（名古屋工業大学退官記念論文）

地震の原因と地震予知

―私説地震学―

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1．はじめに

地震は地下に蓄えられたひずみが、急激な断層運動という形で、そのエネルギーを解放する現象である…。という説が地震学の定説となっているようである。私は地震学を専門としていないので、こうした定説には囚われることなく、地震の発生機構とその予知について自由な考えを述べてみたいと思う。ただし認められた説でもないので私の私説地震学ということで読んで頂きたい。勿論間違いもあるかも知れないが地震予知の一助になれば幸いである。

大地震は地殻に発生したひび割れから落下した地下水（および海水）が高熱の水蒸気となり、さらに深部の溶融マグマに接するために、水素と酸素に熱解離爆発する現象（これが初動の押し、及び地盤の隆起を生ぜしめる）、ならびに再び水素と酸素が結合して水蒸気に戻る結合収縮現象（これが、初動の引きおよび地盤の沈降を生ぜしめる）とによって説明ができると私は考えている。この考えによると地震時の多くの謎が解けてくるのである。たとえば海上を航行中に船底から突き上げられるような衝撃を受けるという海震（sea shock）はどう考えても爆発現象によってしか説明し得ないのではないだろうか。

2．地震発生機構

上述したように地殻に発生したひび割れから水が供給されて解離爆発するものを外部供給型地震と名付けよう。また以前の外部供給型地震の終息時に溶融マグマ内に閉じ込められた水蒸気が、マグマと共に地表に近づいて解離爆発の条件を再び満たすようになり、爆発するものを内部供給型地震と名付けよう。大地震と言われるものは大抵外部供給型地震といえるだろう。そしてこれが地震予知を可能にするのである。また通常の火山爆発は内部供給型解離爆発であるが、山体を吹き飛ばしてしまうような磐梯型噴火は外部供給型解離爆発であると思われる。岩屑流、粉体流というような山津波の現象もこれであろうと思う。

（1）解離爆発

さてどちらの型にしろ解離爆発の時の反応式は小学生でも理解できる次式である。

$$2H_2O + 熱 \rightarrow 2H_2 + O_2 \cdots\cdots(1)$$

この反応は1気圧の下では1.5倍に体積が膨張する。膨張率や、反応速度が地下でどのようになるかは今後の研究を待たねばならないが、反応速度が無限に大きくなるのが爆発で、その条件は温度と圧力によって決まる筈である。この爆発はマグマを流す通路（これをMFT Magma Flow Tunnelと呼ぶことにする）の中心軸方向に円錐状にマグマと周辺の岩盤を押す（Fig-1参照）。これが初動を〝押し〟にする原因であり、〝押し円錐〟といわれて来たものの正体である。この押し領域内のマグマの量が多い場合には、押した後にかなりの空間ができることになる。これが次の段階での沈降の原因を作るのである。

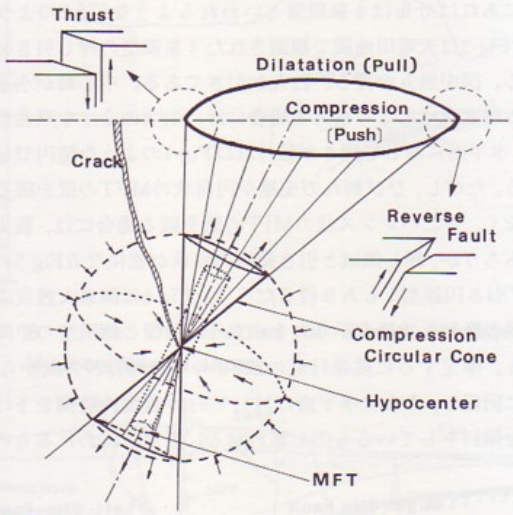

Fig.1 Sketch of Earthquake induced by Decomposition and Explosion (for a inclining MFT)

（2）結合収縮

爆発が発生すると、解離した水素と酸素の一部分は地殻のひび割れを通って地表に漏れ出ることもあるだろう。大気の下での水素と酸素の反応は小学校の理科の実験でやる発光をともなった酸化現象であり、海上でも地上でも火柱を立てることもあるだろう。また日本の古文献でも、中国の唐山地震の時でも火の玉が見られたという報告があるが、いわゆる〝光りもの〟という現象の一つの原因はこれではないだろうか。また火災の原因となることもあろう。津波で水浸しになったのに出火したとか、原因不明の出火とか言われている火災の原因はここにあるように思われる。倒壊率が小さい区域の方が出火率が高いという報告もあるのはこれが原因と思われる。断層面にはH_2の発した形跡があるという研究もある。大部分の水素と酸素は、解離によって下がったMFT内の熱環境の下で再び結合して水蒸気に戻る。そのときの反応式は

$$2H_2 + O_2 \rightarrow 2H_2O + 熱\cdots\cdots(2)$$

である。この反応では体積が収縮するから、押し領域を除く他の領域（これを引き領域と呼ぶことにする）の物質は震源へ向かって吸い寄せられるように移動する。これが初動を〝引き〟にする原因である。解離爆発と結合収縮の時間差は地震動の卓越周期と関連するだろう。この間隔は外部供給される水量によって決まると思われる。即ち大地震になるほどこの間隔は長くなるであろう。直径の大きな打ち上げ花火ほど広がるのに時間がかかるようなものであろうか。爆発で発生した空間が今度は

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急激に減圧するのでMFTが大きな空間を持つ場合即ちMFP（Magma Flow Pool）であれば豊後地震で消えたという瓜生島の沈降というようなことが発生する。MFPの規模が大きければそれだけ広範囲に沈降が生ずるであろう。(Fig-4参照)

3．初動の押し引き分布

初動の押しは解離爆発で生じ、引きは結合収縮で生ずることを考えると、地表面に現れる押し引き分布はMFTの中心軸の傾斜によって違ってくることが推定できる。軸が水平で浅いところにあれば分布は4象限型といわれるようなFig-2のようになる。Fig-3は天竜川地震で観測された4象限型の押し引き分布である。図中黒丸が押し、白丸が引きである。中心軸が水平で、ある程度深いところにある場合には、Fig-4のような双曲型となり、水平面に対して傾きが強ければFig-1のような楕円型分布となる。ただし、ひび割れの先端が円筒状のMFTの壁を破るのではなく、平たいレンズ状のMFPの壁を破る場合には、数少ないであろうが、押し領域と引き領域の形状が逆になるFig-5のような〝引き円錐型〟もあり得るだろう。Fig-6は関東大震災の時の地盤の隆起と沈降を示したもので、双曲型と楕円型の中間であろう。推定するに震源付近のMFTの中心軸はN方向から約50°西に回転し、さらに水平面に対して約40°程度内陸側を下げたような傾斜をしているものと思われる。断層と言われるものは押し領域と引き領域の境界に発生する食い違いのことであり、地震の直接の原因ではない。丹後地震で発生した直交する2つの断層（郷村断層，山田断層）は4象限型分布に伴う断層であろう。軸の傾斜および震源からの距離などによって地表で見られる断層の形状は変化する。逆断層とか正断層とかを区別しても大した意味はないと思われる。尚直下型地震と言っているのは押し円錐の軸がFig-7のように鉛直のものであり規模の小さな地震でも大きな被害を与えることがある。

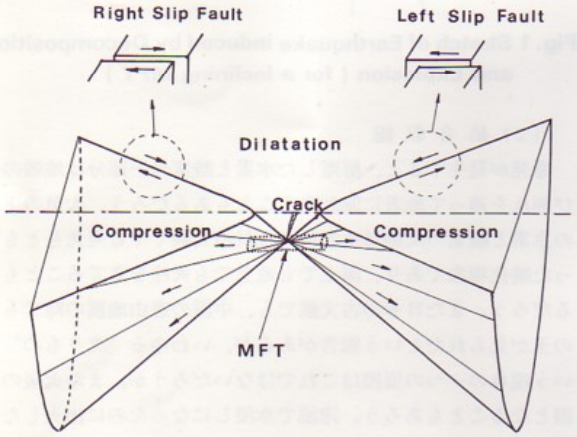

Fig. 2 The Four-quadrant Type Distribution for a Shallow Horizontal MFT

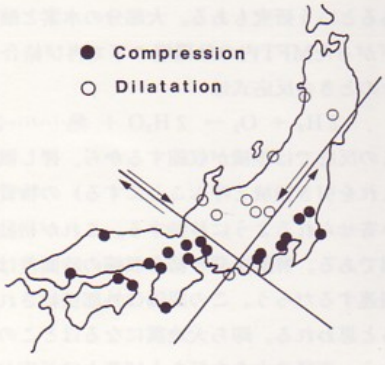

Fig. 3 The Distribution in Tenryugawa Earthquake

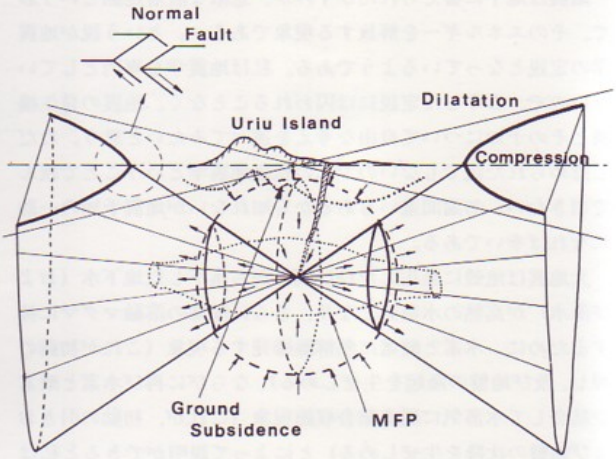

Fig. 4 A Hyperbola Type Distribution and the Subsidence of Uriu Island

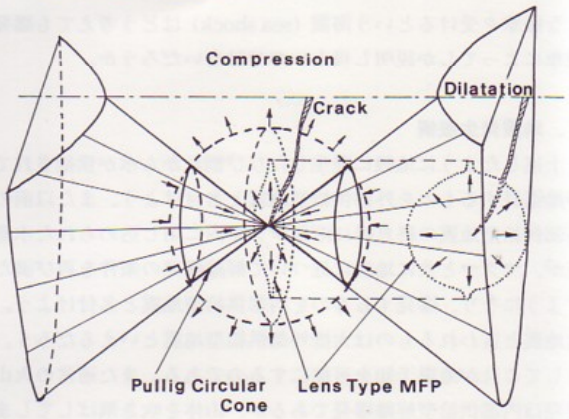

Fig. 5 Sketch of a Lens-type MFT

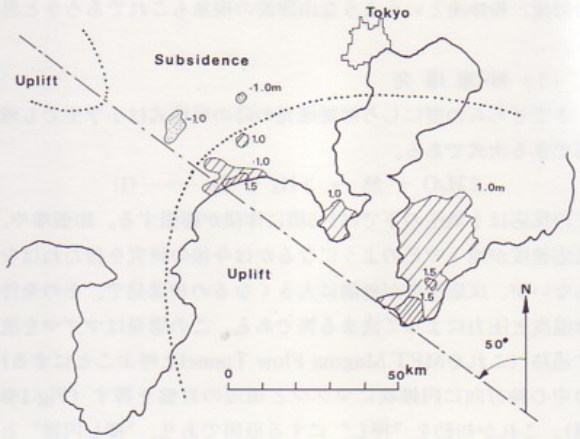

Fig. 6 The Ground Subsidence and Uplift in Kanto Earthquake

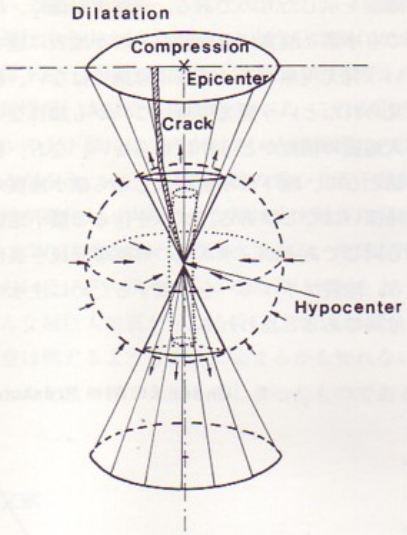

Fig. 7 Sketch of the MFT in a Thrust Type Earthquake

4．深発地震

Fig-8は日本周辺での震源の深さを示したものである。浅い所の地震はひび割れが、地表近くのMFTの壁を破るために生ずるもので、ひび割れがMFTにぶつからずに深部の溶融マグマ本体（これをMFS　Magma Flow Seaと呼ぶことにする）迄達し、そこの天井の壁を破るために発生するものが深発地震であろうと思う(Fig-9参照)。深発地震では押し、引きの動きが地表まで達しなくて、隆起とか沈降という現象を引き起こさないために津波は発生しない。また押し引き分布は軸が水平になるために双曲型となり、軸の方位角はMFSの天井の凹凸によって決ってくる。天井が平面の場合には〝引き円錐型〟となり、軸は天井に垂直となる。震央は大低引き領域になっているが、爆発現象と関連している押し領域ほどの震動が地表まで伝わってこない。時には全く無感であり、むしろ震央をかなり離れた押し領域の方が震動が大であるという異常震域という現象を生ずることがある。Fig-9に示すようにMFSまでの深さは海洋部では浅く、陸地部では深い。これは海洋では熱が逃げ難くてあまり冷却されないからであろう。陸地は裸同然であって冷め易いのであろうと思う。これは雪の下は暖かいが、雪がないとかえって冷えてしまい、秋麦が枯れてしまうことに似ている。従って深発地震の深度は大陸側に向かって深くなっている。つまり深発地震面といわれているのはMFSの天井の面と一致すると思われる。MFTとかMFSとかの壁面付近の丈夫な岩盤体は、剛性率μや、弾性率E（ヤング率）が高く、地震波の伝播速度が速い高速帯なのだと思う。この高速層がプレートテクトニクス理論で言うリソスフェアではなかろうかと思う。その上部に温度、剛性および弾性等の低い低速帯があるのだと思う。温度の低いリソスフェアがマントル内部に潜り込んで行くとか、海洋プレートが大陸プレートの下に潜り込んで行く時に岩盤の弾性反発で大地震が発生するという説はどうも信じられない。MFSまでの深さが急変し、熱移動の形態が違う海洋部と陸地部の境界は当然ひび割れが発生し易い所、即ち地震の発生し易い条件を持つ場所なのであろう。関東で感ずる北海道の深発地震には短周期成分が存在し、九州からくる深発地震波には短周期成分がカットされているという謎はこのような高速帯と低速帯の構成から説明できると思われる。また北緯40°近辺で大地震が多いのは、マグマに作用する天体の影響即ち潮汐を起こす力と同じような力がマグマに作用して、地殻に繰り返し荷重を与え、それがもとで地殻が疲労破壊されることが原因ではないだろうか。北半球でも南半球でも中緯度帯はひび割れの発生し易い所であろうと思う。

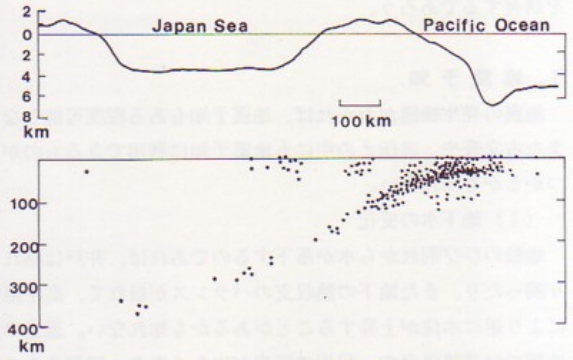

Fig. 8 The Distribution of Deep Earthquake Hypocenters in Japan

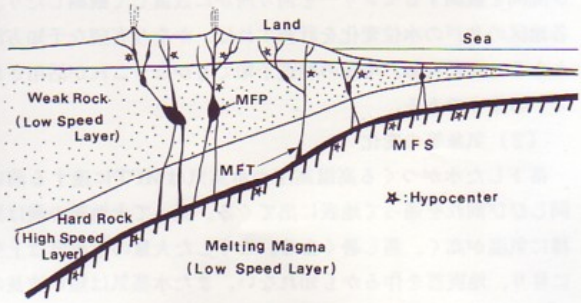

Fig.9 Definition Sketch for Deep Earthquake

5．前震、余震

前震があるかどうかは、地殻のひび割れが複数本できるのか、大規模なものが一本だけできるのかによって決まる。複数本できる時には、小規模な地震が前ぶれとして生ずることも考えられる。また本震の衝撃によって地殻にひび割れが増加するから、余震は熱収支のバランスが取れるまでは付近を通っているMFTの壁面で続くことになる。歪エネルギーの放出説では次々と起こる余震の説明は不可能であろう。

6．ニオス湖のガス噴出

カメルーンの北西部にあるニオス湖が突然多量のガスを湖底から噴出し、多くの死者を出したことは記憶に新しい。ガスは主として二酸化炭素であったという報告がある。この事件で湖面が1m程度急激に低下したということを考えると、ニオス湖でのCO_2の発生機構も解離現象と関係しているだろうと思われる。アフリカ大陸にはソーダを溶かし込んだ地下水があるのではないかと考えられる。炭酸カルシウムの解離は次式のようにCO_2を発生するのである。

$$CaCO_3 + 熱 \rightarrow CaO + CO_2 \quad \cdots\cdots(3)$$

CO_2は空気より重く、谷筋を通って村々を襲ったのであろう。ニオス村周辺の人々は就寝中に瞬間的に酸欠となって死亡したということである。こうした惨事は地球上でこれまでに何度も繰り返されて来たのであろう。恐竜を始め多くの生物が絶滅して行ったのはこのような自然現象が原因していたのかも知れない。谷間の水飲場に集まっていた恐竜が瞬時に死滅するという話はあり得るように思う。大隕石が衝突することもあったかも知れないが、衝突すれば地殻が割れて大量の水が落下し、巨大地震を誘発するであろう。

7．地震予知

地震の発生機構がわかれば、地震予知もある程度可能となる。また古文書や、言伝えの中にも地震予知に利用できるものが見つかるかも知れない。

（1）地下水の変化

地殻のひび割れから水が落下するのであれば、井戸は枯れたり濁ったり、また地下の熱収支のバランスが崩れて、高圧蒸気により逆に水位が上昇することがあるかも知れない。過去の大地震では道後温泉や、紀州の温泉が出なくなり、回復するのに何カ月もかかったという話が伝わっている。地下水の水量および流向を観測するセンサーを何カ所かに設置して観測したり、各地区の井戸の水位変化を計測すれば、かなり有望な予知方法となると思われる。中国の地震予知でもかなりこれが活用されているようである。

（2）気象等の変化

落下した水がつくる高温高圧の水蒸気はMFTに達する前に同じひび割れを通って地表に出てくる。従って大地震の前は異様に気温が高く、蒸し暑くなる。こうした大量の水蒸気は上空に昇り、地震雲を作るかも知れない。また水蒸気は短い波長の光を散乱し、波長の長い光しか通さなくなるから、天空は赤く染め上げられるだろう。時には深海の海嶺で見られるようなブラックスモーカーをひび割れの間から吹き上げて黒雲や、妖雲を作ることがあるかも知れない。また古文書に見られるように太陽や月の周囲に虹が見えることもあるだろう。地中の水蒸気は地電流や、磁気にも変化を与えるであろう。こうしたものを計測し変化に注意を払うことも必要である。

因に1988年12月13日は名古屋地方は空一面の夕焼けであった。夕焼けが終わってしばらくしても東南の空に3条ほどの茜色のベールのような雲が浮かんでいた。それから9日後の22日に愛知県中部を震源とする震度3の地震があった。両者に関連ありとは断言できないが、9日間という日数は震源が深く、落下した水がMFSに達するのに時間を要したということを意味しているのかも知れない。

グァテマラ大地震（M＝7.5）の時にはマヤ族の酋長は夕空の赤いこと、地中から虫が這い出してきたこと、鶏や小鳥などの飼い鳥が止まり木から降りたことの三つの徴候から地区民に非難命令を出し住民の命を救ったという話が文献[3]に見られる。

（3）発光現象

解離反応の速度が無限大となるのが爆発現象であるが、その前にも何%かは解離が生じている筈である。Fig-10は1気圧の下での解離度を示したものである。解離度が低く、反応速度も遅い場合でも水素と酸素に分かれたものが地表に達すれば、酸化結合という発光現象があっても不思議ではない。松代群発地震で良く見られたという発光現象はこれかも知れない。しかし必ずしも大地震の前兆かどうかは判らない。なお、松代やデンバーでの話として、地下に水を注入したら微小地震が頻発したという興味深いはなしがある。ダムを作ると微小地震が増えるという話も同じであるが、水蒸気の解離爆発説を裏付けているようである。地震エネルギーを分散するために注水するという考え方は危険であると思われる。

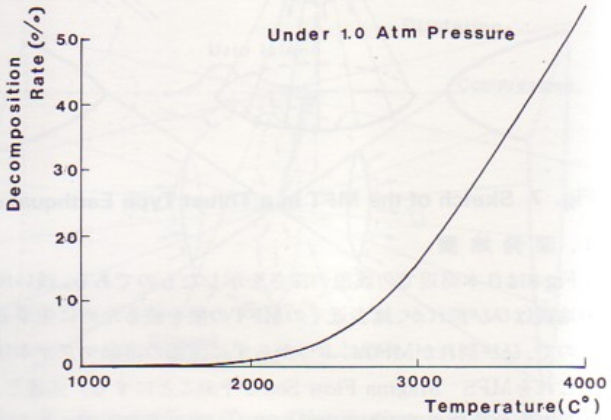

Fig.10 The Variation of Decomposition Rate of Water Vapour with Temperature (1 atm pressure)

（4）小動物の動き

地中からでる高温の水蒸気によって蒸された地中の小動物や虫は地上に這いだしてくる。これを目がけて、鳥や、動物達がえさ捜しに熱中するだろう。水底に住むナマズや、蛸、あわび等は地中に吸い込まれる水の動きを感知してびっくりするだろう。蛸が陸上に逃げて来ることも良くしられている。あるいは動物たちは地電流や、磁気の変化を敏感にキャッチして騒ぐのかも知れない。こうした動物達の動きもマヤ族の酋長を見習って良く観察することである。自然は多くのことを教えてくれている筈である。

地震予知は以上に述べたいくつかの項目についての観測結果から総合的に判断すべきであろう。

8．おわりに

大陸は本当に移動するのだろうか。紅海を挟んだ対岸がピタリと一致するのを見ると、正しいようにも思える。しかし常に移動しているとは考えにくいのではないか。地殻といっても饅頭の皮みたいなものだが、これが大きく切れて動き易くなった時には流氷が動くようにマントル対流に乗って動くかも知れない。しかし皮がぴったりとくっついている時には皮がマントル対流に乗って動くかどうか疑問でもある。大陸は移動することもあるだろうが、浮上したり沈没したりすることもあるだろう。そうしたことの繰り返しがあったからヒマラヤや、アンデスに貝の化石があるのだろう。

大陸という構造物が弱ってきて、コンクリート造りの家のひび割れが進行するように、地殻に大きなひび割れが走れば、大量の水が落下し、超巨大地震が発生することも考えられる。そして大解離爆発、大結合収縮が起きれば、これが引き金になってマントルの上下動にはずみが付き、大陸規模での沈降、隆起だってあるだろう。そうすると地球の重心も若干移動するだろうから地軸が変化し、両極の氷が解け出す騒ぎに発展するかも知れない。これはまるでノアの洪水である。地球が冷却して行く過程においてノアの洪水のようなものは何回もあったことだろう。そんな超巨大地震が起こる時には地上は猛烈に蒸し暑くなり、天空は燃えるような茜色に染まるかも知れない。地震の原因からとんだ話にまで発展してしまったものである。

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THE CAUSE AND PREDICTION OF EARTHQUAKE

— A PERSONAL SEISMOLOGY—

By Akira ISHIDA*)

1. INTRODUCTION

On the basis of the current theory of seismology, earthquake is a natural phenomenon caused by the sudden release, in the form of fierce movements of earthquake faults, of the strain energy accumulated in the crust of the earth. This viewpoint had become the final conclusion of the cause of earthquake, and was accepeted by most of the seismologists. The author, who is not majoring in the research of seismology, thus, may not be fettered by the above final conclusion, and would like to present his own idea upon the occurrence and prediction of earthquake in the present paper. The present viewpoints, however, have not be accepted by the seismologists yet, and may only be refered to as a personal seismology. There may be some mistakes in the present viewpoints, however, the author would be greatly pleased if the present paper will contribute some to the prediction of earthquake.

According to the author's idea, large earthquakes may be explained as follows. The ground water and sea water penetrate downwards through the cracks in the crust of the earth, and gradualy turn into water vapour of high temperature. Coming into contact with the melting magma in a deeper place, water vapour decomposes into oxygen and hydrogen under extreme high temperature and pressure, and consequently induces great explosion which causes the initial compression motion of the earth and the uplitt of the ground. Soon afterwards, oxygen and hydrogen recombine into water vapour and induce a contraction in volume which may result in the initial pulling motion and the subsidence of the ground.

Adopting the present theory, many coseismic mystic phenomena could be reasonably explained. For example, the phenomenon of sea shock, which is a sudden upwards shock exerted on the bottom of a navigating ship from the seabed, may be well explained by the above decomposition and explosion procedure, and it seems that it can not be explained by other theories.

2. THE MECHANISM OF EARTHQUAKE

As mentioned above, the earthquake caused by the decomposition and explosion of the water vopour supplied from ground water and sea water is defined as the external water supply earthquake. On the other hand, when the condition of decomposition of water vapour is achieved near ground surface, earthquake may also be induced by decomposition of the water vapour stored in magma after the last external water supply earthquake stoped. This kind of earthquake may be defined as the internal water supply earthquake. Generally speaking, most large earthquakes are external water supply earthquake. Therefore it may be possible to forecast large earthquakes in accordance with the present theory. Usually, volcanic eruption may be induced by internal water supply decomposition and explosion; however, the volcanic eruption during which rock is erupted out is induced by the external water supply decomposition and explosion. In the latter case, rock slack flow and sandy soil flow, which is called debris flow, may occur as a result of the eruption.

(1) DECOMPOSITION AND EXPLOSION

In both the external and internal water supply type decomposition and explosion, the reaction equation is the following simple equation, which a primary school student can understand,

$$2H_2O + \text{heat} \rightarrow 2H_2 + O_2 \cdots\cdots\cdots (1)$$

in which the volume expands 1.5 times under one atmospheric pressure. Further more research upon the expansion rate and reaction speed at the underground condition is needed. When the reaction speed becomes infinitively great, explosion occurs and the volume expands. The condition of the occurrence of the explosion may depend on the temperature and the pressure. This explosion exerts compression on the rock and the magma within a circular cone whose axis is the same as that of the magma flow tunnel(in short, MFT) (see Fig.1). This is the reason of the initial compression motion, and the true character of the so called compression circular cone. In the case where large quantity of magma exists within this circular cone, there will be a considerable room after the compression motion, and it may cause the ground subsidence in the next stage.

(1) RECOMBINATION AND CONTRACTION

When the explosion occurs, a fraction of oxygen and hydrogen may leak out through the cracks in the earth crust. The reaction between oxygen and hydrogen in air, as that shown in the scientific experiment in primary school, is oxidization which gives out light. When this reaction occurs during a earthquake, it may be seen that flame light up on the ground and on the sea as well. Numerous reports on mysterious light and flame associated with an earthquake can be seen in Japanese classical documents related to earthquakes and Chinese report of Tangshan earthquake (1976.7.28). In some places, flames rush out into sky even though the ground is flooded by the earthquake tsunami, and some fire disasters are caused by some mysterious underground flames. These light and flame that emitted from ground can well explained by the above oxidization reaction.

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Moreover, it was reported sometimes that there is a high fire disaster rate in a area which has a low collapse rate in an earthquake. The reason of this fact can also be explained as above. Besides, some investigations indicate that there are the traces of the emission of hydrogen at the earthquake fault plane, this fact verified the present viewpoints to some extent.

After the decomposition of water vapour, the temperature in MFT decreases and a great part of the oxygen and hydrogen recombine into water vapour. The equation of this reaction is:

$$2H_2 + O_2 \rightarrow 2H_2O + \text{heat} \cdots\cdots\cdots (2)$$

In this reaction the volume contracts, and thus the materials in the region outside the compression circular cone (which is called dilatation region) are absorbed to move to the direction of the hypocenter. This may be the reason of the initial dilatation motion of the ground. The time interval between the decomposition-explosion and the recombination-contraction may relate to the predominant period of earthquake motion, and may depend upon the amount of external water supply. That is, the larger the earthquake is, the longer the time interval will be. This is similar to shooting up fireworks, the larger the diameter of the fireworks is, the longer the time of the diffusion of fire is needed.

Since the pressure in the room formed by the decomposition-explosion decreases drastically, large-scale earth subsidence may happen due to an earthquake in the case of huge MFT, i.e., in the case of Magma Floow Pool (in short, MFP). The more massive the scale of the MFP is, the wider the range of the earth subsidence will be. For example, the Uriu island suddenly disappeared during the Bungo earthquake (1596. 9. 4) (see Fig. 4).

3. THE DISTRIBUTION OF COMPRESSION AND DILATATION OF THE INITIAL MOTION

Considedring that the initial compression is induced by the decomposition-explosion, and that the initial dilatation is induced by the recombination-contraction, the compression and dilatation distribution on the earth surface can be derived according to the variation of inclination of the axis of MFT. When the axis of MFT is horizontal and shallow, the distribution of compression and dilatation is the four-quadrant type as shown in Fig. 2. Fig. 3 illustrated the distribution of initial compression and dilatation measured during the Tenryugawa earthquake (1917. 5. 8), in which the dots represent the compression and the circles represent dilatation.

In the case where the axis is horizontal and deep, the ditribution pattern is called the hyperbola type as shown in Fig. 4. The distribution pattern is the ellipse type when the axis of MFT inclines greatly to the horizontal water level as shown in Fig. 1. If the crack does not destroy the wall of a cylinder MFT, instead it destroies the wall of a lens type of MFP as shown in Fig. 5, which is a rare case, the distribution of pushing region and pulling region is a pulling circular cone type, which is just the opposite of a pushing circular cone type.

The circumstances of ground subsidence and uplift for the great Kanto earthquake (1923. 9 .1) is shown in Fig. 6 where the type of the distribution of compression, and dilatation is between the hyperbola and the ellipse types. Thus it may be infered that the direction of the axis of MFT near the hypocenter is about fifty degrees from North to West, and the angle between MFT axis and the horizontal water level is about fourty degrees, and it inclines down while it approaches to the land from the sea.

The so-called faults result from the conflict between the pushing region and the pulling region, and they are not the direct cause of an earthquake. The Goumura fault and Yamada fault, which appeared in the Tango earhtquake (1927. 3. 7), are at right angle to each other, are the results of the four-quadrant type compression and dilatation. The appearance of the fault at the ground surface may change with the variation of the gradient of the axis of MFT and the distance to the hypocenter of the earthquake. It seems that there is little significance to distinguish between a normal fault and a reverse one. The axis of the compression circular cone of a thrust type earthquake is perpendicular as shown in Fig. 7, the disaster caused by this kind of earthquake is great even though the scale of the earthquake is small.

4. DEEP EARTHQUAKE

Figure 8 illustrates the depths and the distribution of hypocenters near Japan. Shallow earthquake will happen if the wall of MFT near the earth surface is destroied by the crack. When the crack in crust does not encounter with MFT, instead it extends deeply to the main melting magma part (which is called Magma Flow Sea, in short, MFS) and destroies the upper wall of MFS, then a deep earthquake may occur (see Fig.9). Owing to that the pushing and pulling effects of a deep earthquake can not spread to the earth surface, there will be no subsidence and uplift of the ground and no earthquake tsunami either. The distribution of compression and dilatation is the hyperbola type when the axis is horizontal, and the distribution is the pulling circular cone type when the upper wall of MFS is flat and the axis is vertical, here the direction of the axis is determined by the concavity and convexity of the upper wall of MFS.

Generally, the epicenter is in the dilatation region, and the pulling motion induced by the contraction can not reach the earth surface. Sometimes people who live near the source region can not perceive the earthquake motion, whilst, those who live in the compression region which is very distant from the source region can perceive remarkable earthquake motion, this phenomenon is called the anomalous seismic intensity region. The depth of MFS is shallow at the sea and is deep at the land as shown in Fig. 9, this is because heat in the sea is not easy to escape and thus seabed is not easy to

cool down, however, the land is naked and easy to cool down. This fact is similar to the case of snow and wheat in winter, when there is snow it is relatively warm under the snow layer, and when there is no snow it is cold and the wheat will soon wither.

The depth of the hypocenter of deep earthquake increases from the sea to the land, and the hypocenter plane of deep earthquake is identical with the upper wall of the MFS. The hard rocks near the walls of MFT and MFS have great elastic modulus E and rigidity modulus μ, and this region in which seismic wave propagates very quickly is called high speed layer, This high speed layer is the so-called lithosphere in the plate tectonics theory. Above the high speed layer there is a low speed layer in which the temperature is low and the elastic modulus and rigidity modulus are small. It is hard to believe the theory which says large earthquake is induced by the elastic rebound of the strained crust when the lithosphere with low temperature slips into the mantle or the sea plate slips into the land plate.

At the juncture of the sea and the land the depth of MFS varies drastically and the pattern of heat conduction is different, of course, it is the place where the cracks in the crust may easily occur and where the eathquake often occurs. In Kanto district, we can perceive the short-period part in the seismic wave of a deep earthquake happened in Hokkaido, but we can not perceive that part in the seismic wave of a deep earthquake happened in Kyushu, the short-period part is cut down. This fact can be explained by the constitution of the high speed layer and the low speed layer.

Moreover, it is also found that large earthquakes usually happen near the region of fourty degrees north latitude, The author think this fact may be explained by the celestial action exerted on the melting magma. The celestial forces, which are similar to tidal forces, act on the melting magma, and thereby repeatedly forces are applied to the crust of the earth, which may result in the fatigue failure of the crust. That is why the mediate latitude region, either in the southern hemisphere or the northern hemisphere, is the place where cracks in the crust easily occur and earthquakes frequently happen.

5. FORESHOCKS AND AFTERSHOCKS

Whether foreshooks take place or not depends upon whether there are several cracks in the crust of the earth or there is only one large crack. In the case that several cracks exist, many small shocks may take place before a large earthquake. Besides, many cracks may appear in the crust because of the shocks of the major earthquake, therefore afterskocks may continuously happen through the walls of the nearby MFTs before the balance between the heat income and outgo is achieved. The theory of strain energy release can not explain why continuous aftershocks happen after the major earthquake.

6. THE NYOS LAKE EVENT

People may still have a clear memory of the Nyos lake event, in which a large amount of gas emitted from the bottom of the Nyos lake in northern part of Cameroon and caused the death of many inhabitants who lived near the lake. It was reported the chief composition of the gas is carbon dioxide. Considering the fact that the water level of Nyos lake rapidly falled one meter during the event, the author think the mechanism of the emission of carbon dioxide is closely related to the decomposition of water vapour in MFT. It can be reasonably assumes that some kinds of carbonate dissolve in the ground water in Africa, and when the ground water is heated the carbonate such as calcium carbonate decomposes and gives off the carbon dioxide, as shown in the fallowing reaction equation,

$$CaCO_3 + \text{heat} \rightarrow CaO + CO_2 \cdots\cdots\cdots(3)$$

Carbon dioxide is heavier than air, and it assails the nearby villages through the deep valley. The inhabitants died of the lack of oxygen while they were sleeping. Up to now, such horrible disasters might have happened for many times on the Earth. This also might be the cause of the phenomenon that numerous animals, such as dinosaur, became extinct gradually. The dinosaurs, who gathered to drink near lake or pool in a valley, might suddenly die of the lack of oxygen. Another hypothesis says that once upon a time vast stony meteorite might have dashed against the earth and ruptured the crust of the earth, then a great earthquake might have been induced and numerous animals including the dinosaurs might die during the great earthquake.

7. EARTHQUAKE PREDICTION

If the mechanism of earthquake occurrence is understood, then the prediction of earthquake will become possible to some extent. From the ancient Japanese literature and some classical legends, we also can find out many useful knowledge for predicting an earthquake.

(1) THE VARIATION OF GROUNDWATER LEVEL

When groundwater falls down through the cracks in the crust of the earth, some well water may suddenly become muddy and its amount may decrease or reversely increase due to the action of high-pressure water vapour. There are some legends which say that Dougo hot spring and the hot spring in Kishu became dry due to some large earthquakes, and recovered normal after several months. Setting up some sensors in certain places to measure the discharge and direction of the groundwater, and measuring and recording the changes of well water level in every district are considered to be very effective methods for predicting an earthquake. This method is widely used in the earthquake forcasting activities in the People's Republic of China.

(2) UNUSUAL WEATHER CHANGES

The hot water vapour of high pressure, which is converted from the falling groundwater, may also escape out of the ground through the crack before it reach MFT. Therefore the atmosphere temperature becomes unusually high before

a large earthquake. Such a large amount of water vapour rising high to the sky will form the so-called earthquake cloud. Since the water vapour scatters the light of short wavelength and allows the light of long wavelength to pass, the sky looks like being dyed in red. Sometimes it can be seen that black smokes blow out from the cracks as in the ocean ridge at deep sea and form the black cloud or the so-called evil cloud. It was reported in ancient Japanese literature that sometimes there were rainbows around the Sun and the Moon. The underground water vapour may also have some effects on the earth current and the earth magnetiasm. Therefore, in order to predict earthquake, it is necessary to measure and pay more attention to the variations of the earth current and the earth magnetiasm.

In the 13rd December 1988, there were sunset glows on the sky at Nagoya, soon after the sunset glows sisappeared three madder red cloud belts appeared. Nine days latter, i.e., in the 22nd, a M3.0 earthquake happened in the middle region of Aichi County. Of course, it can not be concluded that there are some certain relations between these two events. The nine days interval, however, may be the time needed for the groundwater to reach MFS, which may mean that the depth of MFS is relatively deep. It is reported that, before the large Guatemala earthquake (1976.2.4, M=7.5), the chief of Maya tribe found that the night sky became red, the worms escaped out the ground and birds flied away the trees they nested, according to these three sings he commanded the inhabitants to take refuge and then he saved lieves of the inhabitants.

(3) MYSTERIOUS EARTHQUAKE LIGHT

When the speed of the decomposition of water vapour becomes infinitely large, the explosion which induces earthquake occurs. Before the explosion however, there may be small part of water vapour decomposes into hydrogen and oxygen. The decomposition rate of water vapour under one atmospheric pressure is shown in Fig.10. Even in the case where the decomposition rate is low and the reaction speed is slow, it is also easily to understand that the oxygen and hydrogen may emit through the cracks out of the surface of ground and recombine and give off light in the air.

During the Matsushiro group earthquake, mysterious lights were frequently seen, the reason of these lights may be explained as above. However we can not make such a conclusion as that the mysterious light is surely the sign foretelling an earthquake. Besides, it was reported the microearthquakes frequently happened in Matsushiro and in Denver when water was injected into the ground. Similarly, it was reported that microearthquakes increased after a dam was constructed. These two facts have profound meanings and have supported the present decomposition-explosion theory. It is a dangerous method, however, to inject water into the ground to disperse the earthquake energy.

(4) UNUSUAL BEHAVIOR OF ANIMALS

Under the influence of the high-temperature water vapour which emitted from underground, small worms will crawl out of the ground, and birds and other animals will catch and feed on the small worms. Catfish, octopus and abalone will also become active and sometimes jump out of water, when they feel the unusual motion of the underground water. Perhaps the animals sensitively perceive the changes of earth current and earth magnetiasm, and consequently they behave unusually before an earthquake. In order to predict earthquake we should learn from the chief of the Maya tribe and observe the behaviors of animals carefully. The great nature will teach us many things.

To forecast an earthquake effectively, we should make comprehensive judgement according to the observed results on the above aspects.

8. CONCLUSION

Is the land really moving ? You will believe that is true when you find that the configurations of the two coastlines beside the Red Sea are exactly identical. However, it is not imaginable that the land is incesstantly moving. The crust of the earth is something like the skin of a steam bread, it may be possible for the crust to convect with the mantle like floating ice blocks if it is cut into pieces. When the crust is closly attached on the mantle, it is doubtful whether the crust is still able to convect with the mantle. The land may move, and rise and subside as well. It is because such movements happened many times that the fossils of sea shells can be found on the Himalayas and the Andes.

The structure of land becomes weaker and weaker like that a crack in a concrete house extends constantly. It should be also realized that super-great earthquake would occur if large cracks extend all over the crust and tremendous water fall down. The great decomposion-explosion and recombination-contraction would cause the wave motion of the mantle and the uplift and subsidence of the ground on a vast scale. As a result, the gravity center of the earth would diviate, the axis of the earth would change too, and then the ice at the Poles would melt and great flood would occur. In the cooling process of the Earth such floods might have happend many times. When such a super-great earthquake happens, the weather would become extremely hot and the sky would go red as if it is burning. These words are drawn forth in discussing the cause of earthquake, which digress far from the subject.