

LITHO\_BOOK  
SPECIMEN\_BOOK  
TOOL\_BOOK  
SCIENTIFIC\_BOOK  
DESIGNER\_BOOK  
ARTIST\_BOOK  
WRITING\_BOOK  
PATTERN\_BOOK  
STORY\_BOOK

## /LITHOLOGY

The lithology of a rock unit is a description of its physical characteristics visible at outcrop, in hand or core samples or with low magnification microscopy, such as colour, texture, grain size, or composition. It may be either a detailed description of these characteristics or be a summary of the gross physical character of a rock. It is the basis of subdividing rock sequences into individual lithostratigraphic units for the purposes of mapping and correlation between areas.

The patterns displayed here are [lithologic patterns](#), usually reserved for use on stratigraphic columns, sections, or charts in geological graphics. These patterns has been found in the FGDC Digital Cartographic Standard for Geologic Map Symbolization, prepared in cooperation with the Geologic Data Subcommittee of the Federal Geographic Data Committee by the U.S. Geological Survey, 2006.

### 37—LITHOLOGIC PATTERNS

[Lithologic patterns are usually reserved for use on stratigraphic columns, sections, or charts]

#### 37.1—Sedimentary-rock lithologic patterns

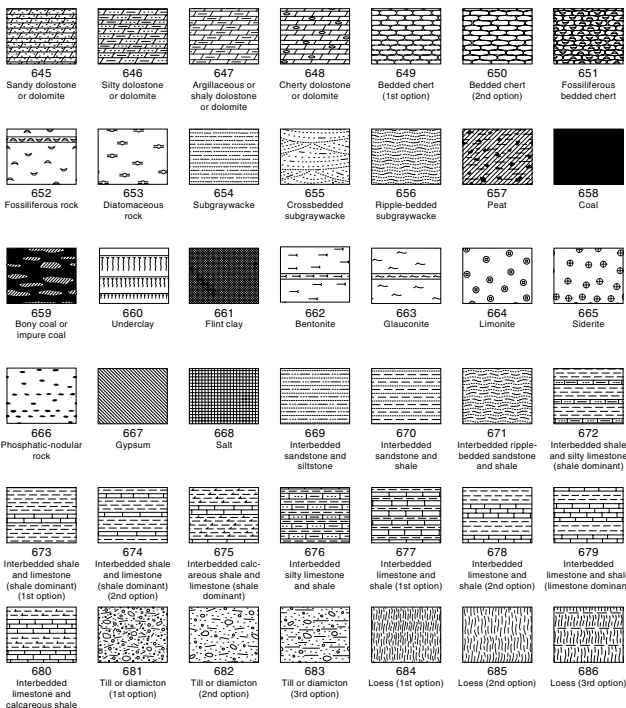
601 Gravel or conglomerate (1st option)	602 Gravel or conglomerate (2nd option)	603 Crossbedded gravel or conglomerate	605 Breccia (1st option)	606 Breccia (2nd option)	607 Massive sand or sandstone	608 Bedded sand or sandstone
609 Crossbedded sand or sandstone (1st option)	610 Crossbedded sand or sandstone (2nd option)	611 Ripple-bedded sand or sandstone	612 Argillaceous or shaly sandstone	613 Calcareous sandstone	614 Dolomitic sandstone	616 Silt, siltstone, or shaly silt
617 Calcareous siltstone	618 Dolomitic siltstone	619 Sandy or silty shale	620 Clay or clay shale	621 Cherty shale	622 Dolomitic shale	623 Calcareous shale or marl
624 Carbonaceous shale	625 Oil shale	626 Chalk	627 Limestone	628 Clastic limestone	629 Fossiliferous clastic limestone	630 Nodular or irregularly bedded limestone
631 Limestone, irregular (burrow?) fillings of saccharoidal dolomite	632 Crossbedded limestone	633 Cherty crossbedded limestone	634 Cherty and sandy crossbedded clastic limestone	635 Oolitic limestone	636 Sandy limestone	637 Silty limestone
638 Argillaceous or shaly limestone	639 Cherty limestone (1st option)	640 Cherty limestone (2nd option)	641 Dolomitic limestone, limy dolostone, or limy dolomite	642 Dolostone or dolomite	643 Crossbedded dolostone or dolomite	644 Oolitic dolostone or dolomite

\*For more information, see general guidelines on pages A-i to A-v.

### 37—LITHOLOGIC PATTERNS (continued)

[Lithologic patterns are usually reserved for use on stratigraphic columns, sections, or charts]

#### 37.1—Sedimentary-rock lithologic patterns (continued)

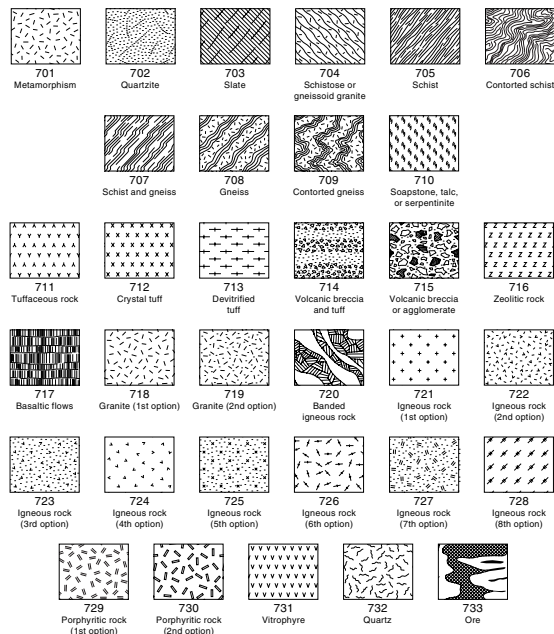


\*For more information, see general guidelines on pages A-1 to A-v.

### 37—LITHOLOGIC PATTERNS (continued)

[Lithologic patterns are usually reserved for use on stratigraphic columns, sections, or charts]

#### 37.2—Metamorphic-rock, igneous-rock, and vein-matter lithologic patterns

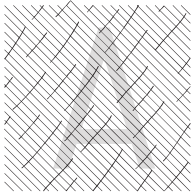


\*For more information, see general guidelines on pages A-1 to A-v.

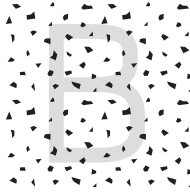
# /TYPEFACE

Litho Typeface est une police de caractères basé sur les motifs lithologiques utilisés par les géologues américains. Les matières principales correspondent à un glyphe qui leur est propre. La Litho transforme les motifs scientifiques conventionnels en véritable écriture digitale et en propose une relecture. Dans l'hypothèse de l'Anthropocène, quels genre de motifs laisse(ra) l'homme dans les couches terrestres futures? Que se passe-t-il typographiquement si ces couches se plient, se détachent, se recombinent, se tordent?

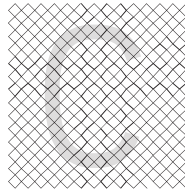




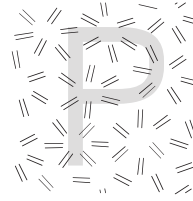
Slate



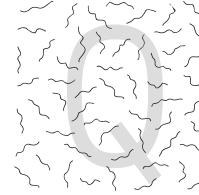
Breccia



Flint Clay



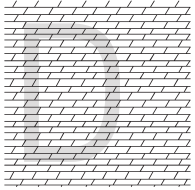
Porphyritic rock



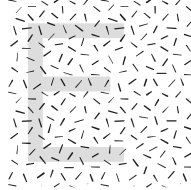
Quartz



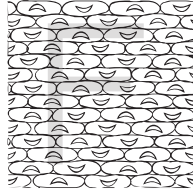
Interbedded  
sandstone and  
siltstone



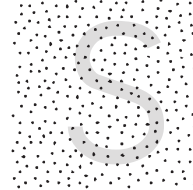
Dolomitic limestone



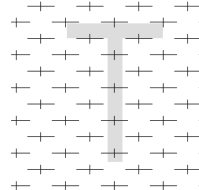
Granite



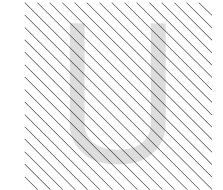
Folissiferous  
bedded chert



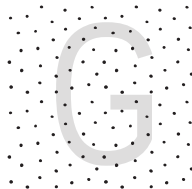
Sand  
or sandstone



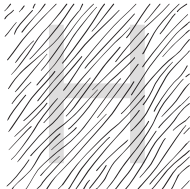
Devitrified  
tuff



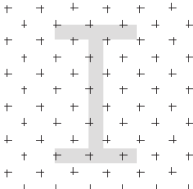
Gypsum



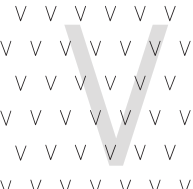
Gravel



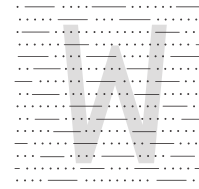
Schist



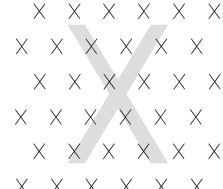
Igneous rock



Vitrophyre



Subgraywacke



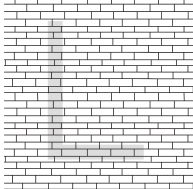
Crystal tuff



Gneiss



Coal



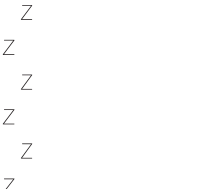
Limestone



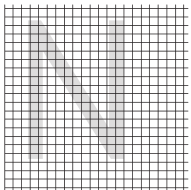
Tuffaceous rock



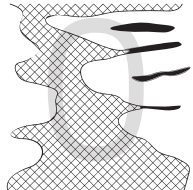
Zeolitic rock



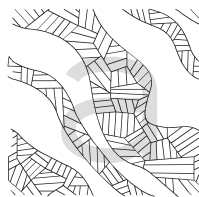
Metamorphism



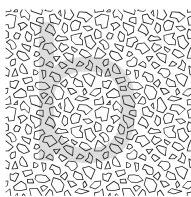
Salt



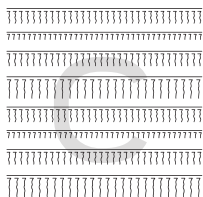
Ore



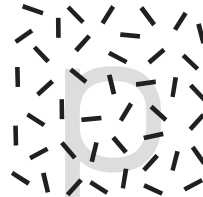
Banded  
igneous rock



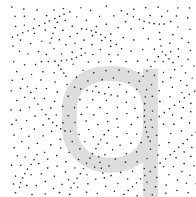
Breccia  
(2<sup>nd</sup> option)



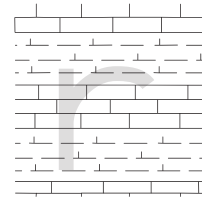
Underclay



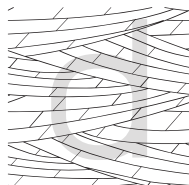
Porphyritic rock  
(2<sup>nd</sup> option)



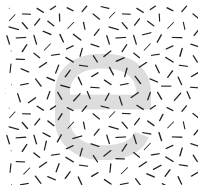
Quartzite



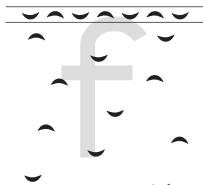
Inter. limestone  
and calcareous shale



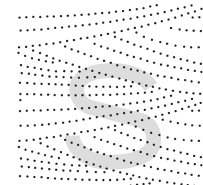
Crossbedded  
dolostone



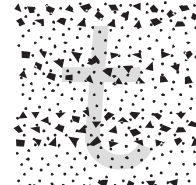
Granite  
(2<sup>nd</sup> option)



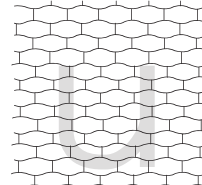
Fossiliferous  
rock



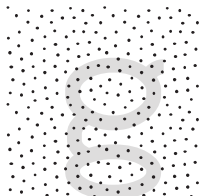
Crossbedded sand  
or sandstone



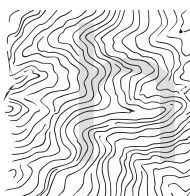
Volcanic breccia  
and tuff



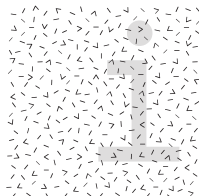
Irregularly  
bedded limestone



Gravel  
(2<sup>nd</sup> option)



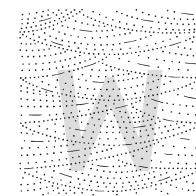
Contorted  
schist



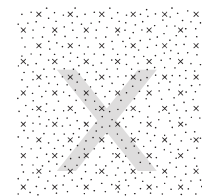
Igneous rock  
(2<sup>nd</sup> option)



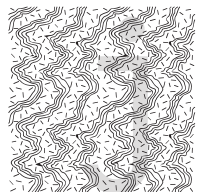
Volcanic breccia  
or agglomerate



Crossbedded  
subgraywacke



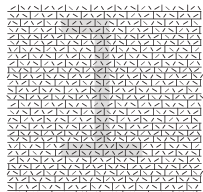
Igneous rock  
(5<sup>th</sup> option)



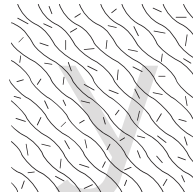
Contorted  
gneiss



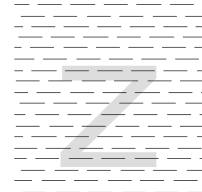
Bony coal  
or impure coal



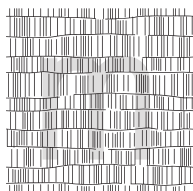
Clastic  
limestone



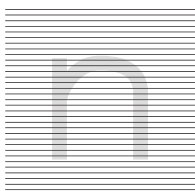
Schistose or  
gneissoid granite



Clay  
or clay shale



Basaltic flows



Carbonaceous  
shale



Oil shale

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Established by Office of Management and Budget Circular A-16, the Federal Geographic Data Committee (FGDC) promotes the coordinated development, use, sharing, and dissemination of geographic data.

FGDC subcommittees work on issues related to data categories coordinated under the circular. Subcommittees establish and implement standards for data content, quality, and transfer; encourage the exchange of information and the transfer of data; and organize the collection of geographic data to reduce duplication of effort. Working groups are established for issues that transcend data categories.



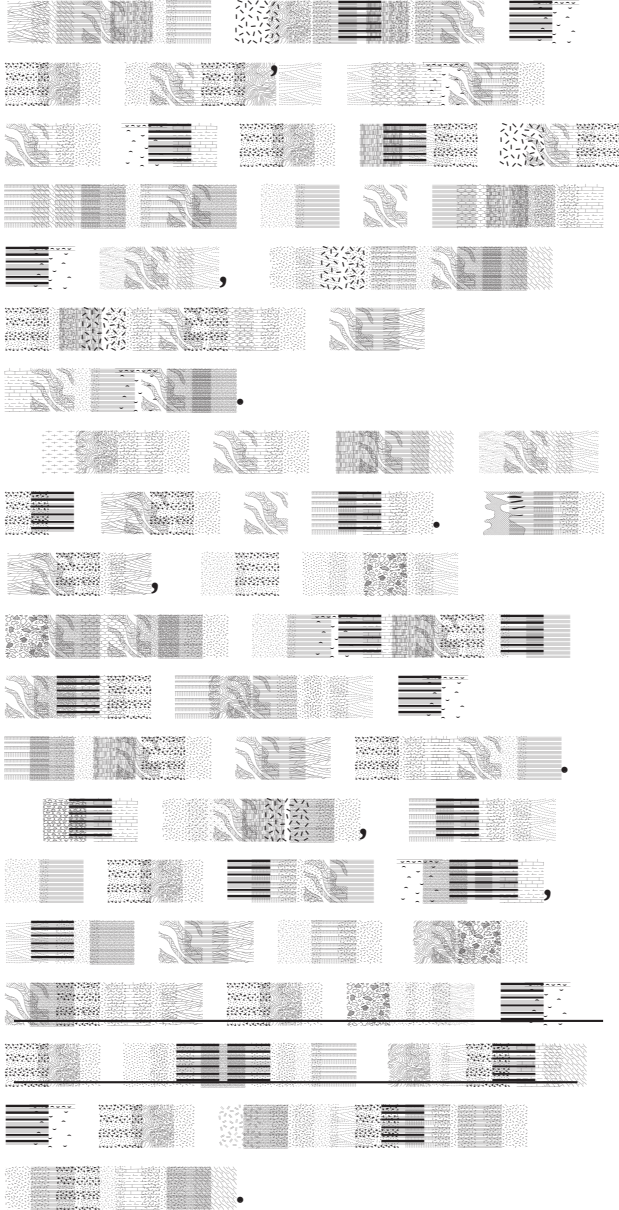
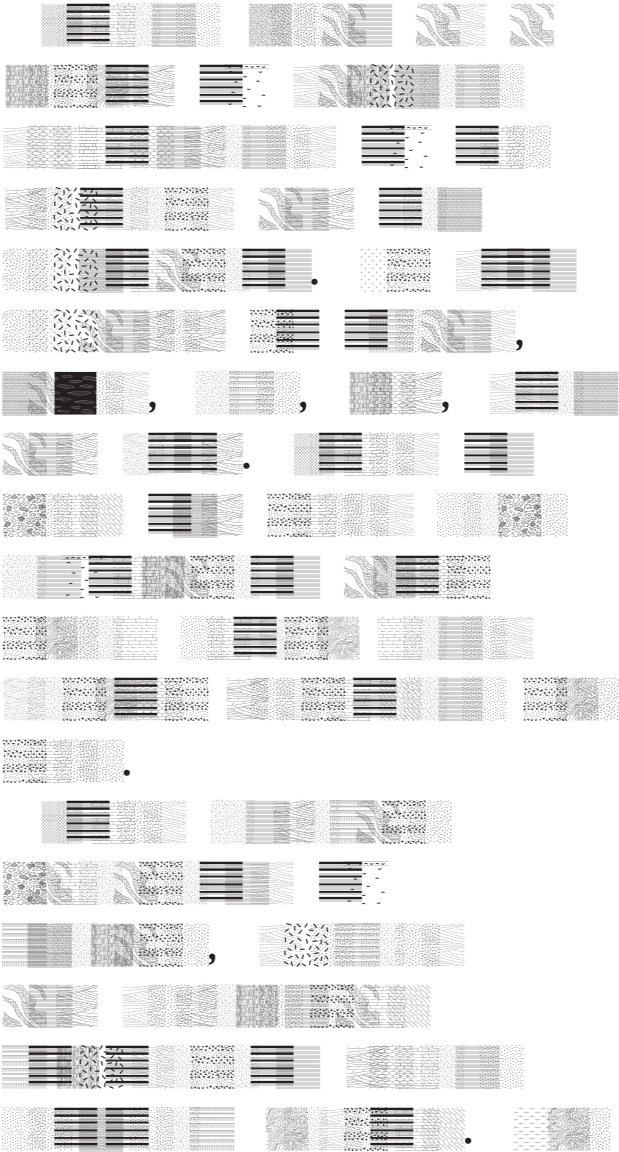
Coring began as a method of sampling surroundings of ore deposits and oil exploration. It soon expanded to oceans, lakes, ice, mud, soil and wood. Cores on very old trees give information about their growth rings without destroying the tree.

Cores indicate variations of climate, species and sedimentary composition during geologic history. The dynamic phenomena of the Earth's surface are for the most part cyclical in a number of ways, especially temperature and rainfall.

There are many ways to date a core. Once dated, it gives valuable information about changes of climate and terrain.

For example, cores in the ocean floor, soil and ice have altered the view of the geologic history of the Pleistocene entirely.







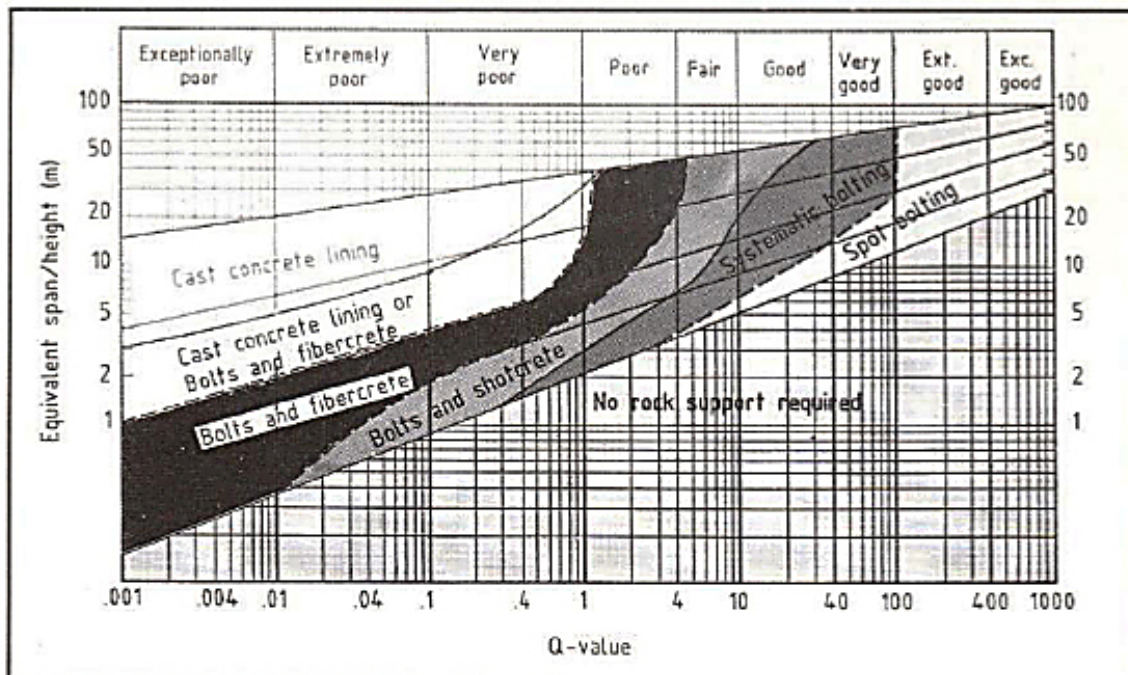
# GEOTECHNICAL DESIGN

Figure 1. Synthesis of Q-system tunnel support recommendations updated to include fibre-reinforced shotcrete (after Grimstad et al 1986).

The rapid development of Norway's hydroelectric potential during the 1970s and early 80s, and major road tunnels during recent years, has had a significant influence on tunnel design work undertaken by the Norwegian Geotechnical Institute (NGI). Field investigations for some 1,200 km of tunnels, support design for 900 km and construction supervision for 600 km (both drill-and-blast and tunnel-boring machine) have set their mark on both the level of experience and on the design methods developed at NGI.

Norwegian tunnels are beset by diverse problems during drilage, such as occasional major water inflows, stress-induced slabbing and rockbursting, unstable clay-bearing jointed rock with notable joint persistence, major faulting and zones of severe swelling clay. This great variability is reflected in the huge numerical range of rock qualities (from 0.001 to 1000), described in the NGI Q-system now used worldwide. Figure 1 shows a recent (1986) update and a new feature - 'S(fr)'.

## Q-SYSTEM B AND S(FR) REINFORCEMENT



Moreover, the initially unreinforced shotcrete gives poor protection to mesh-fixing personnel.

In poor ground, or in a major excavation such as the 60m span Olympic ice-hockey cavern to be described later, it is usual to check the performance of the B + S(fr) support by convergence measurements or by MPBX extensometer installation. B + S(fr) has been used for at least a decade and gives superior advance rates and personnel safety. It is also the major component of final rock support in large caverns and tunnels through difficult ground.

## ROCK MASS VARIABILITY

To those familiar with the Q-system method of rock-mass classification<sup>2</sup> the following six numbers (selected from hundreds of thousands of alternative combinations) communicate a

data can be combined with subsequent data, and manipulated in PC-based spreadsheet format. In the case of the ice-hockey cavern cited earlier, sets of histograms were produced from preliminary mapping in existing, nearby excavations, and subsequently combined with the results of Q-logging of 250-m of drill core<sup>3</sup>. This data base provided cavern support designers with preliminary indications of rock reinforcement needs. The system has since been used for mapping the distribution of Q-values in the arch of the huge cavern and confirming the prognoses obtained from geophysical studies. These studies are described later.

## PREDICTING ADVANCE RATES

Experiences in using the Q-system within NGI...

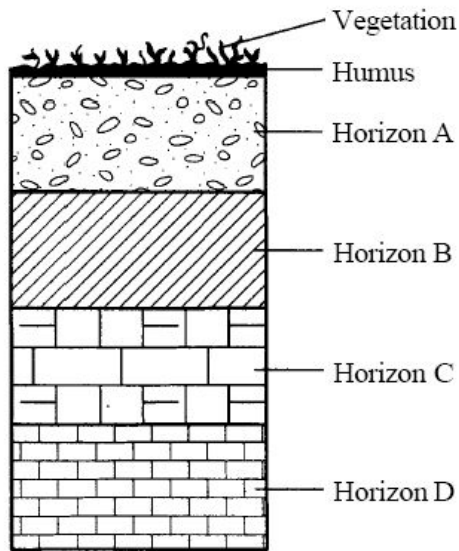
Nature abhors  
a straight  
line.



Lithography is a method of printing originally based on the immiscibility of oil and water. The printing is from a stone (lithographic limestone) or a metal plate with a ball grained surface. It was invented in 1796 by German author and actor Alois Senefelder as a cheap method of publishing theatrical works. Lithography can be used to print text or artwork onto paper or other suitable material.

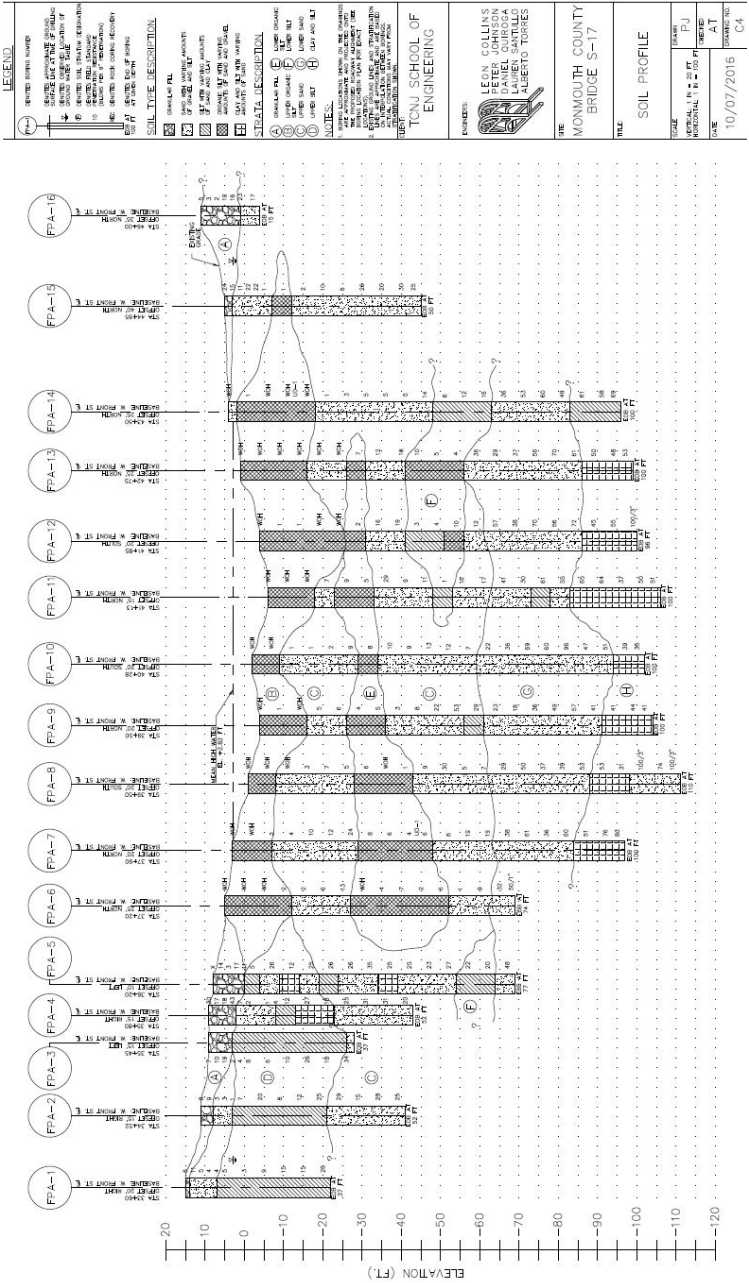
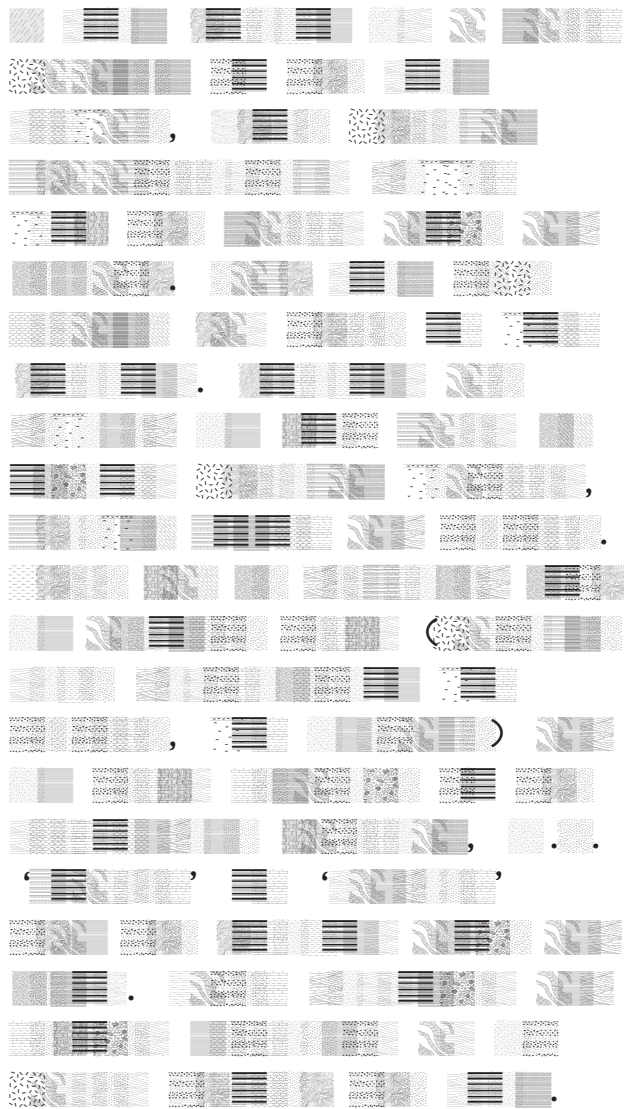
Lithography originally used an image drawn with oil, fat, or wax onto the surface of a smooth, level lithographic limestone plate. The stone was treated with a mixture of acid and gum arabic, «etching» the grease content of the drawing material into the pores of the stone and chemically

creating grease reservoirs. The open stone (without drawing) was affected by the gum arabic creating a thin gum layer that would then attract water. When the stone was subsequently moistened, these gummed areas retained water; an oil-based ink could then be applied with a roller sticking only to the original drawing. The ink would finally be transferred to a cotton fine art paper sheet, producing a printed page. This traditional technique is still used as a fine art medium today.



A soil horizon is a layer parallel to the soil surface, whose physical characteristics differ from the layers above and beneath. Each soil type usually has three or four horizons. Horizons are defined in most cases by obvious physical features, chiefly colour and texture. These may be described both in absolute terms (particle size distribution for texture, for instance) and in terms relative to the surrounding material, i.e. 'coarser' or 'sandier' than the horizons above and below. Water dissolves and removes nutrients as it passes through the soil.

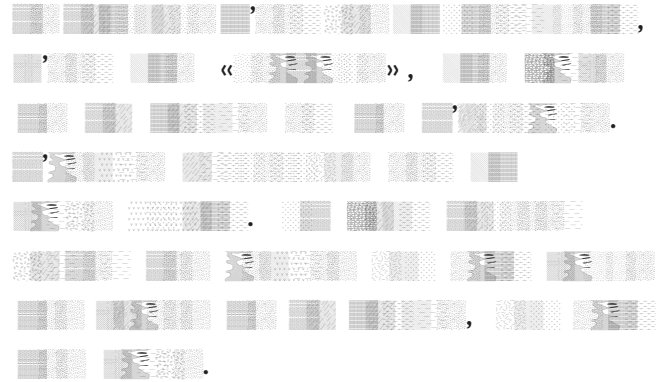






LE LANGUAGE N'EST PAS UN INSTRUMENT,  
C'EST UNE «GÉOLOGIE», UNE FORCE  
DE LA NATURE ET DE L'HISTOIRE.  
L'ŒUVRE ARTISTIQUE EST UN CORPS  
VIVANT. IL FAUT LAISSER PARLER  
LES ŒUVRES QUI SONT COMME DES CHOSES  
DE LA NATURE, QUI SONT DES CORPS.

- HENRI BAUCHAU



20pt

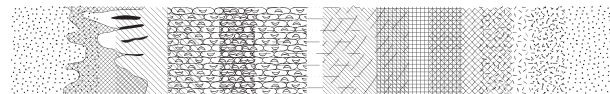
approche 380pt

32pt

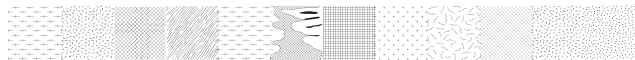
approche 0pt



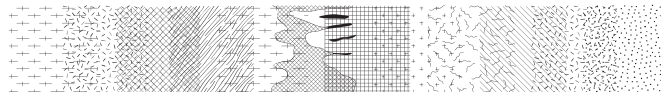
SOUFFRANCES



SOUFFRANCES



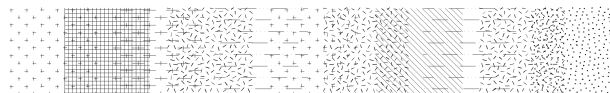
TECHTONIQUES



TECHTONIQUES



INTERIEURES

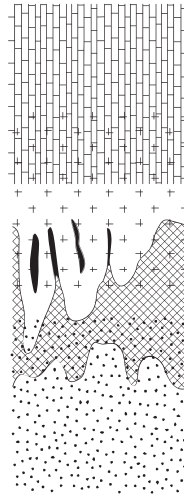


INTERIEURES

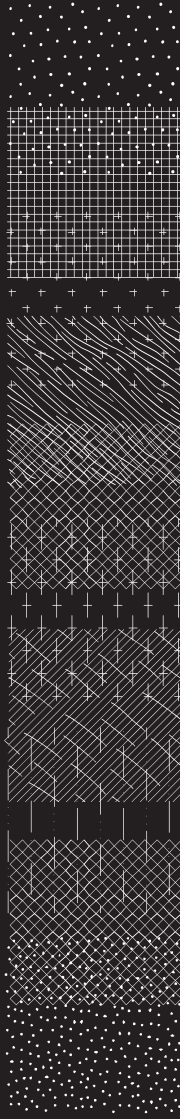
# DIGGING



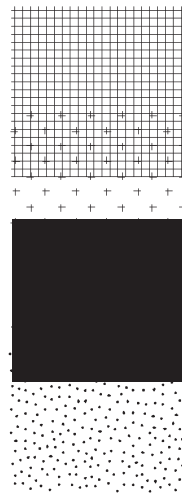
# SOIL



# SCRATCHING



# SKIN

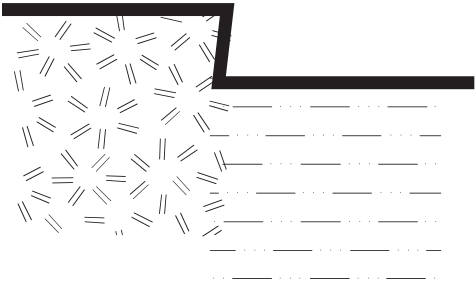
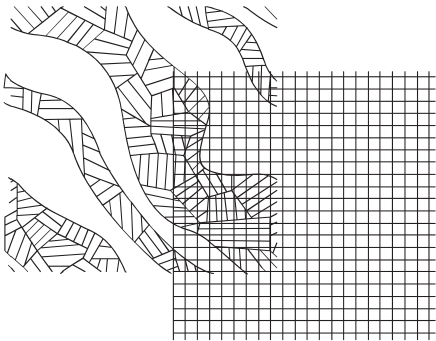
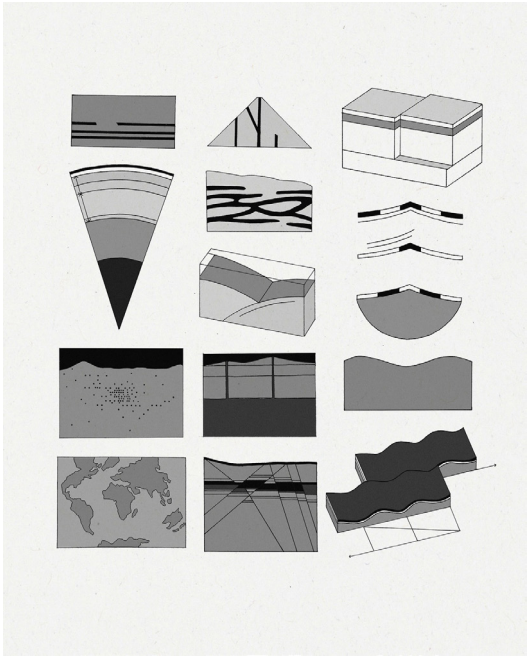








## ETUDE DE PLIS



DECALAGE

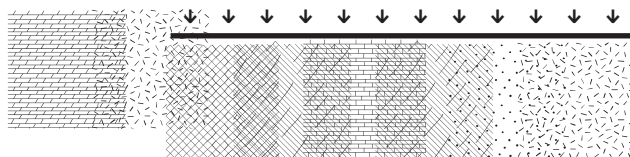
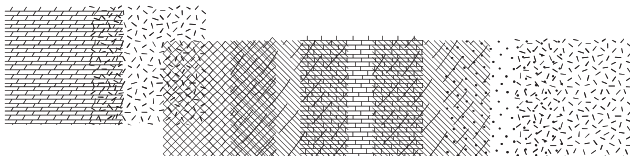
DISCORDANCE

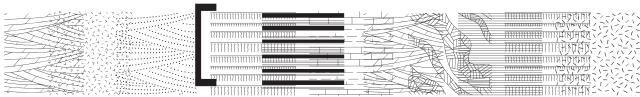
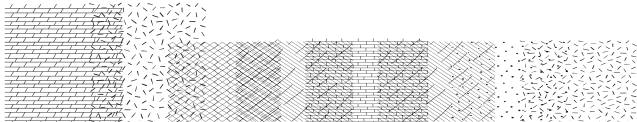
DISSONANCE

DISTORTION

RUPTURE

ESPACE

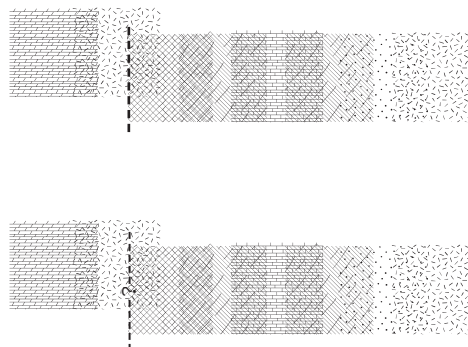


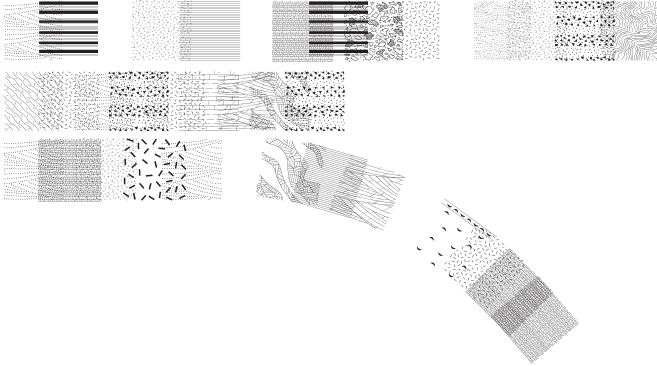


## 2—FAULTS

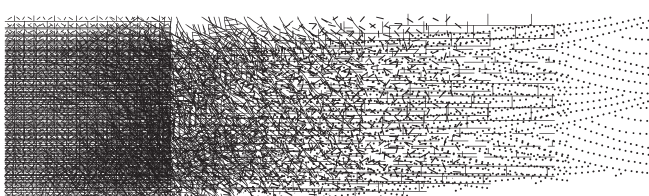
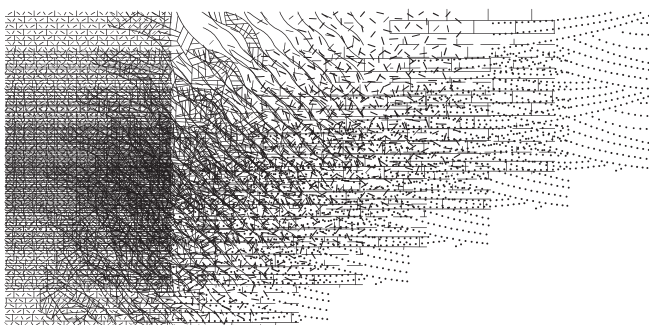
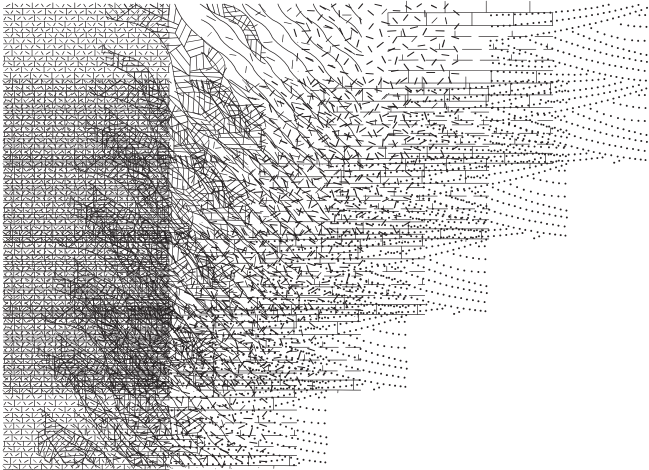
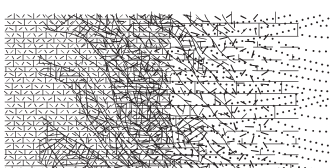
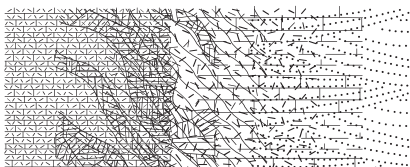
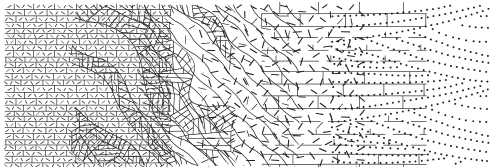
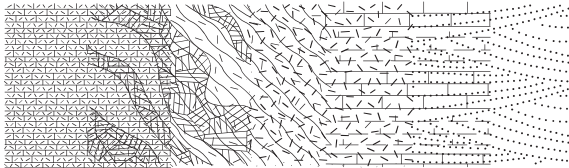
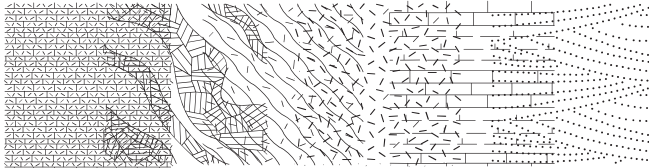
REF. NO.	DESCRIPTION	SYMBOL	CARTOGRAPHIC SPECIFICATIONS <sup>1</sup>	NOTES ON USAGE <sup>2</sup>
	<b>2.1—Faults (generic; vertical, subvertical, or high-angle; or unknown or unspecified orientation or sense of slip)</b>			
2.1.1	Fault (generic; vertical, subvertical, or high-angle; or unknown or unspecified orientation or sense of slip) —Identity and existence certain, location accurate			Use generic, nonspecific (non-orientation) fault symbols when orientation or sense of slip is not known or not specified; use also on small-scale maps to show regional fault patterns.
2.1.2	Fault (generic; vertical, subvertical, or high-angle; or unknown or unspecified orientation or sense of slip) —Identity or existence questionable, location accurate			
2.1.3	Fault (generic; vertical, subvertical, or high-angle; or unknown or unspecified orientation or sense of slip) —Identity and existence certain, location approximate			
2.1.4	Fault (generic; vertical, subvertical, or high-angle; or unknown or unspecified orientation or sense of slip) —Identity or existence questionable, location approximate			Orientation or sense of slip is known and if scale allows, use more specific types of orientationed fault symbols to indicate fault geometry and (or) relative motion.
2.1.5	Fault (generic; vertical, subvertical, or high-angle; or unknown or unspecified orientation or sense of slip) —Identity and existence certain, location inferred			
2.1.6	Fault (generic; vertical, subvertical, or high-angle; or unknown or unspecified orientation or sense of slip) —Identity or existence questionable, location inferred			
2.1.7	Fault (generic; vertical, subvertical, or high-angle; or unknown or unspecified orientation or sense of slip) —Identity and existence certain, location concealed			
2.1.8	Fault (generic; vertical, subvertical, or high-angle; or unknown or unspecified orientation or sense of slip) —Identity or existence questionable, location concealed			

\*For more information, see general guidelines on pages A-i to A-v.

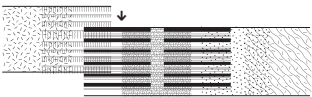
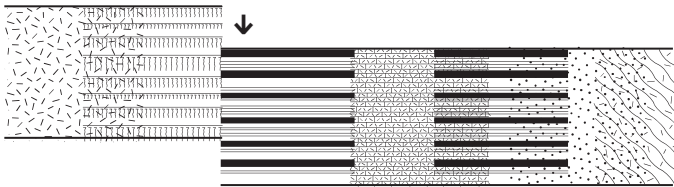
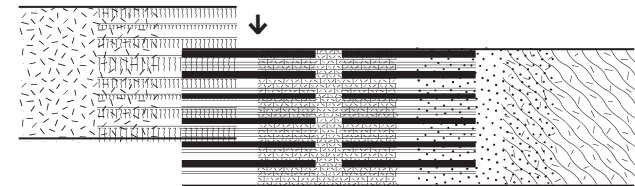
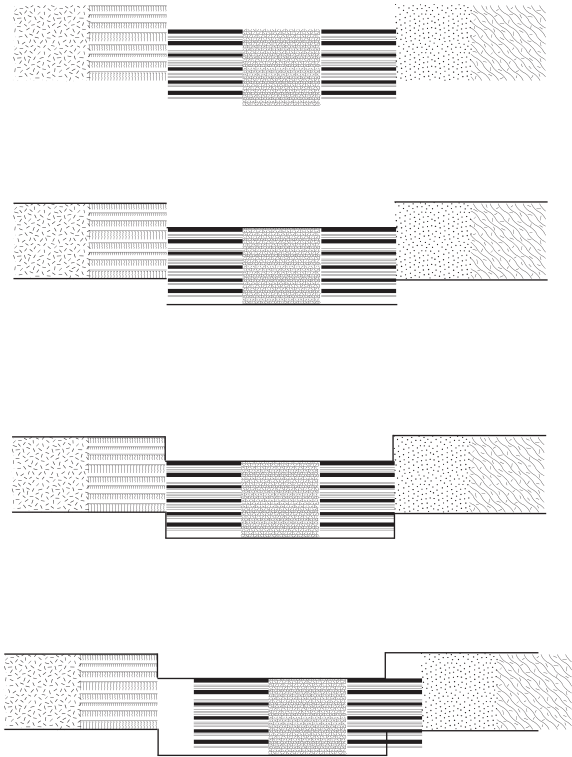




considerer les glyphes non plus  
comme des lettres capables  
d'ecrire mais comme des  
composants rocheux a part entiere.  
experimentations graphiques de  
superpositions, d'approches





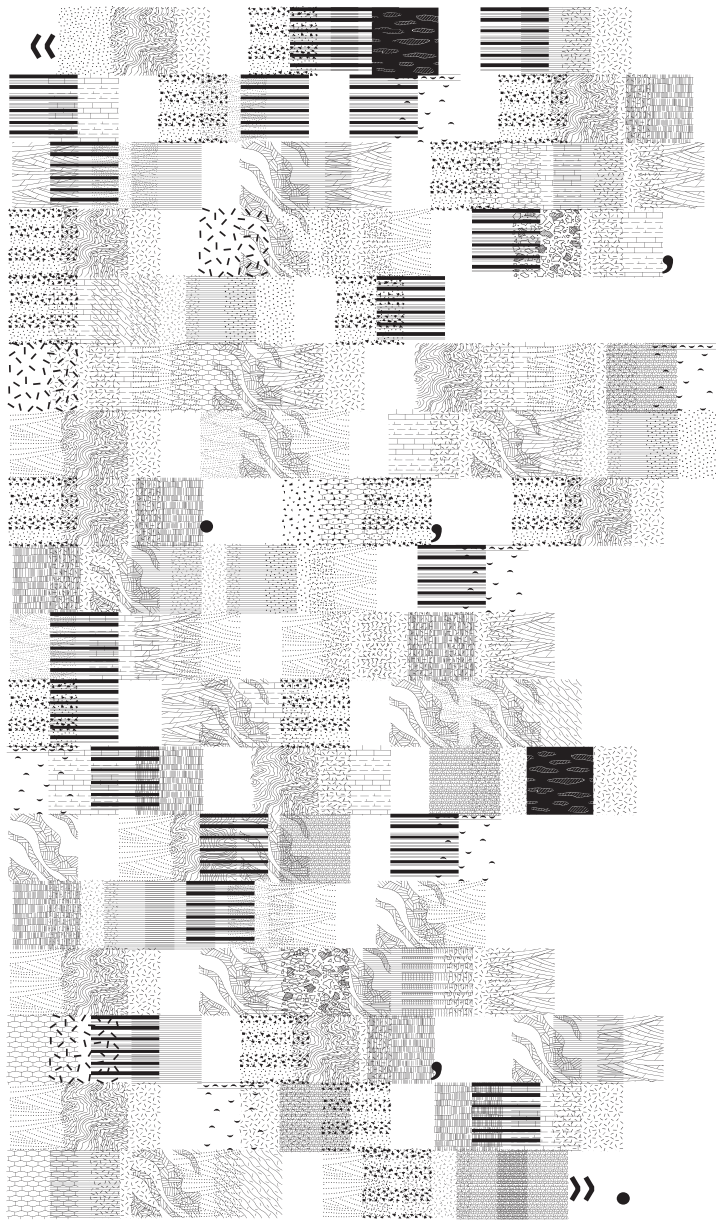


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Que perçoit-on des traces de l'histoire enfouies sous nos pieds, des catastrophes et des ruptures? Tout est aplani, enfoui, recouvert, puis tout recommence. Ce sont des cycles constants, de destructions et de constructions. On mélange, on efface, on recycle les mêmes pierres, on détruit. Du détail, du micro au plan d'ensemble, nous avons besoin de ces rapports d'échelle.

Language operates between literal and metaphorical signification. The power of a word lies in the very inadequacy of the context it is placed, in the unresolved or partially resolved tension of dispartes. A word fixed or a statement isolated without any decorative or « cubist » visual format, becomes a perception of similarity in dissimilars - in short a paradox. Congruity could be disrupted by a metaphorical complexity within a literal system. Literal usage becomes incantatory when all metaphors are suppressed. Here language is built, not written. (...) The scale of a letter in a word changes one's visual meaning of the word.

(...) A word outside of the mind is a set of « dead letters ». The mania for literalness relates to the breakdown in the rational belief in reality. Books entomb words in a synthetic rigor mortis, perhaps that is why « print » is thought to have entered obsolescence. The mind of this death, however, is unrelentingly awake.



«She took one or two of them down and turned the pages over, trying to persuade herself she was reading them. But, the meanings of words seemed to dart away from her like a shoal of minnows as she advanced upon them, and she felt more uneasy still».

In the illusory babels of  
language, an artist might advance  
specifically to get lost,  
and to intoxicate himself in  
dizzying syntaxes, seeking old  
intersections of meaning, strange  
corridors of history, unexpected  
echoes, unknown humors, or voids  
of knowledge... but this quest is  
risky, full of bottomless fictions  
and endless architectures.

La nature est matiere, l'esprit  
est matrice. C'est cela, s'ecria  
Gauguin.