	6.63	6.70	7.08	6.91	7.22	7.31
BA03	Schiste (Argil., mét.)	Sembrancher	6.17	6.31	6.41	6.49	6.53	6.63	6.70	6.83	6.83
ST10	Schiste noir	Car. Lungwurm	5.48	5.90	6.03	6.15	6.21	6.40	6.30	6.48	6.53

P-wave velocity V_2 in km/s

CODE	Type of rock	Location	20Mpa	40Mpa	60Mpa	80Mpa	100Mpa	140MPa	200MPa	300MPa	400MPa
TM20	Schiste vert, Greenschist	Les Haudères	4.37	4.86	5.22	5.43	5.68	6.18	5.95	6.40	6.49
BA15	Schiste, Mica-	Lourtier-Fionnay	5.20	5.55	5.71	5.90	5.97	6.05	6.18	6.31	6.34
TM10	Schiste, Mica-, à albite	Praz-Jean	4.44	4.95	5.29	5.60	5.76	6.11	5.95	6.25	6.31
JB12	Serpentinite	Rte. de Franscia	–	–	–	–	–	–	–	–	–
JB22	Serpentinite	Lac de Sils	6.26	6.29	6.31	6.33	6.33	6.37	6.34	6.41	6.44
ST15	Serpentinite		–	–	–	–	–	–	–	–	–
ST16	Serpentinite		6.54	6.57	6.59	6.63	6.63	6.68	6.65	6.70	6.72
TM22	Serpentinite		5.83	5.90	5.93	5.97	6.00	6.07	6.03	6.10	6.13
CS57	Siltite à ciment calc.(flysch)	Klausen-Strasse	–	–	–	–	–	–	–	–	–
IV43	Stronalite	Piana di Forno	5.70	5.81	5.90	5.96	6.04	6.13	6.22	6.28	6.35
IV44	*Stronalite*	Piana di Forno	6.30	6.50	6.61	6.75	6.80	7.09	6.97	7.24	7.30
IV52	Stronalite	Piana di Forno	5.62	5.90	6.13	6.28	6.36	6.68	6.58	6.81	6.83
IV32	Stronalite mylonitisée	Carrière d'Anzola	6.40	6.49	6.54	6.54	6.57	6.66	6.71	6.74	6.78
IV33	Stronalite mylonitisée	Carrière d'Anzola	6.06	6.18	6.29	6.37	6.46	6.53	6.61	6.77	6.85
IV46	Stronalite mylonitisée	Forno (village,sud)	5.64	5.87	6.03	6.11	6.17	6.29	6.41	6.51	6.53
SL2	*Syénite de Biella*	*Balma (Carrière)*	–	–	–	–	–	–	–	–	6.47
JB08	Tonalite	San Martino	4.85	5.43	5.72	5.93	6.05	6.30	6.18	6.38	6.43

P-wave velocity V_3 in km/s

CODE	Type of rock	Location	20Mpa	40Mpa	60Mpa	80Mpa	100Mpa	140MPa	200MPa	300MPa	400MPa
BA16	Amphibolite	Lourtier-Fionnay	6.71	6.82	6.88	6.94	7.04	7.12	7.22	7.28	7.32
IV36	Amphibolite	Strona (après)	6.51	6.65	6.69	6.77	6.79	6.87	6.92	7.00	7.02
IV37	Amphibolite	Route de Forno(p113)	5.93	6.42	6.56	6.78	6.84	7.03	7.22	7.28	7.35
IV40A	Amphibolite	Rosarolo, rivière	6.28	6.43	6.50	6.65	6.68	6.80	6.91	6.97	7.02
IV40B	Amphibolite	Rosarolo, rivière	6.62	–	–	–	6.84	–	7.01	7.07	7.11
JB20	Amphibolite	Zermez	6.34	6.47	6.55	6.62	6.67	6.76	6.87	6.97	7.00
ST07	Amphibolite		6.10	6.25	6.32	6.38	6.48	6.56	6.72	6.85	6.91
ST13	Amphibolite	Stèle A. Zurbriggen	5.12	5.48	5.74	6.00	6.23	6.47	6.69	6.93	7.03
ST14	Amphibolite à grenat	Glacier Matmark	6.06	6.23	6.35	6.45	6.52	6.66	6.78	6.92	6.99
IV29	Amphibolite mylonit., rétrogr.	Loro	6.85	6.91	6.93	6.95	6.97	6.99	7.02	7.08	7.10
IV41	Amphibolite mylonitisée	Rosarolo rivière	6.61	6.71	6.78	6.84	6.86	6.95	7.01	7.09	7.14
IV55	Amphibolite mylonitisée	Grampl	6.15	6.33	6.52	6.66	6.78	6.95	7.03	7.13	7.19
IV42	Amphibolite tecton., rétrogr.	Rosarolo rivière	–	–	–	–	–	–	–	–	–
ST17	Amphibolite, rétrogradée		4.98	5.58	5.97	6.22	6.38	6.62	6.78	6.95	7.03
SL1	Andésite	Bachetto Sessera	–	–	–	–	–	–	–	–	5.93
IV12	Aplite	Civiasco (après)	–	–	–	–	–	–	–	–	–
IV13	Aplite légèrement foliée	Civiasco (après)	4.78	5.25	5.53	5.72	5.90	6.07	6.18	6.28	6.32
TM02	Brèche calcaro-dolomitique	Gravelone(Sion)	5.99	6.09	6.13	6.19	6.24	6.37	6.48	6.62	6.69
CS73	Brèche,-Micro, dolomitique	Manneberg	–	–	–	–	–	–	–	–	–
CS79	Brèche,-Micro, dolomitique	Charmey	–	–	–	–	–	–	–	–	–
JB24	Brèche, Micro-	Thusis	5.36	5.56	5.74	5.82	5.89	5.96	6.03	6.09	6.12
BA07	Calcaire	Le Châble	6.11	6.26	6.36	6.42	6.46	6.53	6.58	6.63	6.67
CS69	Calcaire	Carrière Audonces	–	–	–	–	–	–	–	–	–
CS86	Calcaire	Rondchâte	–	–	–	–	–	–	–	–	–
JB23	Calcaire	Surs	6.49	6.65	6.74	6.79	6.81	6.85	6.87	6.91	6.97
JB33	Calcaire	Vals, Piedm Strasse	5.65	5.86	5.98	6.07	6.14	6.23	6.29	6.37	6.43
PF5	Calcaire		–	–	–	–	–	–	–	–	–
ST09	Calcaire	Anc. rte du Simplon	5.22	5.55	5.74	5.88	5.98	6.09	6.25	6.37	6.37
TH1	Calcaire	Thônex, forage	5.97	6.03	6.11	6.19	6.22	6.30	6.38	6.46	6.50
TH2	Calcaire	Thônex, forage	–	–	–	–	–	–	–	–	–
TH3	Calcaire	Thônex, forage	6.00	6.08	6.14	6.18	6.26	6.32	6.40	6.49	6.52
TH4	Calcaire	Thônex, forage	6.03	6.08	6.18	6.21	6.26	6.34	6.40	6.50	6.52
TH5	Calcaire	Thônex, forage	6.02	6.08	6.16	6.26	6.30	6.38	6.44	6.49	6.52
TH6	Calcaire	Thônex, forage	5.42	5.56	5.68	5.75	5.82	5.91	5.93	6.01	6.05
TH7	Calcaire	Thônex, forage	6.06	6.09	6.10	6.13	6.15	6.16	6.21	6.29	6.32
TH8	Calcaire	Thônex, forage	5.80	5.93	6.02	6.11	6.15	6.21	6.29	6.35	6.40

P-wave velocity V_3 in km/s

CODE	Type of rock	Location	20Mpa	40Mpa	60Mpa	80Mpa	100Mpa	140MPa	200MPa	300MPa	400MPa
JB17	Calcaire à lumachelles	Bernina	6.50	6.54	6.55	6.57	6.59	6.61	6.64	6.68	6.69
TM27	Calcaire bioclastique	Magnot	6.11	6.15	6.18	6.21	6.23	6.26	6.31	6.32	6.35
CS53	Calcaire biodétritique	Asp	–	–	–	–	–	–	–	–	–
CS82	Calcaire calcarénite	Rondchâte	–	–	–	–	–	–	–	–	–
BA01	Calcaire dolomitique	Sembrancher	6.02	6.29	6.58	6.58	6.65	6.73	6.87	6.93	7.03
CS71	Calcaire dolomitique	Gérignoz	–	–	–	–	–	–	–	–	–
JB19	Calcaire fin	Livigno	6.10	6.28	6.42	6.53	6.62	6.78	6.86	6.96	7.00
CS77	Calcaire glumeleux	Le Brésil, Jaun	–	–	–	–	–	–	–	–	–
CS66	Calcaire Marneux	Pontenet	–	–	–	–	–	–	–	–	–
CAL01	Calcaire massif	CERN, près Genève	6.41	6.41	6.43	6.43	6.43	6.44	6.44	–	–
CS61	Calcaire massif biodétritique	Nestal	–	–	–	–	–	–	–	–	–
CS62	Calcaire micritique	Obersee-Strasse	–	–	–	–	–	–	–	–	–
CS78	Calcaire micritique	Le Brésil, Jaun	–	–	–	–	–	–	–	–	–
CS85	Calcaire micritique	Rondchâte	–	–	–	–	–	–	–	–	–
TM33	Calcaire micritique	Prabé	6.15	6.17	6.18	6.20	6.22	6.25	6.26	6.29	6.33
CS55	Calcaire micritique schisteux	Tierfeld	–	–	–	–	–	–	–	–	–
CS50	Calcaire oolithique	Staffelegg	–	–	–	–	–	–	–	–	–
CS83	Calcaire oolitique	Rondchâte	–	–	–	–	–	–	–	–	–
CS76	Calcaire pélagique	Jaunpass N	–	–	–	–	–	–	–	–	–
CS74	Calcaire pélagique à silex	Ried /Jaunpass	–	–	–	–	–	–	–	–	–
CS84	Calcaire récifal	Rondchâte	–	–	–	–	–	–	–	–	–
CS63	Calcaire siliceux	Obersee-Strasse	–	–	–	–	–	–	–	–	–
TM26	Calcaire siliceux bioclastique	L'Ardève, Leytron	5.15	5.24	5.32	5.40	5.47	5.56	5.69	5.79	5.85
CS58	Calcaire sombre siliceux	Klausen-Strasse	–	–	–	–	–	–	–	–	–
CS68	Calcaire spathique	Carrière Chiètres	–	–	–	–	–	–	–	–	–
BA05	Calcaire spathique gréseux	Sembr.-Le Châble	5.97	6.01	6.12	6.19	6.21	6.27	6.32	6.35	6.37
PF6	Calcaire, jurassique		–	–	–	–	–	–	–	–	–
JB29	Calcschiste	Avers Cresta	6.00	6.10	6.19	6.27	6.35	6.47	6.63	6.72	6.77
ST03	Calcschiste quarztzitique		5.59	5.68	5.82	5.87	5.90	5.99	6.09	6.18	
D6	Conglomérat	Dorénaz	5.49	5.68	5.79	5.85	5.90	5.96	6.00	6.08	6.09
JB25	Conglomérat	Sufers	4.88	5.34	5.59	5.77	5.87	6.04	6.13	6.22	6.27
JB35	Conglomérat	Oberalppass	4.70	5.12	5.41	5.60	5.72	5.90	6.06	6.15	6.21
CS64	Conglomérat (molasse)	Niederurnen	–	–	–	–	–	–	–	–	–
JB32	Conglomérat calcaire	Vals-Strasse	5.66	5.91	6.05	6.15	6.22	6.31	6.39	6.44	6.47
CS59	Conglomérat grossier	Route d'Elm	–	–	–	–	–	–	–	–	–
SL3	Diorite	Vico (Carrière)	–	–	–	–	–	–	–	–	6.36

P-wave velocity V_3 in km/s

CODE	Type of rock	Location	20Mpa	40Mpa	60Mpa	80Mpa	100Mpa	140MPa	200MPa	300MPa	400MPa
SL4	Diorite	Traversella	–	–	–	–	–	–	–	–	6.29
IV16A	Diorite à biotite	Varallo, sortie W	5.85	–	–	–	6.42	–	6.67	6.77	6.87
IV16B	Diorite à biotite	Varallo, sortie W	5.43	5.83	6.06	6.27	6.33	6.51	6.65	6.76	6.80
JB16	Dolomie	Bernina	6.43	6.61	6.76	6.84	6.88	6.95	7.02	7.11	7.16
PF15	Dolomie		6.27	6.47	6.61	6.68	6.77	6.88	7.00	7.12	7.16
ST12	Dolomie		6.90	6.96	7.00	7.02	7.04	7.08	7.10	7.14	7.18
TM25	Dolomie	Drône, Savièse	5.72	5.90	6.04	6.16	6.28	6.43	6.58	6.74	6.83
JB30	Eclogite	Avers Cresta	5.40	5.73	5.99	6.16	6.27	6.48	6.65	6.77	6.82
IV23	Gabbro	Balmuccia (Gualfola)	6.23	6.56	6.81	7.02	7.14	7.29	7.48	7.61	7.64
IV22	Gabbro clair	Balmuccia (Gualfola)	6.21	6.41	6.53	6.66	6.67	6.80	6.85	6.89	6.95
IV21	Gabbro fracturé, rétrogradé	Balmuccia (rivière)	5.77	6.06	6.27	6.42	6.52	6.80	6.96	7.11	7.22
IV02	Gabbro rétrogradé	Loro (église)	6.59	6.84	7.03	7.19	7.24	7.43	7.55	7.65	7.73
TM21	Gabbro, méta-	La Forclaz	5.76	6.00	6.15	6.27	6.42	6.60	6.80	6.97	7.05
ST18	Gabbro, Méta- (Isotrope)		6.32	6.58	6.78	6.91	7.00	7.18	7.35	7.51	7.57
ST19	Gabbro, Méta-, éclogitique		7.13	7.29	7.40	7.57	7.68	7.80	7.93	7.99	8.06
IV01	Gabbro, Rétrogradé	Loro (église)	6.11	6.35	6.47	6.50	6.54	6.69	6.80	6.92	6.97
BA14	Gneiss	Lourtier	–	–	–	–	–	–	–	–	–
JB26	Gneiss	Ausserferrera	5.21	5.61	5.81	5.89	5.96	6.04	6.10	6.18	6.22
JB34	Gneiss	Sedrun	5.43	5.67	5.84	5.94	6.02	6.09	6.17	6.26	6.31
SC1	Gneiss	Mergozzo (après)									6.28
JB36	Gneiss (Granite)	Gottardpass	4.73	5.19	5.59	5.75	5.91	6.03	6.16	6.24	6.27
JB14	Gneiss (Kinzigite)	Chiareggio	–	–	–	–	–	–	–	–	–
ST04	Gneiss (Meta-arkose)		4.84	5.13	5.40	5.59	5.72	5.88	6.04	6.17	–
ST08	Gneiss (Meta-arkose)		5.09	5.54	5.79	5.97	6.04	6.14	6.21	6.28	6.28
D2	Gneiss à biotite	La Balmaz	4.87	5.09	5.28	5.42	5.54	5.70	5.86	6.01	6.09
D3	Gneiss à biotite	La Balmaz	5.06	5.15	5.22	5.30	5.37	5.50	5.64	5.78	5.85
D1	Gneiss chloriteux	Evionnaz	5.55	5.68	5.81	5.88	5.88	5.95	6.02	6.10	6.17
D1A	Gneiss chloriteux	Evionnaz	5.60	5.69	5.77	5.84	5.92	6.01	6.08	6.17	6.20
PF2	Gneiss déformé		5.08	5.38	5.59	5.72	5.82	5.96	5.99	6.10	6.14
PF9	Gneiss déformé		5.53	5.82	6.06	6.18	6.25	6.37	6.46	6.54	6.54
JB01	Gneiss fin très déformé	Val Isorno	4.49	4.89	5.11	5.31	5.42	5.62	5.78	5.91	5.98
JB02	Gneiss grossier	Crevadossola	4.55	5.18	5.49	5.74	5.87	6.01	6.10	6.19	6.23
PF17	Gneiss mylonitisé		5.39	5.61	5.77	5.95	6.03	6.26	6.28	6.34	6.37
JB21	Gneiss oeillé	Zernez	5.03	5.37	5.61	5.74	5.82	5.94	6.04	6.13	6.16
PF7	Gneiss oeillé		5.10	5.37	5.55	5.68	5.78	5.92	6.02	6.14	6.17
ST11	Gneiss oeillé	Car. Baltschieder	5.35	5.53	5.69	5.82	5.89	6.03	6.10	6.30	6.30

P-wave velocity V_3 in km/s

CODE	Type of rock	Location	20Mpa	40Mpa	60Mpa	80Mpa	100Mpa	140MPa	200MPa	300MPa	400MPa
PF3	Gneiss oeillé, mylonitisé		5.51	5.70	5.85	5.93	6.00	6.09	6.18	6.26	6.32
JB06	Gneiss schisteux	Premia	6.06	6.10	6.14	6.17	6.20	6.25	6.30	6.36	6.39
JB18	Gneiss schisteux	Bernina	4.96	5.22	5.43	5.60	5.71	5.87	6.01	6.13	6.20
SS1	Gneiss schisteux	Niederalp (Simplon)									0.00
JB07	Gneiss sombre à hornblende	San Martino	5.20	5.59	5.81	5.98	6.08	6.15	6.22	6.29	6.36
SC2	Gneiss, Ortho-	Germagno(route pour)	–	–	–	–	–	–	–	–	–
TM23	*Gneiss, Ortho-, mylonitique*	*Ferpècle*	5.03	5.31	5.55	5.68	5.81	5.98	6.05	6.16	6.19
ST23	Gneiss, Para-	Entre Eisten et Pont	5.03	5.23	5.40	5.53	5.66	5.83	6.03	6.19	6.28
D5	Granite	Miéville (Carrière)	4.86	5.23	5.48	5.72	5.84	6.04	6.24	6.33	6.40
PF12	Granite		4.79	5.41	5.75	5.99	6.17	6.33	6.45	6.58	–
IV11	Granite leucocrate	Carrière Mte.-Orfano	5.05	5.54	5.88	6.06	6.17	6.34	6.50	6.63	6.69
D4	Granite mylonitisé	Miéville (Carrière)	4.80	5.26	5.61	5.82	5.96	6.12	6.28	6.36	6.39
JB09	Granodiorite	San Martino	4.74	5.22	5.46	5.65	5.77	5.95	6.06	6.20	6.26
IV09A	Granulite	Anzola, carrière	5.63	6.14	6.37	6.57	6.67	6.84	7.03	7.18	7.27
IV06	Granulite à Plg-Ga-Opx	Riale Arca (rivière)	5.91	6.19	6.56	6.81	7.04	7.20	7.43	7.57	7.64
IV45	Granulite à Plg-Ga-Opx	Piana di Forno	5.35	5.74	6.00	6.26	6.43	6.63	6.81	6.95	7.00
IV25	*Granulite à Qz-Plg-Px*	Monte Rubello (sous)	6.90	6.06	6.20	6.29	6.38	6.51	6.62	6.74	6.78
IV07	Granulite basique	Riale Arca (rivière)	6.88	7.01	7.05	7.09	7.15	7.26	7.31	7.40	7.45
IV03	Granulite basique à amphibo.	Riale Arca (rivère)	6.44	6.59	6.68	6.77	6.82	6.92	7.01	7.09	7.13
IV05	Granulite basique à hornblende	Riale Arca (rivière)	–	–	–	–	–	–	–	–	–
IV08	Granulite rétrogradée	Riale Arca (rivière)	6.86	7.00	7.08	7.14	7.19	7.34	7.29	7.39	7.41
BA06	Grès	Le Châble	5.15	5.42	5.61	5.71	5.82	5.96	6.09	6.18	6.23
CS80	Grès	Barrage de Rossens	–	–	–	–	–	–	–	–	–
CS81	Grès	Rondchâte	–	–	–	–	–	–	–	–	–
FAL1	Grès	Car. de Tatür, FR	5.79	5.97	6.04	6.11	6.16	6.20	6.26	6.36	6.39
CS67	Grès calcaire	Tavannes	–	–	–	–	–	–	–	–	–
CS72	*Grès calcaire*		–	–	–	–	–	–	–	–	–
BA04	Grès calcique	Sembr.-Le Châble	5.42	5.61	5.73	5.86	5.89	6.00	6.08	6.15	6.18
CS56	Grès charboneux (flysch)	Klausen-Strasse	–	–	–	–	–	–	–	–	–
CS70	Grès du flysch	Rte. des Mosses	–	–	–	–	–	–	–	–	–
D8	Grès fin	Dorénaz	5.42	5.62	5.77	5.85	5.87	5.96	5.99	6.04	6.09
M1	Grès fin	Challex, Ain, France	3.51	3.76	3.94	4.11	4.23	4.36	4.52	4.76	4.85
M2	Grès fin	CERN, près Genève	4.27	4.56	4.77	4.87	4.99	5.09	5.22	5.33	5.39
MOL6	Grès fin	Cologny, Genève	3.21	3.67	3.98	4.25	4.44	4.71	5.00	5.29	5.46
MOL7	Grès fin	Cologny, Genève	3.99	4.30	4.51	4.77	4.88	5.08	5.32	5.59	5.72
MOL9	Grès fin	G. Motta, Genève	3.33	3.78	4.01	4.19	4.36	4.51	4.75	4.93	5.08

P-wave velocity V_3 in km/s

CODE	Type of rock	Location	20Mpa	40Mpa	60Mpa	80Mpa	100Mpa	140MPa	200MPa	300MPa	400MPa
D7	Grès grossier	Dorénaz	5.54	5.72	5.81	5.89	5.93	5.99	6.08	6.08	6.12
TM03	Grès micacé	Chandoline(Sion)	5.52	5.89	6.05	6.14	6.20	6.25	6.28	6.33	6.36
CS54	Grès rouge	Gausingen	–	–	–	–	–	–	–	–	–
CS60	Grès rouge	Elm-Strasse	–	–	–	–	–	–	–	–	–
BA09	Grès schisteux	Champsec	5.11	5.43	5.61	5.77	5.90	6.06	6.21	6.32	6.35
TM01	Grès silici-calcique	Rte. mayens Riddes	5.16	5.35	5.50	5.64	5.72	5.88	5.98	6.13	6.19
MOL1	Grès très fin	Cologny, Genève	3.56	3.95	4.18	4.38	4.51	4.69	4.84	5.12	5.27
MOL2	Grès très fin	Cologny, Genève	3.79	4.09	4.31	4.37	4.51	4.70	4.86	5.08	5.24
MOL3	Grès très fin	Cologny, Genève	3.64	4.09	4.31	4.48	4.62	4.80	5.01	5.25	5.39
BA02	Gypse	Sembrancher	3.08	3.30	3.51	3.68	3.76	3.95	4.10	4.29	–
TM37	Gypse	Drône, Savièse	–	–	–	–	–	–	–	–	–
CS52	Gypse rubané	Staffelegg	–	–	–	–	–	–	–	–	–
IV04	Hornblendite	Riale Arca (rivière)	6.60	–	–	–	7.17	–	7.45	7.56	7.52
IV34	Kinzigite	Ponte Orchera	5.60	5.79	5.98	6.09	6.17	6.38	6.30	6.47	6.52
IV39	Kinzigite	Grampl	5.87	6.24	6.43	6.48	6.55	6.60	6.82	6.93	6.96
IV48	Kinzigite	Madonna del Boden	6.19	6.34	6.44	6.50	6.56	6.65	6.79	6.87	6.91
IV53	Kinzigite	Grampl (rivière)	5.02	5.44	5.63	5.73	5.84	5.99	5.94	6.06	6.09
IV54	Kinzigite	Grampl (rivière)	4.84	5.30	5.58	5.73	5.82	6.06	6.17	6.31	6.34
IV27A	Kinzigite mylonitisée,rétrogr.	Loro (sous l'église)	5.43	5.62	5.76	5.81	5.93	6.02	6.16	6.29	6.39
IV28	Kinzigite mylonitisée,rétrogr.	Loro	5.89	6.03	6.16	6.22	6.24	6.34	6.40	6.49	6.56
IV50	Mafique faciès amph./gra. myl.	Anzola carrière	6.70	6.81	6.87	6.92	6.90	6.94	6.96	7.02	7.06
IV51	Mafique faciès amph./gra. myl.	Anzola carrière	6.55	6.59	6.68	6.72	6.76	6.84	6.90	7.00	7.04
IV49	Mafique faciès amphib./granul.	Anzola carrière	6.85	6.92	6.95	6.97	6.98	7.03	7.06	7.14	7.16
IV19	Mafique mylonitisée, rétrogr.	Chioso (pont,après)	6.01	6.25	6.38	6.49	6.52	6.67	6.75	6.86	6.92
IV20	Mafique tectonisée, rétrogr.	Balmuccia (rivière)	6.35	6.42	6.47	6.50	6.52	6.57	6.62	6.64	6.65
IV10A	Mafique, f. à amphibolite sup.	Nibbio	5.22	–	–	–	6.41	–	6.86	7.10	6.64
IV10B	Mafique, f. à amphibolite sup.	Nibbio	5.35	5.63	5.87	6.10	6.28	6.53	6.77	6.94	7.06
JB10	Marbre	Malenco,Str.Franscia	5.35	5.94	6.36	6.62	6.80	7.03	7.17	7.32	7.36
JB27	Marbre	Ausserferrera	7.04	7.12	7.16	7.21	7.23	7.25	7.29	7.33	7.35
PF13	Marbre		6.62	6.65	6.76	6.84	6.88	6.94	6.95	6.99	7.01
PF4	Marbre		6.09	6.21	6.25	6.30	6.35	6.38	6.43	6.48	6.50
ST21	Marbre		5.77	6.13	6.43	6.67	6.81	7.00	7.15	7.25	7.29
TM29	Marbre	La Sarva, Saillon	6.41	6.43	6.43	6.44	6.44	6.46	6.49	6.51	6.53
JB03	Marbre blanc cristallisé	Crevadossola	5.57	6.17	6.57	6.81	6.96	7.21	7.29	7.40	7.47
ST20	Marbre dolomitique		7.13	7.29	7.40	7.57	7.68	7.80	7.93	7.99	8.06
ST22	Marbre dolomitique, Trias ?		5.30	6.00	6.47	6.78	6.92	7.07	7.23	7.28	7.33

P-wave velocity V_3 in km/s

CODE	Type of rock	Location	20Mpa	40Mpa	60Mpa	80Mpa	100Mpa	140MPa	200MPa	300MPa	400MPa
PF8	Marbre dolomitisé		6.51	6.69	6.82	6.87	6.97	7.02	7.12	7.17	7.27
JB04	Marbre gris bleu, rubané	Crevadossola	5.30	6.13	6.57	6.87	7.07	7.31	7.47	7.56	7.63
IV15	Marbre impur	Civiasco (après)	–	–	–	–	–	–	–	–	–
IV14	Marbre impur mylonitisé	Civiasco (après)	–	–	–	–	–	–	–	–	–
TM17	Marbre micacé	Martémo(Evolène)	5.65	5.82	5.96	6.04	6.07	6.14	6.22	6.30	6.35
CS65	Marbre sombre	Col de la Furka	–	–	–	–	–	–	–	–	–
JB15	Monzonite, peu déformée	Bernina	5.29	5.54	5.71	5.85	5.94	6.08	6.20	6.28	6.33
SS2	*Mylonite, Blasto-*	Simplon village	–	–	–	–	–	–	–	–	5.97
IV35	Paragneiss à biotite et plg.	Strona (rivière)	5.92	5.98	6.02	6.07	6.11	6.17	6.25	6.34	6.39
TM13	Pegmatite	Praz-Jean	4.94	5.36	5.64	5.83	5.93	6.07	6.18	6.27	6.34
IV17	Péridotite	Balmuccia (Carrière)	7.85	7.90	7.95	7.98	8.00	8.03	8.08	8.13	8.16
IV18	Péridotite	Balmuccia (Carrière)	8.17	8.28	8.31	8.30	8.39	8.41	8.39	8.44	8.47
IV26	Péridotite	Baldissero(Carrière)	8.12	8.29	8.38	8.47	8.51	8.57	8.60	8.63	8.63
IV31	Péridotite	Rio Inferno(rivière)	8.16	8.17	8.19	8.22	8.25	8.25	8.27	8.32	8.33
JB11	Péridotite	Malenco,Str.Franscia	7.15	7.17	7.19	7.21	7.23	7.25	7.27	7.34	7.36
JB13	Péridotite	Malenco,Str.Franscia	7.62	7.64	7.64	7.66	7.66	7.69	7.71	7.73	7.76
IV30	Péridotite, Kéliphyte	Rio Inferno(rivière)	7.90	8.02	8.06	8.16	8.13	8.18	8.23	8.29	8.29
PF16	Porphyre mylonitisé		4.92	5.31	5.55	5.73	5.85	6.01	6.13	6.22	6.27
PF10	Porphyre quartzitique		3.80	4.51	5.00	5.32	5.47	5.72	5.89	5.96	6.07
P2	Porphyre, type Lugano	Borgosesia (sort.SW)	–	–	–	–	–	–	–	–	5.51
PF14	Prasinite		6.25	6.47	6.63	6.77	6.85	6.96	7.10	7.23	7.27
VB	Prasinite	Val de Bagne	5.13	5.60	5.85	6.08	6.17	6.38	6.55	6.65	6.70
IV24	Pyroxénite	Balmuccia (Guaifola)	–	–	–	–	–	–	–	–	–
TM06	Quartzite	Rte. d'Annivers,Fang	4.73	5.11	5.36	5.55	5.65	5.78	5.89	5.99	6.03
JB31	Quartzite conglomératique	Illanz	4.99	5.31	5.49	5.63	5.70	5.81	5.91	5.98	6.02
TM05	Quartzite conglomératique	Combaneire(Dailley)	5.49	5.73	5.85	5.91	5.95	6.02	6.07	6.11	6.14
BA12	*Quartzite massif*	Lourtier	–	–	–	–	–	–	–	–	–
BA10	Quartzite schisteux	Champsec-Lourtier	5.07	5.52	5.72	5.84	5.91	5.99	6.08	6.11	6.16
BA11	Quartzite schisteux	Champsec-Lourtier	–	–	–	–	–	–	–	–	–
BA13	Quartzite schisteux	*Lourtier*	4.96	5.40	5.74	5.95	6.05	6.19	6.36	6.48	6.56
JB28	Quartzite, blanche	Avers Crôt	5.17	5.45	5.57	5.66	5.71	5.76	5.80	5.83	5.84
TM08	Quartzschist	Bevernec (Mase)	5.86	6.00	6.10	6.21	6.25	6.33	6.38	6.48	6.53
CS75	Radiolarite	Jaunpass S	–	–	–	–	–	–	–	–	–
IV38	Roche calcosilicatée	Route de Forno(p113)	6.39	6.57	6.69	6.82	6.86	7.03	7.16	7.28	7.33
BA03	Schiste (Argil., mét.)	Sembrancher	6.42	6.48	6.60	6.64	6.66	6.79	6.82	6.92	6.96
ST10	Schiste noir	Car. Lungwurm	5.62	5.92	6.03	6.18	6.26	6.38	6.46	6.59	6.59

P-wave velocity V_3 in km/s

CODE	Type of rock	Location	20Mpa	40Mpa	60Mpa	80Mpa	100Mpa	140MPa	200MPa	300MPa	400MPa
TM20	Schiste vert, Greenschist	Les Haudères	5.00	5.40	5.71	5.86	6.12	6.34	6.55	6.71	6.75
BA15	Schiste, Mica-	Lourtier-Fionnay	5.78	6.00	6.16	6.24	6.31	6.43	6.53	6.58	6.61
TM10	Schiste, Mica-, à albite	Praz-Jean	5.16	5.64	5.89	6.05	6.16	6.38	6.48	6.60	6.65
JB12	Serpentinite	Rte. de Franscia	–	–	–	–	–	–	–	–	–
JB22	Serpentinite	Lac de Sils	6.26	6.29	6.31	6.33	6.33	6.34	6.37	6.41	6.44
ST15	Serpentinite		7.41	7.47	7.47	7.50	7.52	7.54	7.56	7.59	7.61
ST16	Serpentinite		6.98	7.02	7.04	7.06	7.06	7.08	7.10	7.12	7.14
TM22	Serpentinite		5.94	6.00	6.03	6.06	6.08	6.11	6.15	6.18	6.21
CS57	Siltite à ciment calc.(flysch)	Klausen-Strasse	–	–	–	–	–	–	–	–	–
IV43	Stronalite	Piana di Forno	5.61	5.76	5.92	5.99	6.08	6.25	6.37	6.47	6.56
IV44	Stronalite	Piana di Forno	7.38	7.61	7.73	7.91	7.97	8.00	8.24	8.35	8.40
IV52	Stronalite	Piana di Forno	6.62	6.86	6.94	7.04	7.09	7.25	7.14	7.32	7.34
IV32	Stronalite mylonitisée	Carrière d'Anzola	6.31	6.44	6.47	6.56	6.62	6.70	6.79	6.88	6.92
IV33	Stronalite mylonitisée	Carrière d'Anzola	6.16	6.26	6.34	6.47	6.53	6.62	6.71	6.82	6.86
IV46	Stronalite mylonitisée	Forno (village,sud)	6.60	6.82	6.89	7.00	7.02	7.18	7.23	7.33	7.35
SL2	Syénite de Biella	Balma (Carrière)	–	–	–	–	–	–	–	–	6.53
JB08	Tonalite	San Martino	4.73	5.43	5.68	5.95	6.08	6.25	6.37	6.49	6.52

APPENDIX V

Rock type and thermal conductivities

Thermal Conductivity (in W/m.K)

CODE	TYPE OF ROCK	LOCATION	k_{ndry}	$S.D._{ndry}$	k_{pdry}	$S.D._{pdry}$	k_{nsat}	$S.D._{nsat}$	k_{psat}	$S.D._{psat}$	A_{dry}	A_{sat}
JB20	Amphibolite	Zemez	2.341	0.010	2.693	0.015	2.438	0.017	2.820	0.014	1.15	1.16
TM02	Brèche calcaro-dolomitique	Gravelone(Sion)	3.591	0.009	3.744	0.007	4.026	0.010	4.041	0.013	1.04	1.00
CS73	Brèche,-Micro, dolomitique	Manneberg	2.836	0.016	4.341	0.010	4.024	0.063	4.313	0.008	1.53	1.07
CS79	Brèche,-Micro, dolomitique	Charmey	3.098	0.008	3.122	0.007	3.269	0.016	3.553	0.034	1.01	1.09
JB24	Brèche, Micro-	Thusis	4.234	0.039	5.202	0.051	5.016	0.052	5.866	0.196	1.23	1.17
CS69	Calcaire	Carrière Audonces	3.297	0.037	3.496	0.022	3.952	0.059	3.985	0.022	1.06	1.01
CS86	Calcaire	Rondchâte	3.102	0.022	3.121	0.040	3.286	0.007	3.319	0.120	1.01	1.01
JB23	Calcaire	Surs	3.206	0.017	3.901	0.031	3.401	0.058	4.156	0.051	1.22	1.22
JB33	Calcaire	Vals, Piedm Strasse	2.560	0.011	2.554	0.014	2.755	0.011	2.858	0.009	1.00	1.04
JB17	Calcaire à tumachelles	Bernina	2.848	0.003	2.887	0.025	2.897	0.010	2.936	0.039	1.01	1.01
TM27	Calcaire bioclastique	Magnot	3.175	0.008	3.214	0.018	3.220	0.018	3.307	0.008	1.01	1.03
CS53	Calcaire biodétritique	Asp	3.719	0.023	3.656	0.006	3.718	0.235	3.763	0.084	0.98	1.01
CS82	Calcaire calcarénite	Rondchâte	2.331	0.097	2.493	0.016	2.554	0.028	2.628	0.011	1.07	1.03
CS71	Calcaire dolomitique	Gérignoz	2.706	0.001	2.736	0.005	2.757	0.023	2.849	0.004	1.01	1.03
JB19	Calcaire fin	Livigno	4.384	0.037	4.413	0.049	4.780	0.045	4.793	0.022	1.01	1.00
CS77	Calcaire glumeleux	Le Brésil, Jaun	2.495	0.010	2.598	0.005	2.477	0.013	2.640	0.035	1.04	1.07
CS66	Calcaire Mameux	Pontenet	2.004	0.004	2.274	0.003	2.221	0.010	2.390	0.010	1.13	1.08
CS61	Calcaire massif biodétritique	Nestal	3.198	0.018	3.223	0.017	3.238	0.007	3.250	0.012	1.01	1.00
CS62	Calcaire micritique	Obersee-Strasse	2.914	0.006	2.987	0.028	2.966	0.005	2.954	0.006	1.02	1.00
CS78	Calcaire micritique	Le Brésil, Jaun	2.820	0.202	2.940	0.012	3.037	0.002	3.069	0.009	1.04	1.01
CS85	Calcaire micritique	Rondchâte	3.016	0.008	3.049	0.017	3.078	0.008	3.146	0.008	1.01	1.02
TM33	Calcaire micritique	Prabé	3.090	0.010	3.210	0.012	3.244	0.024	3.302	0.039	1.04	1.02
CS55	Calcaire micritique schisteux	Tierfeld	3.083	0.012	3.656	0.006	3.207	0.052	3.190	0.007	1.19	0.99
CS50	Calcaire oolithique	Staffelegg	2.828	0.017	2.781	0.009	2.824	0.012	2.822	0.013	0.98	1.00
CS83	Calcaire oolitique	Rondchâte	2.233	0.009	2.292	0.008	2.857	0.006	2.876	0.009	1.03	1.01
CS76	Calcaire pélagique	Jaunpass N	2.779	0.008	2.843	0.010	2.841	0.006	3.007	0.014	1.02	1.06
CS74	Calcaire pélagique à silex	Ried /Jaunpass	2.724	0.008	2.737	0.003	2.957	0.029	3.384	0.008	1.00	1.14
CS84	Calcaire récifal	Rondchâte	2.700	0.018	2.850	0.015	2.769	0.005	2.936	0.015	1.06	1.06
CS63	Calcaire siliceux	Obersee-Strasse	3.065	0.013	3.009	0.020	3.075	0.032	3.094	0.076	0.98	1.01
TM26	Calcaire siliceux bioclastique	L'Ardève, Leytron	2.946	0.008	4.156	0.100	4.872	0.083	5.157	0.058	1.41	1.06
CS58	Calcaire sombre siliceux	Klausen-Strasse	3.525	0.002	3.720	0.039	3.807	0.111	3.972	0.019	1.06	1.04
CS68	Calcaire spathique	Carrière Chlètres	3.006	0.008	3.267	0.010	3.045	0.014	3.424	0.192	1.09	1.12
JB29	Calcschiste	Avers Cresta	1.900	0.004	3.336	0.002	3.088	0.017	4.067	0.030	1.76	1.32

Thermal Conductivity (in W/m.K)

CODE	TYPE OF ROCK	LOCATION	k_{ndry}	$S.D._{ndry}$	k_{pdry}	$S.D._{pdry}$	k_{nsat}	$S.D._{nsat}$	k_{psat}	$S.D._{psat}$	A_{dry}	A_{sat}
JB25	Conglomérat	Sufers	2.576	0.005	2.710	0.025	3.775	0.008	4.003	0.056	1.05	1.06
JB35	Conglomérat	Oberalppass	2.509	0.017	2.709	0.007	3.618	0.163	3.764	0.040	1.08	1.04
CS64	Conglomérat (molasse)	Niederurnen	3.238	0.046	3.199	0.021	3.690	0.006	3.490	0.022	0.99	0.95
JB32	Conglomérat calcaire	Vals-Strasse	2.458	0.011	2.501	0.013	2.858	0.009	2.890	0.082	1.02	1.01
JB16	Dolomie	Bernina	4.997	0.038	5.094	0.058	5.358	0.052	5.535	0.085	1.02	1.03
TM25	Dolomie	Drône, Savièse	4.217	0.047	4.512	0.048	4.988	0.027	5.143	0.088	1.07	1.03
JB30	Eclogite	Avers Cresta	2.294	0.018	2.528	0.018	2.773	0.006	3.072	0.018	1.10	1.11
TM21	Gabbro, méta-	La Forclaz	2.613	0.007	2.687	0.010	3.014	0.011	3.069	0.005	1.03	1.02
JB26	Gneiss	Ausserferrera	2.594	0.009	3.222	0.014	3.315	0.027	3.920	0.035	1.24	1.18
JB34	Gneiss	Sedrun	2.746	0.005	3.152	0.036	3.537	0.067	4.008	0.234	1.15	1.13
JB36	Gneiss (Granite)	Gottardpass	2.324	0.009	2.483	0.007	3.377	0.023	3.592	0.109	1.07	1.06
JB14	Gneiss (Kinzigite)	Chiareggio	2.580	0.008	2.839	0.018	3.607	0.011	4.315	0.069	1.10	1.20
JB01	Gneiss fin très déformé	Val Isorno	2.440	0.018	2.847	0.022	3.168	0.003	3.786	0.029	1.17	1.19
JB02	Gneiss grossier	*Crevadossola*	2.708	0.018	3.004	0.009	3.511	0.028	3.942	0.033	1.11	1.12
JB21	Gneiss oeillé	Zermez	2.925	0.010	3.608	0.015	3.722	0.017	4.552	0.042	1.23	1.22
JB06	Gneiss schisteux	Premia	1.479	0.011	2.335	0.027	2.840	0.020	4.378	0.043	1.58	1.54
JB18	Gneiss schisteux	Bernina	2.938	0.005	3.115	0.029	3.575	0.028	3.655	0.013	1.06	1.02
JB07	Gneiss sombre à hornblende	San Martino	2.083	0.007	2.336	0.009	2.364	0.017	2.588	0.004	1.12	1.10
TM23	Gneiss, Ortho-, mylonitique	Ferpècle	2.921	0.006	3.243	0.006	3.809	0.032	3.864	0.025	1.11	1.01
JB09	Granodiorite	San Martino	2.123	0.007	nd		2.782	0.022	nd			
CS80	Grès	Barrage de Rossens	1.559	0.009	1.692	0.003	3.230	0.064	3.415	0.011	1.09	1.06
CS81	Grès	Rondchâte	2.272	0.007	2.304	0.002	2.492	0.022	2.531	0.036	1.01	1.02
CS67	Grès calcaire	Tavannes	1.981	0.007	2.198	0.003	2.340	0.015	2.440	0.007	1.11	1.04
CS72	Grès calcaire		2.836	0.016	3.058	0.023	2.863	0.012	3.056	0.017	1.08	1.07
CS56	Grès charboneux (flysch)	Klausen-Strasse	2.250	0.007	3.862	0.019	2.724	0.008	3.928	0.016	1.72	1.44
CS70	Grès du flysch	Rte. des Mosses	3.320	0.013	3.582	0.016	3.271	0.043	3.632	0.012	1.08	1.11
CS54	Grès rouge	Gausingen	1.601	0.006	1.674	0.005	2.550	0.017	2.575	0.036	1.05	1.01
CS60	Grès rouge	Elm-Strasse	2.822	0.035	2.947	0.023	3.756	0.096	4.026	0.138	1.04	1.07
TM01	Grès silici-calcique	Rte. mayens Riddes	3.114	0.013	nd		4.164	0.079	nd			
TM37	Gypse	Drône, Savièse	1.082	0.017	1.217	0.069	1.383	0.007	1.446	0.005	1.12	1.05
CS52	Gypse rubané	Staffelegg	1.325	0.002	1.345	0.003	1.669	0.246	2.761	0.796	1.01	1.65
JB10	Marbre	Malenco,Str.Franscia	4.104	0.024	4.347	0.037	5.442	0.024	5.567	0.091	1.06	1.02
JB27	Marbre	Ausserferrera	5.759	0.030	6.034	0.035	5.891	0.068	6.077	0.076	1.05	1.03

Thermal Conductivity (in W/m.K)

CODE	TYPE OF ROCK	LOCATION	k_{ndry}	S.D.$_{ndry}$	k_{pdry}	S.D.$_{pdry}$	k_{nsat}	S.D.$_{nsat}$	k_{psat}	S.D.$_{psat}$	A_{dry}	A_{sat}
TM29	Marbre	La Sarva, Saillon	2.742	0.004	2.909	0.013	2.814	0.035	3.095	0.121	1.06	1.10
JB03	Marbre blanc cristallisé	Crevadossola	3.897	0.032	4.172	0.010	5.346	0.154	5.466	0.071	1.07	1.02
JB04	Marbre gris bleu, rubané	Crevadossola	3.925	0.027	4.394	0.010	5.331	0.017	5.681	0.000	1.12	1.07
TM17	Marbre micacé	Martémo(Evolène)	3.243	0.020	3.591	0.036	3.502	0.014	3.971	0.023	1.11	1.13
CS65	Marbre sombre	Col de la Furka	2.487	0.013	2.713	0.011	2.608	0.002	2.747	0.024	1.09	1.05
JB15	Monzonite, peu déformée	Bernina	2.991	0.020	2.992	0.038	3.259	0.012	3.346	0.014	1.00	1.03
TM13	Pegmatite	Praz-Jean	3.693	0.000	3.746	0.020	4.934	0.031	4.624	0.023	1.01	0.94
JB11	Péridotite	Malenco,Str.Franscia	2.669	0.016	nd		2.820	0.022	nd			
JB13	Péridotite	Malenco,Str.Franscia	3.245	0.012	nd		3.316	0.035	nd			
TM06	Quartzite	Rte. d'Annivers,Fang	5.005	0.104	5.678	0.046	6.858	0.079	6.869	0.092	1.13	1.00
JB31	Quartzite conglomératique	Illanz	2.390	0.017	2.559	0.030	3.246	0.013	3.384	0.029	1.07	1.04
TM05	Quartzite conglomératique	Combaneire(Dailley)	4.881	0.030	5.772	0.050	6.104	0.135	6.614	0.093	1.18	1.08
JB28	Quartzite, blanche	Avers Crôt	5.594	0.084	5.834	0.053	7.863	0.350	8.438	0.147	1.04	1.07
TM08	Quartzschist	Bevernec (Mase)	2.989	0.023	4.436	0.011	3.561	0.023	4.875	0.031	1.48	1.37
CS75	Radiolarite	Jaunpass S	3.989	0.015	4.217	0.010	3.910	0.018	4.360	0.019	1.06	1.12
TM20	Schiste vert, Greenschist	Les Haudères	2.042	0.003	2.543	0.008	2.770	0.013	3.114	0.046	1.25	1.12
TM10	Schiste, Mica-, à albite	Praz-Jean	2.169	0.018	3.265	0.004	2.962	0.014	4.055	0.016	1.51	1.37
JB12	Serpentinite	Rte. de Franscia	3.073	0.005	3.110	0.012	4.458	0.098	5.888	0.055	1.01	1.32
JB22	Serpentinite	Lac de Sils	2.799	0.015	2.869	0.022	2.817	0.010	2.823	0.013	1.02	1.00
TM22	Serpentinite		2.395	0.012	2.456	0.007	2.417	0.006	2.451	0.026	1.03	1.01
CS57	Siltite à ciment calc.(flysch)	Klausen-Strasse	2.782	0.042	2.564	0.018	2.925	0.028	2.870	0.047	0.92	0.98
JB08	Tonalite	San Martino	2.133	0.004	2.459	0.018	2.518	0.092	2.798	0.039	1.15	1.11

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k_{ndry}, k_{nsat}	thermal conductivity perpendicular to layering or bedding in dry or in saturated state respectively
k_{pdry}, k_{psat}	thermal conductivity parallel to layering or bedding in dry or saturated state
nd	not determined
S.D.$_{ndry}$, S.D.$_{nsat}$	standard deviation of k_{ndry} or k_{nsat}
S.D.$_{pdry}$, S.D.$_{psat}$	standard deviation of k_{pdry} or k_{psat}
A_{dry}	thermal conductivity anisotropy in dry state
A_{sat}	thermal conductivity anisotropy in saturated state

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