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Энергетика и глобальные изменения

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Аннотация. Энергия полезных ископаемых является результатом серии сложных химических реакций внутри Земли при высоких температурах и давлении, которые происходят в течение длительного периода геологического времени. Продуцирование ископаемой энергии требует огромного количества тепла. Хотя большая часть угля, нефти и газа приурочены к осадочным породам с богатыми геотермальными ресурсами, в земной коре не существует такого явления как «море нефти» или «море газа». Нефть, природный газ, сланцевый газ существуют под землей в виде огромной «капиллярной сети», представленной порами пород, трещинами, пещерами, разломами. Трещины и другие пустоты могут быть полностью внутри коры. Месторождения ископаемой энергии сосредоточены лишь в небольшой части земной поверхности, максимальная глубина, на которую проникает добывающая отрасль, составляет всего 5 километров. Нефть, природный газ и сланцевый газ заполняют эти поры, трещины, разломы и песчаные пласты, эффективно предотвращая чрезмерную утечку земного теплового потока. Огромное давление, создаваемое нефтью, природным газом и сланцевым газом внутри коры, противодействует внутреннему

тепловому давлению земли, обеспечивая динамический баланс. Как только нефть, природный газ и сланцевый газ выкачаны, поток внутренней теплоты земного шара следует за капиллярной сетью из-за потери теплоизоляции и теплоизоляционных материалов, и в конечном итоге достигает поверхности, заставляя кору под поверхностью «лихорадить» и вызывая экологические и геологические катастрофы. Огромные количества экстремально рассеянного тепла вызывают попадание водяного пара, CO_2, CH_4 и других газов из коры в атмосферу и океаны, что нарушает баланс атмосферной энергии и вызывает изменение климата и метеорологические катастрофы. С повышением температуры моря повышается также влажность воздуха, и это приводит к возникновению тайфунов, ураганов и тропических циклонов, а также самые таких погодных аномалий, как сильные местные дожди, снег, засухи, суровые зимы. Ожидается, что эти явления станут более частыми, погода станет более экстремальной. Глобальный климат будет характеризоваться долгосрочным потеплением, если добычу энергетических ресурсов продолжать прежними темпами.

Ключевые слова: добыча энергии; наземный тепловой поток; земная кора; подстилающая поверхность; глобальные изменения.

Energy Mining and Global Changes

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Abstract. Fossil energy is the product of a series of complex chemical reactions inside the earth under high temperature and pressure that occur over a long period of geological time. The production of fossil energy requires a tremendous heat source. Although the majority of coal, oil and gas exist in sedimentary basins with rich geothermal resources, a “sea of oil” or “sea of gas” does not occur within the crust. Petroleum, natural gas, shale gas, *etc*. exist underground in a huge “capillary network” that consists of rock pores, cracks, caves, faults and sand. Cracks and faults may be entirely within the crust. Deposits of fossil energy only cover a small portion of the earth’s surface, and the maximum depth of human mining is only 5 kilometers. Petroleum, natural gas and shale gas seal these pores, cracks, faults and sand beds, effectively preventing excessive leakage of terrestrial heat flow. The enormous pressure formed by petroleum, natural gas and shale gas within the crust oppose the earth’s interior thermal pressure, achieving a dynamic balance. Once petroleum, natural gas and shale gas have been mined, the earth’s interior terrestrial heat flow follows the capillary network because of the loss of thermal insulation and heat-sealants and eventually reaches the surface, causing the crust underlying the surface to “fever” and triggering ecological and geological disasters. Huge amounts

of extreme dispersed heat force the water vapor, CO_2, CH_4 and other gases from the crust into the atmosphere and oceans, which disrupts the atmospheric energy balance and causes climate change and meteorological disasters. With increasing sea temperatures, air humidity has also increased, which has produced the strongest recorded typhoons, hurricanes and tropical cyclones, as well as the strongest recorded local rainfall, snow, drought, winter and cold conditions. These conditions are expected to become more frequent, with the weather becoming more extreme and violent. Global climate will long-term warming if energy mining does not stop.

Keywords: Energy mining; Terrestrial heat flow; The Earth's crust; Underlying surface; Global changes.

Introduction

Currently, frequent ecological and geological disasters, climate change, extreme meteorological disasters, and extensive prolonged mining of fossil energy have caused damage to the crustal insulation seal and increased terrestrial heat flow, which has led to global change caused by increased crustal and underlying surface temperatures; however, such changes are often overlooked.

It is generally accepted in the meteorological community that climate change that occurs for longer than three months is not caused by factors within the atmosphere but outside of the atmosphere.

Maocang Tang *et al*. (Maocang, 1995; Maocang and Xiaoqing, 1992), suggested that “the root cause of climate change is in the solid part of the earth," and the atmospheric change is a response (or adaptation) status. These authors proposed the “geocentric theory of climate change." Ground temperature is a measure of the physical quantity of surface thermal energy, and changes in deep ground temperature are more conservative and caused by hysteresis than by temperature changes. As a part of underlying surface system, the change of ground temperature can cause changes to many of the physical quantities within the atmosphere and oceans, which indicates that various thermal processes in the solid cycle participate in climate change processes (Maocang and Jian, 1994). Ground temperature and sea temperature are direct manifestations of the surface heat content. The heat sources for ground temperature and sea temperature are solar radiation and heat diffusion inside the crust. Based on the degree to which it is affected by the heat source, the crust surface can be divided into a variable-temperature zone, stable-temperature zone and increasing-temperature zone. The variable-temperature zone is the zone with a thin earth surface under solar radiation influences. Because of changes in the solar radiation energy cycles, changes in the daytime and nighttime temperatures and annual or even century-long cyclical changes can be observed in this zone. The magnitude of the temperature change during the year decreases gradually with depth according to certain natural laws. Plains and hilly areas usually have a 15-20 m deep variable-temperature zone (Jun et al., 1990). Solar radiation only affects the earth's surface temperatures, whereas heat diffusion inside the crust affects deep ground surface temperatures and sea temperatures. Numerous years of satellite observation results have shown that the magnitude of the solar constant varies by approximately 1‰, which is not enough to cause changes to the earth's climate. However, the magnitude of the temperature increase caused by doubled greenhouse gases (CO_2, CH_4 and N_2O *et al.*) is not known. Maocang Tang (Maocang et al., 2004) made a rough estimate using ancient historical data, and the preliminary results are as follows: the magnitude of temperature increase caused by doubled greenhouse gases is ≤ 1°C, which suggests that the simulation results of 1.5-4.5°C/2×CO^2 that were obtained from various domestic and international numerical models are not supported by the ancient historical data. The high heat flow from the mantle is not only an important condition for the evolution of organic matter, but it is also a main factor for climate change (Dou et al., 2003). The earth's interior heat constantly diffuses to the ground surface and can produce large values at certain locations (such as craters or fault zones) at certain times (such as after an earthquake), which is called a "sudden ground temperature rise" or "geothermal anomaly" (Maocang and Jian, 1990). According to monthly ground temperature anomaly data from different Chinese stations from 1954 to 1985, among the total statistics from 70 stations, 53 instances of ground temperature sudden rise were caused by geothermal anomalies.

Previous studies have shown that changes in the underlying surface forced are one of the most important causes of climate anomalies (Shukla, 1984). The tropical sea temperature anomalies represented by El Nino events can cause global climate responses. The essence of climate change is its non-thermal insulating properties (Ronghui, 1991). Therefore, underlying surface thermodynamic anomalies are an important cause of climate change. Alternating cold and warm atmospheric temperatures have certain similarities with ground temperature, and they have corresponding cold and warm centers. The cold and warm transitions of ground temperature are synchronized with atmospheric temperature changes, and differences in the atmospheric and ground temperatures are a result of transitions that occur on a small time scale and are more obvious and frequent for atmospheric temperature than for ground temperature. The energy to produce ground temperature change occurs on a large time scale and is stronger than that of atmospheric temperature. The earth’s interior has an impact on atmospheric process through the continuous delivery of materials and energy to the atmosphere, which eventually cause climate change (Xiaoqing et al., 2004).

To address global change, a “pathogenesis” study of global change must be performed because an accurate understanding of the pathogenesis of global change is vital to understand current and future climate change.

Materials and methods

1.1 Evidence of terrestrial heat flow change before and after fossil energy mining

Fossil energy sources such as coal, petroleum, natural gas, shale gas *etc*. are sensitive to geological and environmental factors, such as temperature and pressure. The various tectonic events in the geological evolutionary process have inevitably led to a series of physical, chemical, structural and construction changes in coal, petroleum and gas. Therefore, evidence related to the phenomena of increased ground temperature and sea temperature that have been caused by crust insulation seal damage and increased terrestrial heat flow related to large-scale fossil fuel mining must be contained in the geological record in deep and shallow layers.

Hongyang Li *et al*. (Hongyang et al., 2007) observed ground temperature changes in the Huainan mining area and found that the geothermal gradient in the Panji area (2.80-3.80°C/hm) was significantly higher than in the old area (1.10-1.82°C/hm); the average geothermal gradient (3.42°C/hm) in the Pansan mining area west wing was higher than in the east wing (3.14°C/hm), and the east and west wings both showed positive anomalies. In the old area, long-term mining activity has caused numerous fissures in the rock formations that led to the infiltration of low temperature water, which has cooled the rock formations. In addition, mining area drainage has formed a cold water circulation system that improves the cooling effect on the rock formations. After analyzing the cause of the abnormality, Hongyang Li suggested that the heat source causing the Huainan mining area geothermal anomaly is produced by processes inside the earth, and he clearly stated that coal has much lower thermal conductivity than other sedimentary rocks. Therefore, in coal seams, especially thick coal seams, high geothermal gradients occur. Coal strata contain more coal than the average coal-free sedimentary cover, and there is an overall more pronounced blocking effect on the underground heat. Guangming He *et al*. (Guangming and Kemin, 2009) performed an analysis on the geothermal test data from 30 drilling and mine exploration and construction projects in the deep Panzhihua mine and found that the total trend occurred with increasing depth and high temperature area; thus, the heat source was considered to originate from magmatic residual heat. The coal mine with the deepest mining level in Britain is in Lancashire, and it has a depth of approximately 1300 m. The deepest wellbore is in Walesthe. Yugal K. Verma measured 26 original ground temperature values in 5 coalfields in the south coalfields, and the geothermal gradient measured at a depth of 1220 m was 26.2 °C/hm with an average original ground temperature of 45.7°C. Fourteen data points were measured for coal seams in the middle half of the middle coal deposits, but because of the high density and high thermal resistance coal seams, the geothermal gradient was only 18.7 °C/hm; therefore, the thermal conductivity was relatively low (Shaolin, 1985).

Xuechun Xu *et al*. (Xuechun et al., 2003) performed paleogeothermal research on the Dagang Oilfield and showed that over time, paleogeothermal influences during the Dagang Oilfield oil and gas formation process produced obvious changes at an early stage that flattened at a later stage, which suggests that paleogeothermal change is controlled by regional tectonics, and paleogeothermal peak areas coincide with areas of intense tectonic activity and frequent hydrothermal activity. Therefore, paleogeothermal change is closely related to and caused by the regional tectonic environments and thermodynamic conditions. Periods of paleogeothermal change indicate strong crustal activity and tectonic movement, and they coincide with the peak of petroleum and hydrocarbon migration and accumulation. Heat flow statistics also indicate that the terrestrial heat flow values of geological units decreased with increasing age during the final phase of construction-heat events (Pollack et al., 1993). Peng Zhang *et al*. (Peng et al., 2007; Jun et al., 1995; Shejiao et al., 2000; Hu et al., 2000) suggested that the entire geothermal gradient in the southern North China Basin is between 13.0 and 39.9 °C/hm, with an average of 25.3°C/hm, and the terrestrial heat flow value is between 30 and 89.6 °C/hm, with an average heat flow value of 53.7 °C/hm. Compared with other geological units of the Chinese mainland, the heat flow values are higher, especially in cold basins such as the Tarim Basin (44 °C/hm), Junggar Basin (69 °C/hm) and Songliao Basin (70 °C/hm). From these data, we can clearly see that unmined oil and gas fields (Tarim Basin and Junggar Basin) have lower terrestrial heat values, whereas the large-scale and long-term mined oil and gas fields (Bohai Bay Basin: Dagang Oilfield; Songliao Basin: Daqing Oilfield, Jilin Oilfield, Liaohe Oilfield) have higher terrestrial heat values; the oil and gas fields located between the former two groups (southern North China Basin – southern North China Oil Field) have terrestrial heat values that are between the values of the former two groups. Based on previous studies, Nansheng Qiu (2001) used the thermal conductivity theory to calculate temperature at depth according to a large number of rock thermal conductivity and heat generation rate data to analyze the temperature distribution at depth (below 4 km). Based on these heat flow values, the statistical average heat flow value in Qaidam Basin was found to be 52.6±9.6 °C/hm. However, in the local wellhead, the heat flow value reached above 70 °C/hm and formed a thermal anomaly zone in the basin as a result of the weakened crustal heat seal and increased terrestrial heat flow during large-scale oil exploitation operations.

Hydrocarbon-bearing basins are intrinsically rich in oil, natural gas and geothermal and other resources. Huichao Jiang *et al*. (Huichao et al., 2008) used authigenic illite crystallinity and the chemical composition of authigenic chlorite to analyze the Jiyang depression Cenozoic ancient geothermal gradient. The results showed that the Jiyang depression Cenozoic ancient geothermal gradient is 37.2-38.2 °C/hm. Yuling Gong *et al*. (Yuling et al., 2003) used temperature measurements from 703 drilling wells to calculate the current average geothermal gradient in the Jiyang depression (35.5 °C/hm) and concluded that the ancient geothermal gradient was larger than the current geothermal gradient. The Jiyang depression Zhanhua east block is located in the Hekou District, Dongying, and exploration has confirmed it to be a duplex oil and gas gathering area that is rich in oil and gas resources, as well as diverse oil and gas reservoir types. Based on the district drilling temperature and vitrinite reflectance R_O data. Benhe Chen *et al*. (Benhe et al., 2001) used a multi-stage thermal evolution model that combined lithosphere and basin scales to restore the thermal history of this district after analyzing the current geothermal field in the district. The results are listed as follows. (1) The current geothermal gradient is 35.8 °C/hm, with the Gudao and Kendong areas having higher geothermal gradients of more than 37 °C/hm. (2) The early Paleocene terrestrial heat flow value was 83.6 °C/hm, which is equivalent to a heat value of a modern active rift. Since the Pliocene, basins have shown a gradual cooling trend, although two temperature increases were found, but the rate of increase eventually decreased. The current terrestrial heat flow value is 63 °C/hm, which is close to the global average terrestrial heat flow value. (3) The main hydrocarbon source rocks in this district experienced a continuous heating process and are currently in an "oil generation window," with a large space of oil and gas occurring at depth. The heat evolution background is beneficial for oil and gas generation, which shows that oil and gas generation effectively blocked terrestrial heat flow.

Table 1 – The conductivity of various rocks and fossil fuel

Crustal components	Thermal conductivity (W/m.K)
coal	0.21
petroleum	0.14
natural gas	0.052
oil shale	0.08
shale gas	0.049
combustible ice	0.121
sedimentary rock	3.41
granite	3.49

basalt	2.17

1.2 Evidence of increased ground temperature and sea temperatures in deep and shallow layers caused by increases of terrestrial heat flow

Jun Du *et al*. (Jun et al., 2008) analyzed the deep geothermal change trend in Lasa and showed that the average ground temperature has experienced a significantly increasing trend over the most recent 45 years in Lasa, and the tendency rate is 0.58-0.69°C/10y. Compared with the average rate of atmospheric temperature increase during the same period, the ground temperature has experienced a larger increase. In addition, geothermal observations from seasonal frozen soil and meteorological stations located in permafrost regions of the former Soviet Union have shown that the annual average ground temperature at most of the meteorological stations experienced an increasing trend for nearly a century (Gilichinsky et al., 1998). In the Swiss Alps, the temperature of the permafrost layer below the surface has been increasing at a rate of 0.5-1.0°C/10y since 1980 (Haeberli et al., 1993). The permafrost temperature measurement results, acquired in a north-south direction across Alaska, showed that the upper limit of the permafrost temperatures has increased by 0.5-1.5°C from the late 1980s to 1996 (Osterkamp and Romanovsky, 1999). The permafrost temperature in the Fenghuoshan area, Qinghai-Tibet Plateau, has increased by 0.2-0.3℃ from the 1960s to 1990s (Shaolin, 1993). The linear heating rate of the ground temperature in the north and south regions of the Qinghai-Tibet Railway is high, especially the average heating rate in the south region of the Qinghai-Tibet Railway, which has reached 0.56°C/10y (Dongliang et al., 2005). The permafrost ground temperature in China's Daxinanling Amur region has increased 0.8°C from the 1970s to 1990s (Zhongwei et al., 1993). The ground temperature has increased 0.3-0.6°C in the Heilongjiang upper valley region from 1958 to 1990 (Shengqing and Zhanchen, 1993). Observations based on the Qinghai-Tibet highway and railway geothermal features and degradation mode by Huijun Jin, Dongliang *et al.* (Huijun et al., 2006; Dongliang et al., 2005) showed widespread degradation of frozen soil, increases of ground temperature, increases of the maximum melting depth in summer, decreases of the freeze depth in winter and decreases of the frozen soil layer thickness or its complete absence in certain areas. Currently, the degradation rate of Qinghai-Tibet Railway frozen soil is approximately 6-25 $cm \cdot a^{-1}$, whereas the melting rate has reached 12-30 $cm \cdot a^{-1}$. The rates of increase of the annual average air temperature and ground temperature are 0.33°C/10y and 0.37°C/10y, respectively. Overall, the increasing rate of ground temperature is higher than that of the atmospheric temperature.

According to a report in the British journal "New Scientists" on Dec.

12th, 1994, climate warming is not consistent with expected climate change based on the atmospheric buildup of greenhouse gases in the earth. The researchers suggested that the Southwest Pacific is a valuable reference for monitoring the degree of climate change because it has fewer cities and less air pollution. Research by the New Zealand National Institute of Water and Atmospheric has provided firsthand data on the Indian Ocean warming at depth. Nathan Bindoff from the Antarctic Climate and Ecosystems Cooperative Research Centre (Hobart, Tasmania, Australia) compared temperature data recorded in vessels crossing the Indian Ocean during the early and mid-1960s with data recorded by the Darwin research vessel in 1987, and he found that the temperature in the ocean had increased by approximately 0.5°C at latitude 32° south at a depth of 250-1500 m. Bindoff suggested that the temperature change of the deep ocean is an important indicator of total global climate change. He suggested that when measuring temperatures deep in the ocean, seasonal fluctuations are small; therefore, compared to measurements at sea level, measurements in the deep ocean can provide more accurate results with fewer observations. The Indian Ocean is the third ocean that has experienced deep warming water. Similar results were published by Bindoff in 1992 and showed that the temperatures of the Southwest Pacific increased at almost the same rate. Gregorlo Parrilla and his research team at the Spanish Institute of Oceanography found that the North Atlantic is also warming (Qingshan, 1995).

Professor Pollack (1991) analyzed the ground temperature data of more than 60 locations in South Africa and found that the ground temperature in this area has increased by 0.3-0.8°C over the past 100 years, with an average increase of 0.55°C, which is consistent with research results on global change. Internationally renowned geothermal scientist and U.S. National Academy of Sciences member Arthur H. Lachenbruch studied a large number of drilling temperature data from northern Alaska (within the Arctic circle) and concluded that the temperature has increased 2-4°C in this area in the last century (Lachenbruch and Marshall, 1991). The vice-chairman of the International Heat Flow Committee and former director of the Physics Institute of the Czechoslovak Academy of Sciences Dr. Čermák studied temperature data from more than 30 drilling holes in Cuba and indicated that the temperature has increased 2-3°C over the past 200-300 years in Cuba (Čermák *et al.*, 1991). Professor Mareschal from the Université du Québec, Canada and Dr. Jessop from the Geological Survey Institute of Canada (Jessop *et al.*, 1991) studied a large amount of measurement data from central and East Canada and reported that the temperature has increased 1-2°C in this region over the past 100-200 years and indicated that most of the temperature changes predicted from geothermal data are consistent with the observation results at meteorological stations.

Results

From 1998 to 2000, four curves representing temperature changes in the Northern Hemisphere and worldwide over nearly a thousand years have been published in international journals. The study timelines extend over 1000 years and the curves represent temperature changes in the Northern Hemisphere and worldwide for the following reasons: a long enough time line must be used to show whether the climate warming of the 20th century is abnormal and infer whether this is a result of human activities; in addition, such studies include the Medieval Warm Period (MWP) and Little Ice Age (LIA), which show climate change in the Northern Hemisphere and worldwide because both of these climatic events occurred before human activities could have had a significant influence; therefore, most authors ascribe them to natural climate change. If natural change happens globally and the change magnitude is close to or even greater than the climate warming of the 20th century, it would suggest that the warming in the 20th century could be attributed to natural causes. Shaowu Wang *et al*. (Shaowu *et al.*, 2002) performed a comprehensive analysis of four Northern Hemisphere and global temperature series over the past 1000 years using the history built by Mann *et al*., Jones et al., Crowley *et al*. and Briffa. In addition, they compared different temperature series with the simulation results (S) using global average temperature series (W) over the past 1000 years that were calculated from data from 30 sites and the S for the temperature change over the past 1000 years based on the energy balance model. They concluded that the LIA was significant and the MWP was not as consistent as the LIA. The years 1925, 1950, 1975 and 2000 were used to calculate average over one hundred years, and an anomaly of approximately 0.50°C was found in the average of 1000 years; the 20th century average was significantly higher than any of the century averages significantly higher than the century average from the 11th century to the 12th century. Therefore, the century average of the 20th century is significantly higher than that of any century average over the past 1000 years. Clearly, climate change has not been caused by natural causes for nearly a century since the 20th century.

The insulated sealing function of fossil energy, increased terrestrial heat flow caused by overexploitation, and increased ground temperatures and sea temperatures in deep and shallow layers were analyzed together so that the relationship between environmental changes over nearly one hundred years and various intensified abnormal disasters might be explained. For example, long-term continuous increases of ground temperature in the deep and shallow layers causes crustal mechanical structure changes, soft changes in soil and rock cohesion, frequent geological disasters, such as mudslides and landslides; in addition, increased ground temperatures cause harmful substances in the rock to dissolve in the groundwater, which may cause water shortages related to water quality.

Observations by scientists have suggested that over the past 50 years, nearly 40 coastal waters have developed dead sea conditions because of pollution and global warming. Scientists from China's State Oceanic Administration confirmed that the Western Pacific coastal sea level will show an accelerated rising trend in the future and increase by 10-40 cm in 2030 and 40-90 cm in 2100.

Temperature increases of the underlying surface and sea water not only cause the melting and disappearance of glaciers and frozen soils but also cause increased acidity of seawater; thus, the survival of marine organisms will become more difficult, and the continual extinction of marine organisms and exacerbated global warming will occur. Increases of lake water temperature aggravates eutrophication, and cyanobacteria and red tides frequently occur, leading to deterioration of water quality. With continued increases of evaporation, a large number of lakes will tend to dry up. When the ground temperature increases, snow melts and snow lines rise, soil moisture evaporates, droughts and floods frequently occur and land desertification intensifies.

Increased sea temperature in deep and shallow layers causes the rapid evaporation of water from the ocean and increased rainfall in flood-prone areas. Winter temperatures are rising, and accumulated amounts of snow are decreasing. Melted snow is no longer slowly flowing down mountains within months but directly flowing into rivers. An increasing number of rivers are becoming seasonal rivers because floods that used to occur once every one hundred years now occur every year. If El Niño/Southern Oscillation (ENSO) and La-Nina events occur, they can cause rare localized hot or cold temperatures, and these events not only cause climate anomalies, such as polarized temperatures, with harsh summer and winter seasons and imperceptible spring and fall seasons, but they also lead to extreme rain and drought events. Thus, anomalous precipitation events are causing the world climate to gradually polarize towards summer and winter and rainy seasons and drought seasons.

According to statistics, over the past 20 years, the number of worldwide natural disasters has increased more than three fold. The average number of global natural disasters was 120 per year in early 1980s, whereas the number has increased to approximately 500 per year today. Numerous reports have been made on climate change and the associated environmental changes and geological hazards (Steffensen et al., 2008; Fujita, 2011; Petit et al., 2008; Visser, 2010; Pörtner and Farrell, 2008; Marin, 2010).

Table 2 – Exploitation quantity of global coal, crude oil and natural gas Vs ENSO frequency of occurrence output (add up) (unit: billion ton, trillion m^2)

Time	Coal	Crude oil	Natural gas	ENSO frequency of occurrence
1649-1879				Closely related to submarine volcanic eruption
1880-1980	1500 (1500)	517 (517)	30 (30)	Happen once between 2 and 7 years, duration is about 1year.
1981-2005	1125 (2625)	440 (957)	20 (50)	Time interval of occurrence is 3 years around, duration is about 15 months, time lag of

				several El Nino events from 1990's of last century to now is only half year around, and long one is no less than 2 years, duration can reach 3 years.

The underlying surface heat and increased ground temperature have move the distribution of tropical plants northward, and the invasion of harmful species will have a significant impact on northern plant distributions. Temperature increases have caused decreased numbers of sperm in male animals, male genetic material degradation in plants, and mass extinction of flora and fauna populations. Increased ground temperatures, water temperatures, sea temperatures and atmospheric temperatures have produced aggressive northward changes in the distribution of endemic tropical pests and diseases, such as southern schistosomiasis, malaria and the disease carried by cockroaches, which threaten human health. Frequent warm winters have caused changes in natural biological habits as hibernation and exponentially increased the reproduction of pests and toxicity to the environment because of the extensive use of highly toxic pesticides, which will aggravate environmental degradation.

Discussion and conclusion

Is there a huge fireball with high temperatures and pressure inside the earth? Do fossil energy resources such as coal, petroleum and natural gas provide highly efficient, long-lasting thermal insulation functions for the crust? Does each rock layer in the hard crust have an insulation effect? The Mawangdui No. 1 Han Tomb in Changsha, which was excavated by Chinese archeologists in April, 1972, and the Ming Dynasty Tombs in Beijing, which were excavated by the Institute of Archaeology, Chinese Academy of Sciences in May, 1956, provided sharp contrasts in their unintentional objectives and long-term “scientific experiments” on the thermal insulation of charcoal, grease and rock. The Mawangdui Han Tomb did not use stones for insulation; instead, the tomb was sealed with white plaster, charcoal and grease, which preserved all of the items in the tomb, including the coffin, body, silk textiles and grain, for more than 2100 years (Chuanxin, 2005; Chuanxin, 2005). In contrast, in the Ming Dynasty Tombs, six layers of the hardest white marble and striped stone were used to build the cemetery and coffins, but the tombs owners were still not preserved. The body of Emperor Wanli had rotted in less than 400 years, leaving only a dry skeleton (Fangliu, 2008; Qian, 2003). Thus, regardless of a rock's thickness or hardness, it would not be able to withstand normal terrestrial heat flow, let alone increased terrestrial heat flow. This example shows that coal, oil and gas have highly efficient, long-lasting heat insulation functions. If the combination of white plaster and charcoal was able to perfectly seal the Mawangdui Han Tomb, then the combination of oil, gas and coal in the earth's crust has produced a perfect seal.

Since the Industrial Revolution in Britain, the large scale mining of dispersed and countless coal mines, oilfields and gas fields (there were already more than 4,000 mines of various size in Shanxi Province, and the quantity of global mining, oil and gas wells would be impossible to count) has produced hundreds of thousands of local mining operations that have added to the overall effect of global change caused by changes to the crust and underlying surface "heating," which is very apparent.

The relationship between atmospheric CO_2 concentrations and climate have been challenged because the magnitude of temperature increase is much lower than the temperature value estimated by scientists based on increased CO_2 concentrations. Numerous climate and natural anomalies have caused confusion in relation to the greenhouse effect theory of climate change (Smith, 2013; Guemas et al., 2013; Crucifix, 2008; Zahn, 2009). In fact, most of the CO_2 in the air is absorbed by the sea and gradually becomes carbonate deposits in the seabed, forming a rock, or moves to the land through the shells and bones of aquatic organisms and dust. Carbonates absorb CO_2 from the air to become bicarbonates that are dissolved in the water and return to the ocean (Riebesell, 2008). Along with the underlying surface, the seawater continues to absorb heat, and the rate of increase of the ground temperature and sea temperature will be significantly greater than the magnitude of the average atmospheric temperature increase (Rosenthal et al., 2013). In some cases, the average global atmospheric temperature may stop rising.

The research from Amanda Scott *et al*. from the National Oceanic and Atmospheric Administration (NOAA, US) showed that global warming is now irreversible and in an accelerating trend. Even if humans stop emitting greenhouse gases, global warming will still continue for 1000 years. This conclusion denies the greenhouse effect theory of climate change, suggesting that global warming is caused by other factors.

The rates at which glaciers and frozen soil are melting (Huijun et al., 2006; Kaus, 2013) (upward, bottom up melting) and deep sea temperatures and ground temperatures are increasing are far greater than the magnitude of increase of the average atmospheric temperature for the same period (Qingshan, 1995; Zahn, 2009; Sloyan et al., 2013; Cartes et al., 2013), and these occurrences cannot be explained by the greenhouse effect theory.

In summary, the following evidence has presented in support of the theory that crustal heat seal damage caused by fossil energy mining is the main reason for global climate change: global warming is not consistent with predicted climate change based on the buildup in the earth's atmospheric of greenhouse gases; in addition, global warming is now irreversible and in an accelerating trend, and even if humans stop emitting greenhouse gases, climate warming will still continue for 1000 years. Scientists have shown that the high heat flow from the mantle is not only an important condition for the evolution of organic matter but also the main factor for climate change; thus, the earth's interior influences atmospheric processes through the continuous delivery of material and energy to the atmosphere, which ultimately contributes to climate change. Fossil energy formation in the crust has effectively blocked the terrestrial flow of heat, and scientific observations have shown that through fossil energy exploitation, the terrestrial heat flow can reach significant values and produce a geothermal sudden increase phenomenon. Observations across the globe have shown a significant increase in ground temperatures and sea temperatures in the deep and shallow layers. Moreover, the Mawangdui Han Tomb excavation showed that white plaster mixed with charcoal and animal grease can effectively block the terrestrial heat flow for more than 2100 years, whereas the Ming Dynasty Tombs that were built with six layers of hard rock did not provide the same level of thermal insulation. Therefore, fossil energy in the crust provides significant thermal resistance effects (Jiyang and Zhanxue, 2001).

We believe that when human societies are made aware of this issue, a large number of scientists will find more direct or indirect evidence for increased ground temperatures and sea temperatures that are caused by crustal heat seal damage related to large-scale continuous mining operations for fossil energy; such operations will continue to cause ecological and geological disasters, climate change and a range of meteorological disasters.

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