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Conservation Principle of Rock - Fossil Orderly Degree Information in Earth's History

Jin-zhong Gong
Hebei Institute of Geophysical Exploration, Langfang, 065000, China

Abstract: According to the crystallization degree of mineral that composed the rocks, the author set a topological parameter, rock and ores orderly degree Di=2ne , to calculate the sum of the orderly degrees of North China landmass each lithostratigraphic unit, that is rock and ores orderly degrees + biological fossil specie numbers. The results show that, its sum is basic floating between 200 -350, the average is very close to 100e. The sequence also exists golden section Φ=0.6180, fine structure constants α=0.00729, the Planck constant h / 2π = 1.05456 and the Fergenbaum constant δ= 4.6692. This paper has fully inherited, carry forward and deepen the great thinking of Lyell, but also compatible with Cuvier's catastrophism. This regular pattern may have global universal significance, may also become another cosmic rule after the immortality of matter, the law of conservation of energy.

Key words: Information total conservation; topological orderly degree; rock and strata; mineralization; biological fossil; biological and non-biological

There is a significant difference between biological and non-biological, generally considered, the current physics and chemistry are still difficult to explain all the events in the time and space of life organism. The living cells chromosomes are aperiodic crystals, while physics only studies lifeless periodic crystals. From the angle of statistical thermodynamics, the living organism seems to introduce the negative entropy - S = log (1 / D) into itself, to offset its entropy increase in life, thereby maintaining itself at a stable low entropy (ordered) level, spread wonderful regularity, showing the ability to maintain order(*E. Schrödinger*, 2016).

Ancient naturalists insist that "nature does not produce a leap in order." Canadian coast 3.77-4.30 billion years of microbial fossils, indicating that, the earliest life on Earth close to the time of Earth's formation (*Carolyn*, 2017).

Hazen presents the paradigm of the origin of life that rock surface life molecular template synthesis. Many of the most vital molecules of life are stuck on the natural mineral surface. Rocks provide a hotbed, organic molecules assembled into a complex life structure. The evolution of life has led to the formation of rich minerals in the earth. Mineral-biological co-evolution theory, let us know how to produce the earliest creatures of the earth, by reaction of organic molecules and rock crystals, other aspect is more than two-thirds of the earth's mineral species(*R. Hazen*, 2012).

1. The setting and calculation of the order degree of rock formation

The latest results of the survey of lithostratigraphic, biostratigraphy, intrusive rock and mineral resources in North China (*Hebei*,1989; *Hebei*, 1996; *Bai*,1986; *Sun*,2006; *Liaoning*,1989; *Shandong*,1989; *Shanxi*,1989; *Inner Mongolia*,1989; *Yuan*,2011; *Yan*,1997; *Li*,2005) show , in a particular area, between the fossils and rock formation, with a fixed correspondence, that some kind of fossil is usually produced only in particular one or several types of rocks. The direction, stage nature and irreversibility of biological evolution, can be reflected in the time evolution of rock geochemistry. There is a correspondence and relevance between the rock type, geochemical and fossil distribution. The biologic outbreak and extinction correspond to the geochemical interface of the rock strata. The chemical element content level is the threshold of restricting the presence or absence of biological fossils. There is a significant correlation between the content of rock elements and the number of biological fossil species.

Throughout the North China landmass sedimentary rocks, fossils, sedimentary minerals, volcanic rocks, metamorphic rocks and its corresponding intrusive rocks and magmatic hydrothermal minerals, we can find out, the difference in the number of each lithostratigraphic unit components is very significant, some mainly sedimentary rocks, some mainly magmatic rock, some fossils are scarce and some fossils are rich. However, is there a near constant numerical value between them?

Usually, between different types of rocks, different generations stages, mineral crystal particles (eco-niche) showing a geometric series change. Accordingly, we set a rock and ore orderly degree topology parameter:

$D_i=2^n e$, n=-1, 0, 1, 2, 3

Among oil and gas $D_1=2^{-1}e=1.36$, sedimentary rocks and sedimentary minerals $D_2=2^0e=2.72$, volcanic rocks $D_3=2^1e=5.44$, metamorphic rocks $D_4=2^2e=10.88$, intrusive rocks and magmatic hydrothermal minerals $D_5=2^3e=21.76$.

To calculate the sum of the orderly degrees for each lithostratigraphic unit:

In $S=\sum(2^n eTro+Spf) \rightarrow 100e = 271.8$ Tro =Type-Rock +Ore Sp f= Species-fossil

Table 1 Minerals grain length change of magmatic rock

Minerals	Feldspar	Quartz	Mica	Accessory	Fine-grain	Crypto-crystal
Granitoidal texture /mm	10-6	6-4	5-2	2-1	0.5-0.01	⩽0.01
Metasomatic texture /mm	18-10	9-4	4-2	2-1	0.5-0.01	⩽0.01

Table 2 Rocks orderly degrees setting form

Rock types	petroleum	Sedimentary rocks	Volcanic rocks	Metamorphic rocks	Intrusive rocks
Mineral composition quantity	2-4	2-5	3-9	3-10	4-10
Mineral average quantity	3.50	4.27	4.30	7.27	8.00
Mineral medium size/mm	0.10-0.20	0.25-0.50	1-2	1-3	2-5
Orderly degrees setting 2^ne	1.36	2.72	5.44	10.88	21.76

2. Mathematical Characteristics of Orderly Degrees Sequence

We can find that orderly degree sum basic floating between 200 -350, their arithmetic average of 270.4, very close to 100e. With the deepening of geological and mineral work, the author believe that this value will continual to approach 100e = 271.8.The sequence asymmetric degree Skew=0.5527→γ=0.5772 （Euler-Mascheroni constant）, absolute deviation Avedev=54.33→20e, sum of square deviation Devsq=199733→10000ee^2.

With the its ordinal number difference increases, the sum of difference between the two sequence values change between -200 ~ -400, the sequence geometric mean **Geomean（$\Delta D_1 : \Delta D_{46}$）=-273.58→-100e;**The arithmetic mean of its mean sequence **Average（$\Delta D'_1 : \Delta D'_{46}$）=-25.06→-10e.**

We arranged the sequence from small to large, separating it from the middle into two parts, the sum of the smaller part is 4845, the sum of the larger part is 7865, the ratio of the larger part to the whole part **7865/12710=0.6188**, the ratio of the smaller part to the larger part **4845/7865=0.6160**, both are very close to the **golden section constant Φ=0.6180**.

this sequence adjacent data differenc evalues incremental sequence: 0, 0, 0, 0, 0, 1, 1, 1, 1, 1, 2, 2, 2, 2, 2, 2, 3, 3, 3, 3, 4, 4, 4, 4, 5, 5, 5, 5, 6, 6, 6, 8, 8, 8, 8, 8, 9, 9,10,10,11, 11, 22,23, 27,35.The ratio of steady median /maximum orderly degree: 3.5/443=0.007901,close to **fine structure constantsα=0.00729**.

We calculated this sequence（max-min）/mean=（443-153）/270.4=1.0725→h/2π=1.05456（reduced Planck constant）.In this sequence $(a_n-a_{n-1})/(a_{n+1}-a_n)$ ratio ,we select ratio≥3.0 series data：3.0, 3.4483, 5.0455, 5.9444, 6.5, its arithmetic mean avevage = 4.7876, geometric mean geomean = 4.5807, the two average mean = 4.6842→ **Feignbaum constant δ = 4.6692**.

3. Theoretical significance of the study results

This statistical law contains at least the some aspects connotations: ⑴There is a balance complementary relationship between rock and fossil, the same epoch, the higher the degree of rock crystallization, the corresponding reduced in biological fossils, the reverse is also true. This explains the relationship between the biologic silence or prosperity and the volcanic magma activity. ⑵The time length of different geological units to achieve orderly equilibrium state is significant difference, the overall trend is the newer the times, the faster the evolution rate of geological differentiation. ⑶ Natural diagenesis mineralization and biological fossil formation process has the same orderly degrees meaning, they also same forms the geological product of the evolutionary history of the earth, that is rock and ore types with specific structural and chemical composition. ⑷ According to the relative size of orderly degrees numerical ratio distribution, we can identify the magma outbreak（Ar-Pt_1), life outbreak（Chch, Jxh, Qbx, Z, €, O, S,C,T_3x, K_{1-2},Q）and mineralization outbreak (Wt_3,Chc,J_2-K_1) and other great geological historical events.

Gould points out that, the core part of the Charles Lyell concept, the most central point of his earth concept, the earth has been basically the same since its formation (even change of the appearance). Land and sea's changes over time are balanced. Species are produced and destroyed, but the average complexity of the creature remains the same. Details changes endless, the whole is constant - dynamic steady state. Unfortunately, his view of this even change has been quietly forgotten. Of course, due to lack of related data, Lyell had mistakenly used his ideas (*Stephen*, 2017). This paper has fully inherited, carry forward and deepen the great thinking of Lyell, but also compatible with Cuvier Georges's catastrophism.

We even can find out, there is a contrast between the three main gods of India and the orderly degrees of the Earth's rock fossils.

In short, the discovery of this law quantitatively reveals the deep intrinsic connection between biological and non-biological. In view of the comprehensive, systematic, typical and representative of the regional geology of the North China landmass, as well as geological research work thorough and careful, this law may have global universal significance. It may also become another cosmic rule, after the law of matter immortality and conservation of energy.

Table3 India's three main gods and Earth rock fossils orderly degrees comparison

Main gods	Shiva	Vishnu	Brahma
Functional characteristics	The Lord of life, the god of destruction, the god of regeneration, mysterious, lively dancers, affable protector, horrifying destroyer in the mountain. The source of strength, to maintain the operation of the universe. He dominates the movement of the universe, the rhythm of life, the joy of the dance. The myth that he destroyed heaven, earth, and empty three cities, reflecting his destruction of the universe at the end of every robbery.	As a protector and a retainer, he incarnate as an animal or human, came to earth to avoid the occurrence of major disasters in order to maintain the order of the universe. His embodiment reflects the evolution of the various forms of life on earth, the beginning, it is the fish of the water, to the end of the destruction by the destroyer Gali at the end of the horrific time.	The personification of the highest will of universe, the creator of all things, the Lord of the world. The highest and the absolute truth, Eternal change, godhead can not be destroyed, the root of all things, omniscient, transcendental law, each creature has Brahma representation.
Earth Geology	Stratigraphic - rock mass - deposit	Biological fossils	Orderly degrees sum
Classification connotation	Sedimentary rocks, volcanic rocks, metamorphic rocks, intrusive rocks, metals-nonmetallic, exogenous deposits, endogenous deposits, tectonic magmatic cycles	Bacteria, algae, moss, ferns, gymnosperms, angiosperms, protozoa, sponge cups, coelenterate, brachiopods, arthropods, echinoderms, chordates	Rock ore orderly degrees + the number of biological fossils in the basic between 200-350,the average is very close to 100e. The sequence exists for the golden section constant, the Planck constant, the refinement constant, and the Fergenbaum constant

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Jin-Zhong GONG (1962—), Male, 1983 graduated from the China University of Geosciences (Wuhan) geochemical exploration professional, now as a professor, 40 papers published articles and published 4 books.

E-Mail: gjz212@tom.com; 2548180918@qq.com

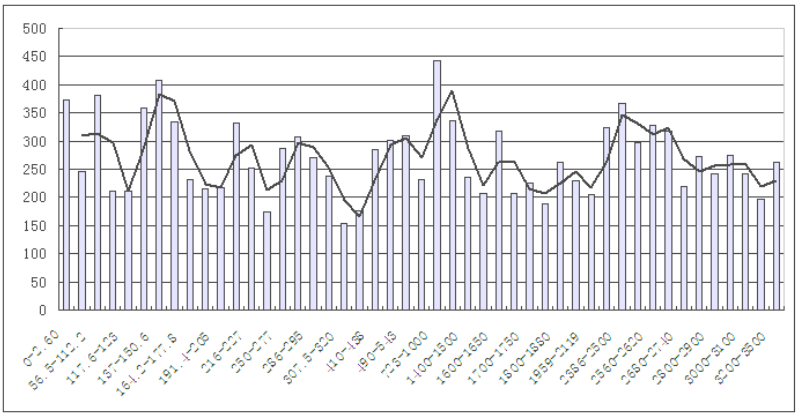


Figure 1 The orderly degrees time evolution sequence of lithostratigraphic unit in North China landmass

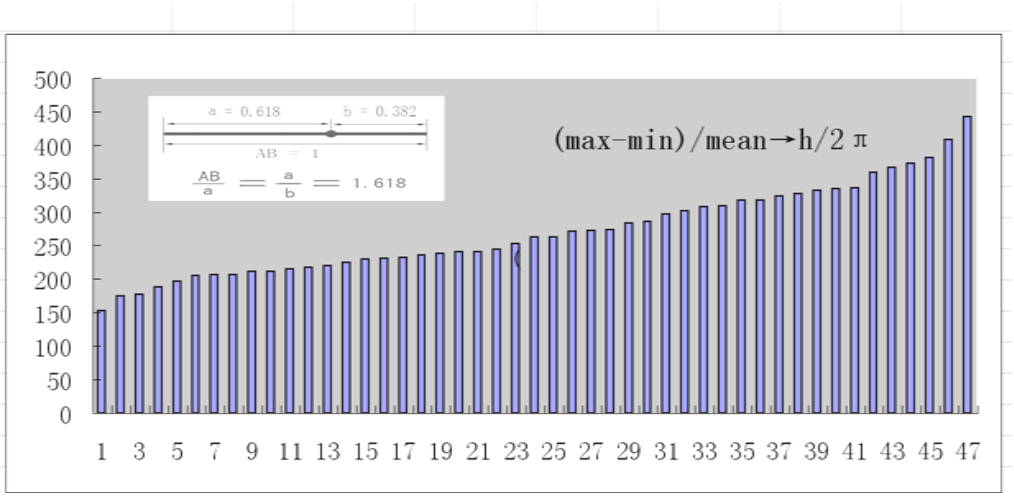


Figure 2 Golden section and Planck constant of the orderly degrees sequence of lithostratigraphic unit in North China landmass

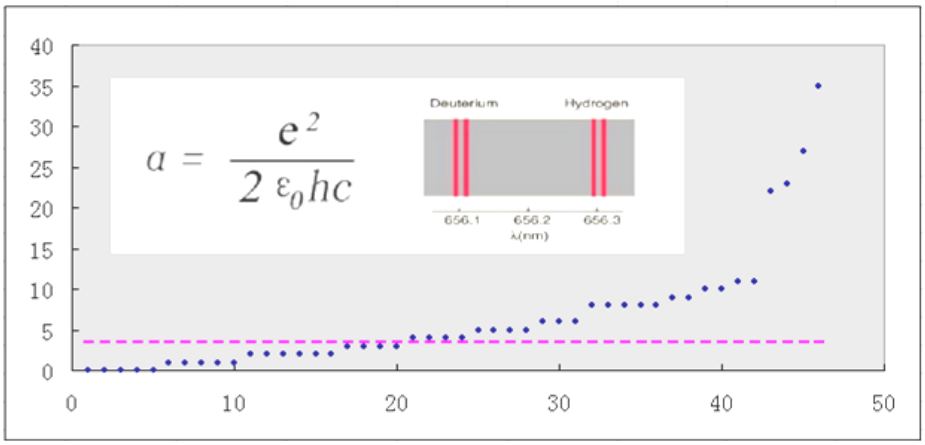


Figure 3 Fine structure constant of the orderly degrees sequence of lithostratigraphic unit in North China landmass

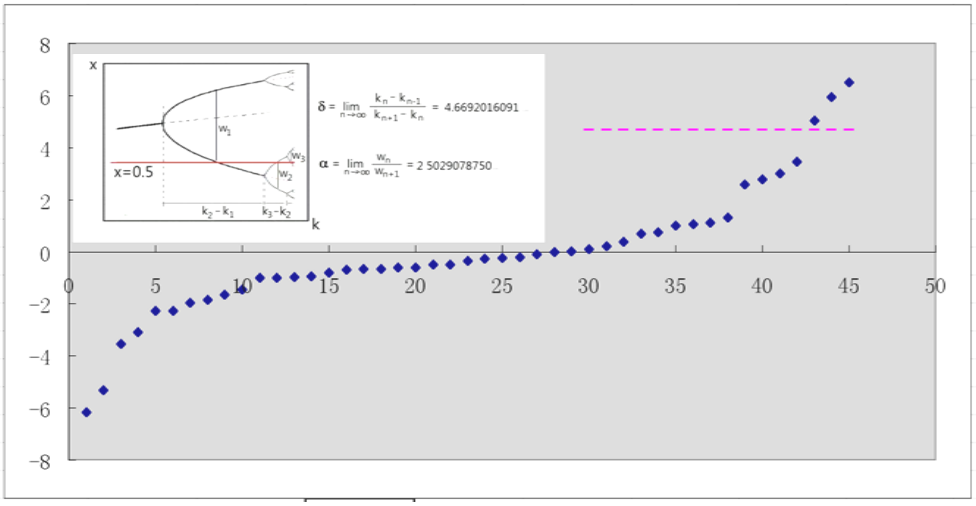


Figure 4 Feignbaum constant in the orderly degrees sequence in North China landmass

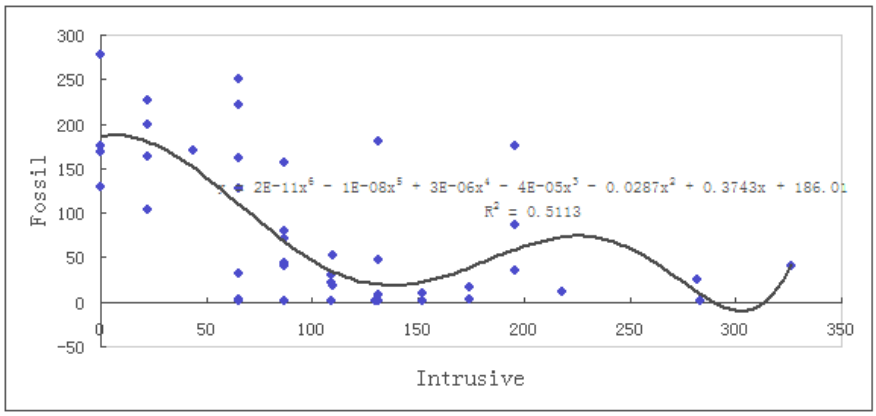


Figure 5 Relationship Scatter plot of fossils number - invasive rock orderly degrees in North China landmass

The count form of orderly degrees of rock - fossil in North China landmass

Strata	Age /Ma	Stratigraphic rocks and sedimentary minerals	Intrusive rocks and magmatic hydrothermal minerals	Number of fossil species	Orderly degrees sum
Q	0.00-2.60	95.2	0	278	373
EN	2.60-56.5	116	0	129	245
K_{1-2}	56.5-112.2	64	65.3	251	381
K_1y	112.2-117.6	32.6	131	48	212
K_1d	117.6-123	46	87	79	212
K_1z	123-137	52	282	25	359
J_3tch	137-150.6	41	326	41	408
J_2t	150.6-164.2	51.6	196	87	335
J_2j	164.2-177.8	38	65.3	128	231
J_1x	177.8-191.4	56	87	72	215
J_1n	191.4-205	57	152	9	218
T_3x	205-216	21	131	180	332
T_2e	216-227	22	196	35	253
T_{1-2}	227-250	44	87	44	175
P_2s	250-277	57	218	11	286

$P_{1-2}sh$	277-286	21	65	222	308
P_1s	286-295	22	22	227	271
C_3t	295-307.5	16	22	200	238
C_2b	307.5-320	27	22	104	153
D	320-410	46	109	22	177
S	410-438	57	65	162	284
O	438-490	59	87	156	302
€	490-543	94	44	171	309
Z	543-723	63	0	169	232
Qb	723-1000	71	196	176	443
Jx	1000-1400	160	0	176	336
Nkg	1400-1500	139	65	32	236
Nkd	1500-1600	68	109	30	207
Cht	1600-1650	190	87	41	318
Chch	1650-1700	22	22	163	207
Chc	1700-1750	35	174	16	225
Chz	1750-1800	49	131	8	188
Ht_3G	1800-1880	109	152	2	263
Ht_2t	1880-1959	141	87	2	230
Ht_2^2	1959-2119	66	109	30	205
Ht_2^1	2119-2386	164	110	52	324
Ht_1	2386-2500	239	110	19	367
Wt_3G	2500-2560	12	283	2	297
Wt_2T	2560-2620	174	152	2	328
Wt_1S	2620-2680	141	174	3	318
Fp_2W	2680-2740	152	65	3	220
Fp_1Ch	2740-2800	141	130	2	273
Zhm	2800-2900	109	131	2	241
Zhw	2900-3000	120	152	2	274
Qxst	3000-3100	131	109	1	241
Qxs	3100-3200	87	109	1	197
Cz	3200-3500	196	65	2	263

Appendix I Rock - fossil distribution form of North China Landmass

Strata	Age /Ma	Stratigraphic rocks and sedimentary minerals	Intrusive rocks and magmatic hydrothermal minerals	fossil specie
Qhq	0.001	Sub-clay, sub-sand, sand, peat, Datong basalt; Sunit baking soda, natural base with mirabilite and stone salt, Guyang vermiculite mine, Erlian sandstone-type uranium		51
Qpq	0.01	Fine sand layer, muddy silt, clay, sand - gravel; sand layer, ooze		104
Qpm	0.87	Loess gravel layer, loess layer, secondary loess, grail, Yanshan-Xiaoshan: basalt, tuff		10
Qpc	1.74	loam, silty clay, gravel layer, Liaodong basalt		13
Qpn	2.6	Silt, silty clay, coarse sand, sand - gravel, marl		100
N_2s	5.3	Sandstone, conglomerate, silty clay rock, clay rock		40
N_1j	23.3	Conglomerate, coarse sandstone, sandstone, siltstone, clay rock, Yuncheng stone salt, mirabilite, gypsum		17
ENh	26.4	Olive basalt, pyroxenite-basalt, vesicular basalts, basanite, basaltic-andesite, sandy-conglomerate, siltstone, clay rock, carbonaceous shale, lignite, oil shale, North China oil - gas		38
$E_{2-3}x$	56.5	Clay rock, shale, sand-conglomerate, sand, siltstone, marl, gypsum-clay, lignite, Shahejie formation mudstone, gypsum, diatomite, natural sulfur		34
$K_{1-2}n$	96	Conglomerate, sand-conglomerate, sandstone, siltstone, mudstone, claystone, marl	Aegirine-augite-syenite, syente- porphyry	20
K_1q	101.4	Shale, mudstone, muddy- siltstone, sandstone		83
K_1xd	106.8	Shale, mudstone, muddy-siltstone, oil shale, Erlian: oil-gas	K_1Sd biotite orthoclase granite	42
K_1jf	112.2	Mudstone, shale, siltstone, oil shale, marl, sandstone, andesite		106
K_1y	117.6	Andesite, siltstone, shale, gritstone, basaltic agglomerate, agglomerate lava, mudstone, sandstone, conglomerate	K_1S admellite porphyry, K_1H syenite, quartz -syenite, K_1X quartz-syenite 133 -118Ma, Jiaodong Au mine 117-126Ma, Shilipu Ag mine	48
K_1d	123	Andesite, basaltic andesite, andesite breccia, tuffaceous conglomerates, sandstone, shale, tuff, marl	K_1W quartz-monzonite, north Hebei fluorite mine, Wulong Au mine 125-135Ma, Huanggangliang Fe-Sn mine	79
K_1z	137	Rhyolite welded tuff, rhyolite, quartz -trachyte, andesite, trachyandensite, gritstone, conglomerate, gravel-coarse sandstone, zeolite, bentonite, Jianping wollastonite, Balin nephrite	K_1H quartz-diorite, K_1H aegirine-augite syenite, J_3Bb alkaline-granite, J_3Sz fine alkaline-granite, J_3L quartz-alkali -feldspar syenite, J_3Dn alkaline quartz-syenite, J_3C quartz–syenite-porphyry, J_3Bh quartz -monzonite porphyry, J_3M coarse syenite-porphyry, J_3B quartz-syenite-porphyry, Caijiaying Zn-Pb-Ag mine, Zhijiazhuang: concealed breccia type silver mine, Diaoquan silver copper mine 131Ma, Lingqiu quartz-porphyry manganese silver mine	25
J_3tch	150.6	Tuffaceous conglomerate, gravel coarse sandstone, marl, silty shale, sandstone, siltstone, andesite, trachyte, rhyolite, zeolite, crystal fragment tuff, perlite	J_3W granite-porphyry, J_3X quartz-admellite, J_3S orthoclase -granite, J_3D	41

			porphyritic -admellite, J_3G quartz -monzonite, J_3N quartz-diorite -porphyry, J_3Ger monzonite, J_3X monzodiorite, J_3J fine diorite, J_3Y quartz-monzo- diorite 152 -140 Ma, Han-Xing Fe-Co mine, Lai Yuan Fe–Zn -Cu-Mo mine, Dazhuangke Mo mine 139-147 Ma, Zhang Majing U-Mo mine, Bajiazi Pb-Zn mine	
J_2t	164.2	Andesite, hornblende-andesite, pyroxene andesite, trachyandensite, trachyte, rhyolite, breccia tuff, tuffaceous sandstone, conglomerate, siltstone, mudstone	J_2ss porphyritic hornblende -diorite, J_2D fine hornblende diorite, J_2J porphyritic orthoclase granite, J_2C porphyritic - admellite, J_2T bear-porphyritic – quartz-monzonite 159-173Ma, J_2S quartz-monzo-diorite, J_2Q hornblende diorite, Yinyeling Pb -Zn-Ag mine, Chaichang Au mine	87
J_2j	177.8	Conglomerate, sandstone, siltstone, claystone, tuffaceous conglomerate, silty shale, mudstone, coarse sandstone, lithic sandstone, marl, coal line, trachyte, dacite tuff	Yuernie Au mine175Ma, Guilaiz -huang Au mine 176Ma, Mengen taolegai Ag-Pb-Zn mine 182Ma	128
J_1x	191.4	Fine sandstone, silty shale, carbonaceous shale, gravel coarse sandstone, coarse sandstone, conglomerate, limestone, carbonaceous mudstone, clay rock, feldspar sandstone, feldspar quartz sandstone, siltstone, medium granar sandstone , Fine conglomerate, marl, coal, phyllitic slate, chlorite hornfels, Changqing oil - gas	J_1N orthoclase granite 181Ma, J_1Z quartz monzo diorite 196Ma, T_3Y orthoclase granite 198Ma, Dabieshan: garnet-bearing granite 190Ma	72
J_1n	205	massive basalt, stomatal vesicular amygdaloidal basalt, andesite agglomerate, andesite, andesite-welded breccia, dacite lava breccia, andesite–trachyandensite-breccia-tuff, tuffaceous sandstone, siltstone, fine sandstone, rhyolite lava tuff, silty mudstone, shale	Liaoning olive basalt, kimberlite, diamond, J_1K hornblende gabbro, hornblende pyramidite, J_1S por-admellite, J_1B por-quartz -monzonite	9
T_3x	216	Conglomerate, sandstone, siltstone, mudstone, clay rock, shale, coal line, Changqing oil - gas	T_3Sz admellite 203-221Ma, T_3W admellite, Xiuyan diorite 215Ma, Sadaigoumen Mo mine, Chang -cheng Au mine 213 -217 Ma, Xaotongpuzi Au mine 211 Ma	180
T_2e	227	Feldspar-sandstone, silty mudstone, conglomerate, shale, fine sandstone, siltstone, oil shale, chrysanthemum tuff	T_3S quartz –monzonite 217Ma, T_3X orthoclase granite 213Ma, T_3J pyroxene-diorite 202Ma, Lingyuan nepheline syenite 226 Ma; Saima: ijolite –syenite, trachyte -porphyry U-Th-REE mine 237-223Ma, Tianzhen: foyaite, miaskite 226 Ma, Gaojiapu Ag mine 229Ma	35
T_2h	241	Calcareous siltstone, silty mudstone, feldspar sandstone, siltstone, gritstone, fine sandstone, shale	T_3D gabbro, pyroxite, Dongping Au mine 237Ma	24
T_1l	250	Feldspar sandstone, quartz sandstone, silty mudstone,	Beiqinling: granite246Ma	20

		siltstone, silty shale, fine sandstone, conglomerate, marl, dolomitic marl		
P_2s	277	Conglomerate, siltstone, silty mudstone, feldspar sandstone, mudstone, shale, quartz-sandstone, argilli sandstone, carbonaceous shale, clay rock, marl, limestone, slate, crystalline limestone, rhyolite, crystal fragment tuff, rhyolite- porphyrite, dacite-porphyrite	Hegenshan dunite, pyroxene - peridotite, olivine pyroxenite, gabbro, Gushanzi pyramidite – pyroxene diorite, P_2H biotit e-admellite, P_2N orthoclase - granite, Niujuan Ag-Au mine, Siziwangqi fluorte mine	11
$P_{1-2}sh$	286	Quartz sandstone, fine sandstone, siltstone, silty mudstone, shale, bauxitic mudstone, coal seam, Erlian oil - gas	P_1T middle-coarse granite, P_1W admellite, P_1D por-admellite	222
P_1s	295	Fine sandstone, siltstone, sandy mudstone, shale, coal seam, medium grain quartz-sandstone, carbonaceous shale, bauxitic shale	P_1H quartz diorite260-275Ma	227
C_3t	307.5	Shale, sandstone, coal, limestone, bauxite, siltstone	Beiqinling: muscovite - pegmatite 300Ma	200
C_2b	320	Conglomerate, sandstone, fine sandstone, siltstone, mudstone, variegated iron-aluminumite, limestone, shale, bauxite, coal	Beiqinling: porphyroid - admellite 366Ma	104
D	410	Conglomerate, sandstone, siltstone, limestone, slate, feldspar sandstone, bioclastic limestone, sandy limestone, marl, phyllitic slate	gabbro, diorite, granodiorte, plagio-granite 374Ma, por phyroid -admellite 383Ma	22
S	438	Conglomerate, arenose, sandstone, siltstone, shale, limestone, phyllite, quartzite, quartz schist, sandy slate, fine sandstone, crystalline limestone	gneissic muscovite granite, granodiorte, greisen diorite	162
O_3d	448	Thick limestone, tumour limestone, chert limestone		11
O_2m	459	Micrite-dolomitic-limestone, muddy limestone, lime dolomite, muddy dolomite, muddy limestone, brecciated dolomite, medium-thick limestone, brecciated limestone		52
O_2l	480	Dolomite, calcareous dolomite, worm-like limestone, chert nodule leopard skin-like limestone, medium-thick limestone, thin limestone	Mengyin changma porphyritic – kimberlite 490-450Ma, diorite, quartz diorite, granodiorte	32
O_1y	490	Mud stripe limestone, dolomitic limestone, gravel clastic limestone, shale, thin limestone, leopard skin-like micritic limestone		61
$€_3cm$	495	Mud streaked limestone, medium-thick limestone, gravel clastic limestone, muddy siltstone, thin limestone		55
$€_3g$	500	Shale, muddy siltstone, tumour limestone, gravel-clastic limestone, thin limestone, sand-clastic limestone, oölitic limestone	pyramidite, gabbro	31
$€_2z$	513	Thick oölitic limestone, mud-stripe limestone, micritic - limestone, algal limestone, dolomitic limestone, muddy siltstone, calcareous shale, thick-layer dolomite, North China oil-gas		41
$€_{1-2}m$	528	Purple mica shale, marl, muddy dolomite, muddy siltstone, silty shale, calcareous shale, oölitic limestone, micriyic limestone, gypsum		34
$€_1c$	543	Leopard skin-like limestone, powder-microcrystalline dolomitic limestone, thick fine powder crystal - microcrystalline limestone, lime- dolomite, asphaltene limestone		10
Z_2jx	650	Conglomerate, sandstone, siltstone, mudston, shale, dolomite, lime dolomite, mudlimestone, limestone, quartz-sandstone, stromatolithic limestone, mudstone		111
Z_1wh	723	Quartz sandstone, sandstone, siltstone, shale, dolomite, lime dolomite, mud limestone, limestone, micritic		58

		limestone, silt limestone, siliceous rock		
Qbj	800	Muddy dolomitic limestone, shale, calcareous shale, glauconite coarse feldspar sandstone, fine conglomerate, calcareous fine sandstone, siltstone, limestone	Douling quartz-diorite	12
Qbl	900	Conglomerate, feldspar quartz-sandstone, feldspar sandstone, siltstone, variegated shale, glauconite fine sandstone	Qihezhuang: ouralite, serpent -tinite, gabbro 896Ma	57
Qbx	1000	Silty shale, siliceous shale, marl, clay shale, variegated shale, siltstone, iron sandstone, fine sandstone, glauconite sandstone, chaly beate siltstone, carbonaceous shale, Flint breccia	Songshugou:dunite, pyroxene peridotite, amphibole eclogite, pyramidite, hornblendite 938 -1030 Ma	107
Jxt	1100	Manganese - bearing dolomite, sandstone, purple - green shale, stromatolithic limestone, basin clastic limestone, dolomitic limestone; Beixiaojian formation: quartz sandstone, feldspar quartz sandstone, sandy shale, glauconite sandstone, dolomite, breccia dolomite, dolomitic sandstone, quartzite 1129-1215Ma; Wafangzie: laminar dolomite, striped limestone, mudstone, siliceous limestone, manganese ore layer		60
Jxh	1200	Illite-shale, siltstone, muddy dolomite, thin quartz sandstone, planar sandy dolomite, paper shale; Baicaoping: shale, sandy shale, sandstone, gravel-bear sandstone, calcareous sandstone		72
Jxw	1300	Flint striped dolomite, stromatolithic dolomite, asphaltenic dolomite, fine-grainular dolomite, coarse-grainular dolomite, lamellar dolomite, lime dolomite, mud debris dolomite, siliceous rock, sandstone, clay rock, sepiolite, oil and gas in North China; Yunmengshan: conglomerate, sandstone, shale, feldspar sandstone, andesite -porphyry 1267Ma		34
Jxy	1400	Silt dolomite, flint dolomite, muddy dolomite, coarse-grained dolomite, dolomitic limestone, asphaltened dolomite, mud-like gravel dolomite; Bingmagou: purple conglomerate, sandy conglomerate, gritstone, silty shale		10
Nkg	1500	Planar dolomite, flint dolomite, muddy dolomite, manganese dolomite, dolomitic limestone, stromatolithic dolomite, lime dolomite, dolomitic sandstone, gravel coarse sandstone, bear feldspathite quartz-like sandstone, asphaltene dolomite, carbonaceous slate; Majiahe: andesitic porphyrite, rhyolite porphyry, dacite, andesitic basalt, marl; Langshan: Magnetite dolomite marble, phyllite, graphite schist, mica schist, quartz albite leptite, biotite oligoclase schist, chlorite-schist	Gaobanhe pyrite Zn-Pb mine, Dongshengmiao pyrite-Pb-Zn mine, Tanyaokou Cu-Zn mine	32
Nkd	1600	Quartzite-like sandstone, feldspar quartz sandstone, calcareous shale, potassium-rich shale, potassium-rich trachyte, potash basalt, fine dolomite, flint dolomite, chalybeate sandstone, siltstone, fine sandstone; Jidanping: rhyolite porphyry, dacite porphyry, quartz porphyry, andesitic porphyrite, perlite, obsidian	Pt_2Ao nepheline syringes, Pt_2H aegirine-augitesyenite, Pt_2C quartz -syenite, Pt_2P fine granite, Pt_2Dy porphyritic granite 1657Ma	30
Cht	1650	Thick iron-bearing dolomite, silty micritic dolomite, stromatolithic dolomite, flint strip dolomite, sandstone, quartz -like sandstone, silty shale, magnetite sand-conglomerate; Xujiashan: andesitic porphyrite, andesitic basalt porphyrite, rhyolite porphyry, dacite porphyry, vitric fragment-tuff 1765Ma; Zhaertai: striped quartzite, marble, silicified limestone; Baiyun ebo: potassium-rich slate, mica rock, massive hematite, crystalline limestone, carbonaceous slate; Jianshan: phosphorus-bearing carbon slate, feldspathic quartz sandstone, garnet - bearing sandstone, garnet grunerite apatite	Baiyunerbo REE-Nb-Fe-fluorite mine1683-1692Ma, diopsidetre -morlite	41

Chch	1700	Calcareous silty illite shale, paper-like silty shale, siltstone, fine sandstone, carbonaceous dolomite; Xuanlong: fine sandstone, ferruginous quartz sandstone, oolitic-kidney hematite	Maoyu Au mine 1722-1624Ma	163
Chc	1750	Conglomerate, gravel-- bearing coarse sandstone, feldspar quartz-sandstone, quartz-like sandstone, quartz-sandstone, quartzite, sandstone, siltstone, sand -shale; Zhaertai: carbonaceous schist	Pt_2S gabbro1691Ma, Pt_2My cou -titanomagnetite norite 1702Ma, Pt_2D anorthosite 1735Ma, norite 1735Ma, Pt_2Sc rapakivi granite 1716Ma, Pt_2Dj biotite quartz –monzonite 1735-1791 Ma; Fanshan Fe-P mine, Huogeqi Cu-Pb-Zn mine	16
Chz	1800	purple shale, stromatolithic dolomite, ferruginous breccia; Dashigu: feldspar-quartz- sandstone, sandstone, shale 1778Ma; Jining group: Slate, phyllite, magnetite-quartzite 1753Ma	Pt_2G serpentinization pyroxene -peridotite, dunite 1796-1837Ma, Pt_2Hs diopside -hornblendite, hornblende -diopsidite, Pt_2DQ hypersthene -monzonite, Xiaoyingpan Au mine 1826-1800Ma	8
Ht_3G	1880	Metamorphic conglomerate, phyllite, quartzite, gravel-bearing feldspathic-quartzite; Liaohe group Gaixian formation: two-mica schist, leptite, biotite leptynite, Chlorite sericite schist, slate, marble	$Pt_1^2\gamma$ metamorphic granite, $Pt_1^2\delta o$ quartz-diorite, $Pt_1^2\eta o$ quartz –monzonite 1800 Ma; Seerteng –Daqingshan gabbro, diorite, biotite-potash granite, muscovite -pegmatite 1800 -1950 Ma	2
Ht_2t	1959	Phyllite, metamorphic siltstone, crystalline dolomite, marble; Liaohe Group Dashiqiao formation: two-mica schist, leptite, Biotite leptynite, chlorite sericite schis, metamorphic sandstone, slate, magnesite, talc, serpentine nephrite	$Pt_1^2\eta\gamma$admellite, $Pt_1^2G\gamma$ garnet -admellite, $Pt_1^2\eta\gamma$ hornblende -admellite, $Pt_1^2\pi\eta\gamma$ porphyritic –biotite -admellite	2
Ht_2b	2039	Micrite dolomite, slate, dolomite	Guandishan granite2050Ma	24
Ht_2hy	2119	Dolomite, slate, micrite dolomite, oolitic dolomite	Fuxin-granodiorite, monzonite, gabbro, Paishanlou Au mine 2105Ma	6
Ht_2d	2199	Slate, micrite dolomite	$Pt_1^2\eta\delta o$ quartz-monzo-diorite, $Pt_1^2\delta$ metamorphic diorite 2131 Ma	13
Ht_2j	2278	Phyllite, slate, mudstone, siltstone, micrite dolomite		22
Ht_2h	2358	Micrite dolomite, quartzite, slate, metamorphic basalt	Shujigou admellite 2365Ma	15
Ht_2w	2386	Quartzite, slate, crystalline dolomite, Fenzishan: graphite marble	Graphite-plagioclase gneiss, graphite-diopsidite	2
Ht_1q	2415	Phyllite, sandy phyllite, feldspar quartzite, quartzite, crystalline dolomite, metamorphic basalt	$Pt_1^2\beta\mu$ metamorphic diabase-gabbro	3
Ht_1d	2443	Quartzite, feldspar quartzite, phyllite, dolomite, crystalline dolomite, metamorphic conglomerate; Xingtai magnesite	Qingchengzi Pb-Zn mine	10
Ht_1n	2472	Quartzite, phyllite, sandy –braring marble	$Pt_1^1\pi\gamma$ metamorphic porphyritic granite	3
Ht_1s	2500	Metamorphic conglomerate, quartzite, sandy phyllite; Liaohe Group: amphibolite, carbonaceous slate,Boron -bearing rock series	$Pt_1\varphi o$ fine hornblendite	3
Wt_3G	2560	Fine quartzite, met-siltsone, calcareous sandstone, phyllite; Jiangxian group: biotite schist, chlorite schist, garnet two-mica schist, sandy phyllite, sericite schist, metamorphic basalt; Qingyuan group: carbonized sulfide schist, grunerite schist	$Ar_3^2\beta\mu$ amphibolite–metamorphic diabase- gabbro, Ar_3^2dN fine amphibolite, $Ar_3^2\varphi o$ medium -coarsehornblendite, Ar_3^2dN biotite – olivine -serpentinite, $Ar_3^2\kappa\gamma$ orthoclase	2

			granite, Ar_3^2ηγ admellite, Mengyin tonalite, kimberlite, diamond, Jinchnagyu Au mine, Tongdongyu Cu-Co mine, Hongtoushan Cu-Zn mine	
Wt_2T	2620	Sericite quartzite schist, chlorite quartzite schist, magnetite quartzite, metamorphic sand conglomerate, marble, quartzite, feldspar quartzite, gravel two-mica schist, biotite schist, quartz two-mica schist, chlorite schist, chlorite albite schist, dolomite quartzite schist, chlorite sericite quartz schist, amphibolite, biotite leptynite	Ar_3^2κγorthoclase granite, Ar_3^2γmetamorphic -granite, Ar_3^2γδgranodiorte, Ar_3^2N serpentine -hornblendite, Ar_3^2πγ porphyritic granite, Ar_3^2δo quartz-diorite, Ar_3^2γ biotite -granite	2
Wt_1S	2680	Feldspar quartzite, biotite leptynite, diopside marble, amphibolite, hornblende leptynite, magnetite quartzite, quartzite, chlorite schist, micaite quartz schist, garnet mica quartz schist, hornblende schist, sericite quartz schist, quartz talk schist	Daixian rutile- actinolite - tremolite rock, chlorite - tremolite rock, anthophyllit, Ar_3^2κγgn monzonitic – orthoclase -gneiss, Ar_3^2Tγgn two-mica -oligoclase- gneiss 2591Ma, Ar_3^2πγgn biotite - monzonitic gneiss, Ar_3^2δgn biotite –hornblende –plagio clase gneiss, Ar_3^2d*N* hornblende -pyramidite	3
Fp_2W	2740	Leptite, diopside tremolite, diopside calsite monzonitic lepynite, diopside amphibolit, diopside tremolite, diopside actinolite, dolomite marble; Taihua group upper: graphite silica -garnet biotite gneiss, amphibolite, graphite marble, quartzite; Dengfeng group upper part: metamorphic quartz keratophyre, chlorite schist, quartz schist	Ar_3^1κγgn biotite -potash feldspar gneiss, Ar_3^1ηγgn biotite -monzonitic gneiss, Ar_3^1δgn porphyritic – hornblende -monzonitic gneiss	3
Fp_1Ch	2800	Plagioclase leptynite, amphibolite, two-pyroxene granulite, magnetite quartzite, leptite, marble, corundum silicate gneiss; Taihua group lower: quartzite, biotite leptynite; Dengfeng group lower: hornblende leptynite, metamorphic spilite, quartz keratophyre; Zanhuang group: cyanite biotite plagioclase gneiss	Ar_3^1δgn hyperthene –grano diorte gneiss, Ar_3^1Togn biotite –hornblende -plagioclase gneiss, Ar_3^1Tγgn biotite - plagioclase gneiss, Ar_3^1γ ohornblende -plagioclase gneiss, Ar_3^1δgn biotite– diopside-plagioclase gneiss, Wulashan graphite – sillimanite -gneiss	2
Zhm	2900	Biotite-plagioclase-liptynite, amphibolite,magnetite-quartzite, hornblende-biotite- plagioclase-liptynite,monzonitic-leptynite; Anshan:sericite-chlorite-schist, chlorite-quartz-schist, phyllit; Jining:feldspathic-quartzte, graphite –diopside-marble	Ar_2To+Tγgn biotite-monzonitic gneiss, Ar_2Tγgn biotite - hornblende-monzonitic gneiss, sillimanite-garnet - monzonitic gneiss, graphite - gneiss, diopsidite rock, Tuguiwula mica-granite - pegmatite	2
Zhw	3000	Medium-coarse amphibolite, diopside -amphibolite, plagio -diopside ,hornblendite, hornblende -biotite-liptynite, biotite- amphibolite; Anshan group upper: biotite-quartz-schist, magnetite -quartzite, two-mica –sillimanite –quartz -schist, tourmaline -leptite, marble	Ar_2Togn hornblende –plagio clase gneiss, Ar_2γδgn granodiorte gneiss, Ar_2Togn streaked –biotite -plagioclase gneiss, Ar_2δgn hornblende - plagioclase gneiss, Ar_2Tch charnockite, Liangcheng two pyroxene -gabbro, norite	2
Qxst	3100	Two pyroxene-granulite, diopside- granulite, two pyroxene- plagioclase-gneiss, amphibolite, garnet - leptite, magnetite -quartzite; Xiabaiyao: sillimanite-	Ar_2Pgn gneissic – biotite – oligoclase -granite, Ar_2Sgn hyperthene biotite –	1

		garnet-leptynite, graphite - garnet-leptite, feldspathic - quartzte; Anshan group lower: biotite- leptynite, hornblende-leptynite, garnet-biotite- leptynite	hornblende -plagioclase gneiss 3000Ma, Ar_2dN diopside- amphibolite, gabbro, Anshan biotite - plagioclase gneiss	
Qxs	3200	Two pyroxene-granulite, diopside-granulite, amphibolite, biotite- leptynite, garnet-leptite, magnetite-quartzite; Anshan group lower : hyperthene monzonitic granulite, pyroxene-amphibolite	Ar_2δgn biotite –hornblende - plagioclase gneiss, Ar_2Togn ptygmatic -biotite – plagio clase gneiss, Ar_2Tγgn hyper thene monzonitic gneiss, Ar_2Togn hyperthene biotite - monzonitic gneiss, Anshan hornblende- two pyroxene - plagioclase gneiss	1
Czh	3350	amphibolite, feldspathic-quartzte, chrome mica-quartzte, biotite- leptynite, cordierite-quartzte, scapolite hornblendite, Ba-adularia-gneiss, magnetite-quartzite, olivine-magnetitite, diopside- marble	Ar_1Hgn biotite -plagioclase gneiss, hornblende –plagio clase gneiss, diopsidite rock	1
Czp	3500	quartz-almandine eulitite, hornblende –plagioclase - leptynite, garnet-biotite-leptynite, granulite, komati, light granulite, graphic leptite, magnetite-quartzite		1

Appendix II List of Biotic Fossils in North China Landmass

Strata	Age /Ma	fossil species	Biological community composition
Qhq	0.005	51	ostracoda7,foraminiferida7,mollusca7,vertebrata7,herbaceous11, woody plants 6, broadleaf plants 5,Hmankind cultural relics1
Qpq	0.01	104	gastropoda28, ostracoda 21,lamellibranchia2,bacillariophyta1,charophyta1, mammalia 7, spore - pollen44
Qpm	0.87	10	mollusca 6,struthio1,mammalia2, foraminiferida 1
Qpc	1.74	13	mammalia 13
Qpn	2.6	100	gastropoda 7,bivalvia8, ostracoda 12, foraminiferida 1,fish1, spore-pollen 2, struthio 1, mammalia 67, humankind cranium & palaeolith1
N_2s	5.3	40	gastropoda 9, ostracoda 2, lamellibranchia 9, mammalia 20
N_1j	23.3	17	mammalia 17
ENh	26.4	58	flora35,lnsecta1, gastropoda 20, mammalia 2
E_{2-3}x	56.5	34	gastropoda 4, lamellibranchia 6,algae1,pteridophyta1,gymnospermae4,angiospermae18
K_{1-2}n	96	20	estheria 1, bivalvia gastropoda 5, flora 6,reptilian dinosaurs8
K_1q	101.4	83	flora 55, lamellibranchia 14, gastropoda 12, estheria 1, fish 1
K_1xd	106.8	42	estheria7, flora 7, fish 5, lnsecta 1, spore-pollen 19, ostracoda 3
K_1jf	112.2	106	fish 6, lnsecta 16, bivalvia 16, gastropoda 9, estheria 7, ostracoda 22, filices-coniferae25, reptilia5 Dinosaur Jingshang Luanping
K_1y	117.6	48	estheria 10, bivalvia 3, ostracoda 6, flora 16, fish 9, lnsecta 4,aves1
K_1d	123	79	flora 13, gastropoda 5, ostracoda 26, estheria 13, bivalvia 5, fish 2, lamellibranchia 14, reptilia1
K_1z	137	25	Gymnospermae ginkgopsida coniferae 7, estheria 3, lnsecta 1, lamellibranchia 1, gastropoda 1, ostracoda 2, fish 2, bivalvia 8
J_3tch	150.6	41	gymnospermae 5, spore-pollen 3,estheria20, ostracoda 3, bivalvia 2, lamellibranchia 3, fish 1, lnsecta 2, reptilia2(Rehe foot track, Xuanhua dragon)
J_2t	164.2	87	gymnospermae 80,lnsecta2, estheria 2,bivalvia3
J_2j	177.8	128	Flora cycadopsida,filices, coniferae ginkgopsida41genus111species, spore-pollen 3, estheria 2, ostracoda 5, bivalvia 3, lnsecta 3, fish 2,reptilia2
J_1x	191.4	72	flora 25, spore-pollen 41, bivalvia 2, lnsecta 2, estheria 2
J_1n	205	9	flora 9
T_3x	216	180	Gymnospenmae-pteridophyta20 genus 28, spore-pollen 54 genus 110 species, bivalvia 34, estheria 7, lamellibranchia 1
T_2e	227	35	flora 21, estheria 2, lnsecta 2, China Ken's beast-Sinokannemeyeria10
T_2h	241	24	Ribs plant 8, estheria 2, Quadruped 3, fish 2, bivalvia 9
T_1l	250	20	flora 11, estheria 5, Triops spp. 2, vertebrata 2
P_2s	277	11	flora 6,platysomoidei1, ostracoda 2, lamellibranchia 1, vertebrata 1

$P_{1-2}sh$	286	222	Cathaysian flora 70 genus 218 species, *lingula*,brachiopoda, bivalvia, Sawtooth dragon, Giant dragon fauna
P_1s	295	227	flora 56 genus 169,spore-pollen19,fusulinids13,anthozoa3, brachiopoda 6, foraminiferida 3, bivalvia 6, Triops 4, lnsecta 4
C_3t	307.5	200	lycopsida,sphenopsida, filices,pteridospermopsida32 genus 97, spore-pollen 4, brachiopoda 17, anthozoa 13, fusulinids 25, bivalvia 8,conodonts3, gastropoda 7,cephalopoda2, foraminiferida 13, echinodermata2, bryozoa9
C_2b	320	104	Flora lepidodendron & pteridospermopsida 6 genus 19 species, spore-pollen 3, anthozoa 6, fusulinids 27, brachiopoda 18, conodonts 6, foraminiferida 6, bivalvia 9, bryozoa 2,trilobita2, gastropoda 4, cephalopoda 2
D	410	22	brachiopoda 9,tetracoralla7,tabulata3, conodonts 2,ammonitida1
S	438	162	trilobita 4, conodonts 4, brachiopoda 5, anthozoa 39 genus 86 species, graptolithina27, conchostraca3, nautilida4, shell3, stromatoporoidea19,bryozoa7
O_3d	448	43	anthozoa 6, conodonts 5
O_2m^3	448.4	10	cephalopoda 7, brachiopoda 1, stromatoporoidea 1,grinoidea1
O_2m^2	458.8	22	conodonts 6, graptolithina 1, cephalopoda 13, trilobita 1, gastropoda 1
O_2m^1	469.2	20	trilobita 1, conodonts 6, cephalopoda 7, gastropoda 4, brachiopoda 2
O_2l	479.6	32	trilobita 2, conodonts 13, gastropoda 2, cephalopoda 14,archaeocyatha1
O_1y	490	61	trilobita 16, graptolithina 18, conodonts 21, gastropoda 2, brachiopoda 3, cephalopoda 1
$\in_3cm$	495	55	trilobita 38, graptolithina 4, conodonts 3,brachiopoda1, nautilida 12
$\in_3g$	500	31	trilobita 30, brachiopoda 1
$\in_2z$	513	41	trilobita 40, brachiopoda 1
$\in_{1-2}m$	528	34	trilobita 31, brachiopoda 2, algae 1
$\in_1c$	543	10	stromatolite1, trilobita 5, brachiopoda 2,porifera1, gastropoda1
Z_2jx	650	111	stromatolite 36, micro-paleobota75
Z_1wh	723	58	stromatolite 10, micro-paleobota35, Carbon macro fossils 7,vermes6
Qbj	800	12	Macro algae 3, micro-paleobota9
Qbl	900	57	micro-paleobota23 genus 54 species, Macro algae 3
Qbx	1000	107	micro-paleobota35 genus 105 species, Carbon macro fossils 2
Jxt	1100	60	micro-paleobota27 genus 60 species
Jxh	1200	72	micro-paleobota31 genus 72 species
Jxw	1300	34	micro-paleobota15 genus 34 species
Jxy	1400	10	micro-paleobota5 genus 10 species
Nkg	1500	32	micro-paleobota9 genus 27 species, Macro algae 1 genus 2 species, Eukaryotic macro fossils 3
Nkd	1600	30	micro-paleobota12 genus 28 species, Macro algae 2 species
Cht	1650	41	micro-paleobota14 genus 35 species, Macro algae 4 genus 6 species
Chch	1700	163	micro-paleobota44 genus 162 species, Macro algae 1
Chc	1750	16	micro-paleobota5 genus 13 species, Carbon Macro algae 3
Chz	1800	8	stromatolite 8
Ht_3G	1880	2	stromatolite 2
Ht_2t	1959	2	stromatolite 2
Ht_2b	2039	24	stromatolite 24, Bifurcated columnar stromatolites mainly flourished at 2 billion -6 million years ago
Ht_2hy	2119	6	stromatolite 6
Ht_2d	2199	13	stromatolite 13
Ht_2j	2278	22	stromatolite 22
Ht_2h	2358	15	stromatolite 15
Ht_2w	2386	2	stromatolite 2
Ht_1q	2415	3	stromatolite 3
Ht_1d	2443	10	stromatolite 10
Ht_1n	2472	3	stromatolite 3
Ht_1s	2500	3	Australia, North America and South Africa 11 sites found more than 2.5 billion years of laminated stone
Wt_3G	2560	2	India's Madras G.R. group is greater than 2600Ma
Wt_2T	2620	2	Bulawayo limestone 2600Ma: Bifurcated columnar stromatolite began to appear in the formation of 2.5-2.7 billion years
Wt_1S	2680	3	Southern Croce quartzite is greater than 2700 Ma; Hammersley Group 2700Ma
Fp_2W	2740	3	Wittwatersrand rock is about 2640-2820 Ma
Fp_1Ch	2800	2	South Africa North Cape found 2.8-2.5 billion sulfur fossil fossils; 2.8 billion years ago in South Africa Brava about dolomite stromatolite

Zhm	2900	2	
Zhw	3000	2	India Madras Gneiss is greater than 3000Ma
Qxst	3100	1	South Africa Braila Bulawayan limestone 3.1 billion years prokaryotic cells blue - green algae (Large stromatolite)
Qxs	3200	1	South Africa found 3.2 billion years ago superfossils—Pseudomonas sp
Czh	3350	1	Western Australia found 3.43 billion years of microfossils
Czp	3500	1	Western Australia Pilbara's Wallahuna Group 3.5 billion years ago bacterial fossil – siliceous stromatolite

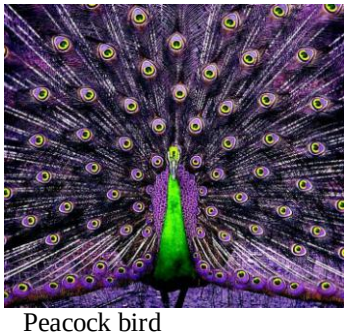
Fluorite crystals druse

Chinese rose flowers

Conchs-Bivalvia

Azurite - malachite assemblage

Lavender plant



Peacock bird

The equivalence of natural order of Mineral - Plant - Animals