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須崎

縱行一八橫行三三
圖幅第二四八號

地質說明書

地質調查所

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須崎 縱行一八橫行三三 地質說明書 (昭和五年九月稿)

商工技師 鈴木 達 夫

第一章 地 質

一 上部古生界—秩父系

本系ハ圖幅地ノ西北部ニ發達シ、砂岩、粘板岩、角岩、石灰岩ノ累層ヨリ成リ閃綠岩及蛇紋岩ニヨリテ貫通セラル、高岡郡長者村長者附近ニ於テハ下部ニ千枚岩狀ヲ呈セル綠色粘板岩層、上部ニ石灰岩及赤色角岩ヲ挟メル粘板岩層アリ、高岡郡別府村都地方ニアリテハ下部ニ蠶岩ヲ挟メル粘板岩層、上部ニ角岩ヲ挟メル粘板岩層及石灰岩ヲ挟メル砂岩、粘板岩層アリ、本系ノ厚サハ約三千米ニ達スルカ如シ

砂岩 灰色或ハ暗灰色細粒ニシテ石英、長石、硅岩、粘板岩等ノ細粒ヨリ成リ普通二米乃至五米ノ厚サヲ以テ粘板岩ト互層ス

粘板岩 灰色、暗灰色、黒色或ハ綠色ヲ呈ス、灰色ノモノ最モ普通ナリ、黒色ノモノハ板狀ニ剝離シ時ニ硅質ニシテ石英脈ニ貫通セラル、モノアリ、綠色ノモノハ硅質ニシテ千枚岩狀ヲ呈シ板狀ニ剝離シ小褶曲ヲ現ハセルコトアリ、又稍淡色ノ部分ト濃色ノ部分ト交互シテ厚サ各一厘内外ノ縞狀ヲ呈スルコトアリ、稀ニ變岩狀ヲ呈スルモノアリ、本岩ハ○三米乃至五米ノ厚サヲ以テ砂岩ト互層シ其中ノ厚キモノハ三十米ニ達スルコトアリ

角岩 灰色、赤色、綠色、黒色或ハ白色ヲ呈シ灰色ノモノ最モ普通ナリ、緻密堅硬ノモノト稍結晶質ノモノトアリ、赤色及灰色ノモノハ少量ノ赤鐵礦ヲ含ミ、時ニ放散蟲ヲ含メルコトアリ、本岩ハ秩父系ノ上部ノ砂岩、粘板岩層中ニ介在シ一層ノ厚サ一米乃至十米アリ

石灰岩 白色若シクハ灰色ニシテ緻密又ハ細粒結晶質ナリ、本岩ハ秩父系ノ上部ノ粘板岩層又ハ砂岩粘板岩互層中ニ介在シ一層ノ厚サハ普通一米乃至五米ナレトモ最モ厚キ鳥形山ニ於ケルモノハ五十米ニ達ス、本岩中ニハ時ニ紡錘蟲ヲ檢出スルコトアリ

構造 高岡郡佐川町ヨリ西方尾川村佐ノ國ニ互レル秩父系ハ斷層ヲ以テ北ハ三疊系ニ、南ハ珠羅白堊紀ノ鳥ノ巢嶺石統ニ接ス、後者ノ斷層ハ斗賀野村殖生川附近ニ於テ見ルカ如ク明

カニ衝上斷層ニシテ秩父系ノ石灰岩ハ鳥ノ巢嶺ノ砂岩頁岩層上ニ座セリ、地質圖上ニハ斷層ハ其著シキモノヲ表シタルノミナルモ其他ノ賦存區域ニ於テモ斷層ハ多數アリテ小日浦、南川、堂林、白石川、黒瀧川ニ於ケル秩父系ハ斷層ニヨリテ數區ノ小區域ノ地塊ニ賦カル、唯北西部長者別府村都及鳥形山ノ區域ノモノハ北隣伊野圖幅及西隣卯之町圖幅ニ互リテ廣ク發達セリ、是等各地塊ノ秩父系ハ略東西乃至北東ヨリ南西ニ走り北方五十度乃至八十度ニ傾斜セル單斜層ヲ成セリ

化石 高岡郡佐川町及加茂村ニ於ケル赤色角岩中ニハ放散蟲ヲ含ミ江原博士ハ *Coniopsis* sp., *Liliopsis* sp. ヲ、高岡郡尾川村佐ノ國及峰、長者村、黒瀧川及白石川、東津野村上郷ニ於ケル石灰岩中ニハ *Neoschwagerina craticulifera* Schwager 其他ノ紡錘蟲ヲ檢出セリ、即チ上古古生代ノ二疊石炭紀秩父系ノ一部ニ屬スルモノナリ

二 上部古生・三疊系—虚空藏山層

本層ハ高知圖幅ノ三寶山層ヨリ連續セル地層ニシテ本圖幅地内ニ於テハ其下部ノ石灰岩中ニ上部古生代ノ紡錘蟲ヲ檢出シ上部ノ硅板岩中ニ放散蟲ヲ發見シタル外之ト連續セル三

寶山層ヨリハ高知國幡地内佐古村三寶山ニ於テ三疊紀ノ介化石記載セラレタル事實ニヨリ上部古生代ノ秩父系及三疊系ニ屬スル部分アルコト明カナルモ之ヲ各別ニ區分スルヲ得サリシカ故ニ茲ニ虚空藏山層ナル名稱ヲ設ケテ記載スルコト、セリ

本層ヲ構成スル岩石ハ砂岩、頁岩、石灰岩、硅板岩等ヨリ成リ岩質ハ國幡地北西部ノ秩父系ヨリモ稍新シキ觀ヲ呈ス、本層ヲ上下ノ二層ニ分ツヲ得

(一) 下部層

本層ハ石灰岩ヲ挾メル砂岩、頁岩層ニシテ稀ニ硅板岩及凝灰岩ヲ挾有ス

砂岩 灰色乃至暗灰色ヲ呈シ細粒ニシテ主ニ石英及長石ヨリ成ル、十米内外ノ厚サヲ以テ頁岩ト互層ス

頁岩 灰色或ハ暗灰色ヲ呈ス、〇五米乃至十米ノ厚サヲ以テ砂岩ト互層シ板狀或ハ塊狀ヲ成ス

石灰岩 白色乃至灰色ヲ呈シ細密堅硬ニシテ結晶質ノモノト、頁岩質非晶質ノモノトアリ、塊狀或ハ塊狀ヲ呈シ普通厚サ一米乃至三十米ナルモ高岡郡吾桑村空谷及東津野村古味口芳生野間ニ露ハル、モノハ五十米ニ達ス、屢々凝灰岩ヲ挾ミ又ハ上下ニ頁岩ヲ伴ヘリ、鏡下ニ於テハ方解石ノ微晶及粘土質物ヨリ成レルモノ、方解石ノ細結晶粒ヨリ成レルモノ及篩狀構造

ヲ示セルモノ等アリ、北原村神谷^{ウツ}ニ於ケル石灰岩ハ *Neofusulinella* ニ類スル紡錘蟲及放散蟲ノ形骸ヲ含メルヲ檢セリ

凝灰岩 綠色或ハ紅色ヲ呈シ細粒質ニシテ普通厚サ一米乃至十米ノモノ石灰岩中ニ挾マレ或ハ其上下ニ現出ス、鏡下ニテハ主トシテ綠泥石ヨリ成リ粘土質物ヲ交フ

硅板岩 赤色或ハ灰色ヲ帶ヒ、緻密堅硬ニシテ時々塊狀ヲ呈ス、厚サ一米乃至五米ノモノ砂岩頁岩層中ニ介在ス

構造 本層ハ高岡町ノ北方ナル清瀧寺伊野國幡地内ヨリ北原村神谷、虚空藏山、蟠蛇森、鶴松森、芳生野ニ亙レル山脈ヲ構成シ數個處ニ於テ斷層ニヨリテ切斷セラル、モ概シテ東北東ヨリ西南西ニ走リ北々西ニ五十度乃至八十度傾斜ス、其南側ハ斷層ヲ以テ安藝川層ニ接シ北側ニテハ虚空藏山上部層ニヨリ整合的ニ被覆セラル、厚サハ千五百米ニ達スルモノ、如シ

(二) 上部層

本層ハ硅板岩ヲ挾メル砂岩、頁岩層ニシテ稀ニ疊岩ヲ挾有ス、厚サハ二千五百米ニ達ス

砂岩 灰色或ハ暗灰色ヲ呈シ細粒質ナルモノ最モ多ク又普通塊狀ヲ成スモ時ニ塊狀ノモノアリ、主ニ石英及長石ヨリ成リ粘板岩ノ角礫ヲ交フルモノアリ、塊狀ヲ呈セルモノハ往々炭化物質ヲ含ミテ稍柔軟ナリ、砂岩ハ一米乃至十米ノ厚サヲ以テ硅板岩及頁岩ト交互ス

頁岩 灰色或ハ暗灰色ヲ呈シ緻密ナルモ稍柔軟ニシテ露頭面ニテハ小片ニ破碎シ易シ、一米乃至五米ノ厚ザラ以テ砂岩ト互層シ又硅板岩中ニ薄層ヲナシテ之ト交互ス

硅板岩 ハ灰色、暗灰色、赤色又ハ淡綠色ヲ呈シ十厘米内外ノ厚サヲ以テ縞狀ヲ成セルモノ及緻密堅硬ニシテ塊狀ヲ成セルモノアリ、本岩ハ厚サ一米乃至五米ノ層ヲ成シテ砂岩、頁岩互層中ニ介在スルモ又薄キ頁岩ヲ挟ミテ地質圖ニ示セルカ如キ厚層ヲ成セルモノアリ

綠色及赤色ヲ呈セル硅板岩中ニハ放散蟲ノ形骸ヲ含メルコトアリ、高岡郡斗賀野村ノ硅板岩中ニハ放散蟲 *Cenosphærum* sp., *Sphaerozoom* sp., *Poroliasus* sp. ヲ認メタリ

蠻岩 ハ尾川村小日浦ノ南方ニ露出シ暗灰色ニシテ小豆大ノ硅岩、砂岩、粘板岩等ノ圓礫ヨリ成リ暗灰色粘土質物ニテ膠結セラル、厚サハ二米内外ナリ

構造 本上部層ハ南ハ下部層上ニ累重シ、北ハ斷層ヲ以テ大部分ハ上部珠羅紀ノ鳥ノ巢層ニ、少部ハ尾川村及大桐村ニ於テ秩父系ニ接ス、此走向斷層アルタメニ本層ノ分布區域ハ廣狹ノ差アルモ地層ハ齊シク東西乃至東北東—西南西ニ走リ北方ニ四十度乃至八十度ニ傾斜セル單斜層ヲ成ス、唯斷層ニ近キ部分ニアリテハ南方ニ傾斜セルコトアリ

化石 本上部層ノ發達地域内即チ、佐川、須崎間鐵道ノ斗賀野隧道内ニ於テ頁岩中ヨリ採取セリト傳フル一化石ヲ入手シタリ、本化石ハ小林貞一氏ノ鑑定及記載ニヨレハ佐川盆地ノ下

山ノ三疊系ヨリ産セル *Pecten suwakii*, *Kobayashi* ト同種ナリトセラレタリ、然ラハ本上部層ハ少クトモ共一部ニ三疊系ヲ包括スルモノナリトス、斗賀野隧道ニ産シタリト云フ事實ニ就キ多少疑アリテ未タ明確ナラサルモ茲ニ之ヲ附記ス

三 三疊系

本系ハ關幅地ノ北部ナル佐川町附近ニ露出シ南及北ハ東西ニ走レル斷層ニヨリテ秩父系ニ接シ東北東ヨリ西南西ニ互リテ狹長ナル地帯ヲ占ム、佐川町附近ニテハ走向北六十度東ニシテ北西五十度内外ニ傾斜セル單斜層ヲナス

本系ハ主トシテ砂岩、頁岩ヨリ成リ蠻岩ヲ挾有シ其厚サ三百米内外ニ達ス

砂岩 一米乃至五米ノ厚サ毎ニ頁岩ト互層シ帶黃灰色或ハ灰色ヲ呈シ石英及長石ノ細粒ヨリ成リ稍脆ク膠結シ塊狀ナリ、佐川町佐川、岡崎附近ノ砂岩ヨリハ *Duroella* sp. 採取セラレタルコトアリ

頁岩 一米乃至十米ノ厚サヲ以テ砂岩ト互層ス、本岩ハ灰色、暗灰色或ハ綠色ヲ呈シ灰色及暗灰色ノモノハ小片ニ破碎シ易ク綠色ノモノハ稍堅硬ニシテ塊狀ヲ呈ス、佐川町藏法院谷ニ

於テ暗灰色ノ頁岩中ヨリハ *Dronella Kotoi* Mojs., *D. sakawana* Mojs. ヲ採取セリ
 鑿岩 暗灰色ヲ呈シ小豆大ノ砂岩、粘板岩ノ礫カ暗灰色粘土質物ニテ膠結セラレタル
 モノナリ

時代 本層ハ三疊系ノ内所謂ダオネラ層ニ屬スルモノニシテ多數ノ地質學者ニヨリ研究
 セラレタリ

藏法院産ダオネラノ二種 *Dronella sakawana* Mojs., *Dronella Kotoi* Mojs. (E. v. Mojsisovics ニヨリテ
 初メテ記載セラル(E. v. Mojsisovics, 1889). *Veber einige japanische Trias-fossilien* (Beitr. z. Pal. u. Geol.
 Oester. Ung. u. d. Orients, Bd. VII 參照)

其後矢部博士及清水博士ハ次ノ同地産ノ化石ヲ記載セリ (H. Yabe and S. Shimizu, (1927), The
 Triassic Fauna of Kifu near Sendai. (Sci. Rep. Tohoku Imp. Univ., Sendai, Japan, Second Series, (Geology) Vol.
 XI, No. 2.) 參照)

Dronella Kotoi Mojs.

Dronella Kotoi Mojs. var. *alta* Yabe and Shimizu

Dronella sakawana Mojs.

Dronella densisakata Yabe and Shimizu

Dronella densisakata Yabe and Shimizu var. *subquadrata* Yabe and Shimizu

尙ホ小林貞一學士ハ佐川町藏法院産ノダオネラヲ研究シ次ノ種類ヲ附加セリ(小林貞一
 土佐國佐川ノ三疊紀層と上部古生層ノ横移岩塊クリツペン) 地質學雜誌 第參拾八卷 第
 四百五拾貳號及第四百五拾四號參照)

Dronella taitoo Bittner

Dronella taitoo Bittner var. *solomonensis* Kobayashi

Dronella densisakata Yabe and Shimizu var. *adhaeri formis* Kobayashi

Dronella densisakata Yabe and Shimizu var. *Shimizu* Kobayashi

然ルニ清水博士ハ最近佐川町青山文庫所藏ノ藏法院産菊石ヲ研究シテ *Protrochlyceris* aff.
orbicularis (Lanthe) *Tylosites orientalis* Shinzui ヲ記載セリ (S. Shimizu, (1930) On Some Triassic Ammonites
 from the Sakawa Basin, Province of Tosa in Shikoku, Jap. Jour. Geol. and Geogr. Vol. VIII, Nos. 1—2 參照)
 前者ハ同一標本中ニ *Dronella densisakata* Yabe and Shimizu ノ印像存スルヲ以テダオネラ層ニ屬
 スルコト明カニシテ後者ハ其化石帶ヲ明カニセサルモ下部カーニツク階ニ屬スルモノト稱
 セラル

始メ Mojsisovics 氏ハダオネラ層ヨリノ化石ヲ記載スルニ當リ *Trochomonotis orbicularis* ノ共産ス

ルコトヲ述ヘラレタルモ其後矢部、早坂兩博士等ノ周到ナル採集ニモ拘ハラズ之ヲ發見セス、
小林學士モ亦此ノ事實ノ誤謬ナル事ヲ詳述セリ

要之、藏法院、ダオネラ層ハ矢部、清水兩博士、小林學士ノ主張スルカ如ク所産ノ *Protosiphonius*
aff. archelus (Janbe), *Dionella indica* Britton ニヨリ陸前國利府ニ於ケル「ダオネラ」層ト對比シ得ヘク
後者ト同様ニ「ラヂニツク」階ニ相當スヘシ

四 珠羅系

(一) 安藝川統

本統ハ虚空藏山層ノ南方ニ於テ廣域ヲ占メ、砂岩、頁岩ヲ主トシ部分ニヨリ放散蟲頁岩、石灰
岩等ヲ挾有スル厚キ岩層ニシテ次ニ記セルカ如ク上下ノ二部層ニ分チタリ

本統ト鳥ノ巢層トノ關係ハ各分布區域ヲ異ニスル爲メ確然判斷スル能ハサルモ佛像及桑
田山ニ於ケル上部層石灰岩ヲ挾ミ頁岩ニ富メル砂岩頁岩層中ノ石灰岩ハ鳥ノ巢石灰岩ニ酷
似セルヲ以テ上部層ヲ鳥ノ巢層ト同位ノモノト認定スレハ安藝川統ハ珠羅紀ニ屬スルモノ
ト看做シ得ヘシ

(4) 下部層

本層ハ放散蟲頁岩ヲ挾メル砂岩頁岩層ニシテ處ニヨリ蟹岩及石灰岩ヲ挾有ス

砂岩 灰色、暗灰色等ヲ呈シ石英及ヒ長石ノ細粒ヨリ成リ粘板岩ノ小破片ヲ交エ粘土質物
ヲ以テ膠結セラル、厚サ〇三米内外若クハ一米乃至五米ノ厚サ毎ニ頁岩ト互層セルモノト厚
サ十米ニ達スルモノトアリ

頁岩 灰色、暗灰色時ニ綠色或ハ黑色ノモノアリ、板狀或ハ塊狀ニシテ緻密堅硬ノモノ或ハ
裂理多クシテ小片ニ破碎シ易キモノアリ、時ニ泥灰岩球ヲ埋藏スルモノアリ、砂岩ト互層セル
モノハ厚サ〇三米乃至一米ナルモ厚キモノハ八十米ニ達ス

放散蟲頁岩 主トシテ赤色ヲ呈シ稀ニ綠色ヲ呈ス、赤鐵礦ヲ含メル赤色粘土質物ヨリ成リ
放散蟲形骸ヲ包藏ス、時ニ硅質ニシテ宇佐村龍其他ニハ硅板岩ト稱スヘキモノアルモ圓幅内
一般トシテハ頁岩狀ヲ呈スルモノ多ク殊ニ板狀ニ剝離シ露頭面ニテハ粘土狀ヲ現ハスモノ
アルヲ以テ圖上ニハ頁岩トシテ塗色セリ、厚サ一米乃至五米ノモノ普通ニシテ稀ニ十米ニ達
スルコトアリ

蟹岩 須崎町ノ南東海藏寺ノ南麓ニ砂岩中ニ挾マレテ露出シ、灰色或ハ暗灰色ヲ呈シ小豆
大乃至胡桃實大ノ硅岩、砂岩粘板岩等ノ礫ヲ砂粒ニヨリテ膠結セルモノニシテ厚サ一米乃至

三米ナリ

石灰岩 ハ白色ヲ呈シ塊狀ノ部分ト縞狀ノ部分トアリ、縞狀ノ部分ハ硅質ヲ帶フ、本岩ハ下部層ニハ稀有ノモノニシテ唯須崎灣ノ東岸勢井ニ發見セラレタルノミ、厚サ三米内外ナリ

構造 本層ハ北方ニ於テ宇佐村ヨリ多郷村ヲ經テ東津野村新田ニ互レル斷層ヲ以テ安藝川統上部層ニ接シ南ハ久禮町ヨリ大野見村ヲ經テ大正村ニ互レル斷層ニヨリテ限ラル、其走向略東西或ハ東北東―西南西ニシテ傾斜ハ三十度乃至八十度ニシテ多クハ北方ニ傾クモ時ニ南方ニ傾ケルトコロアリ

本層ハ走向斷層竝ニ褶曲多キニヨリ反覆露出シ爲メニ地域内ニ於テハ幅廣ク發達セルモ厚サハ四千米内外ナルヘシ

(ロ) 上部層

本層ハ石灰岩ヲ挾メル砂岩頁岩層ニシテ頁岩其大部ヲ占メ稀ニ放散蟲頁岩ヲ伴ヘリ、半山村ニ於テハ砂岩頁岩ノ互層發達セリ

砂岩 灰色或ハ暗灰色ヲ呈シ石英及ヒ長石ヨリ成リ灰色粘土質物ニヨリ膠結セラル、厚サ〇三米乃至一米毎ニ頁岩ト互層セルモノト厚サ五米ニ達スルモノトアリ

頁岩 灰色、暗灰色或ハ綠色ノモノアリ稍軟脆ニシテ小片ニ破碎シ易キモノ多シ、砂岩ト互層セルモノハ板狀ニ剝離ス、石灰岩若クハ泥灰岩ノ圓球ヲ包藏スルコトアリ、普通厚サ〇三米乃至五米ニテ砂岩ト互層セルモ時ニ厚サ二十米ニ達スルモノアリ

石灰岩 灰色或ハ暗灰色ヲ呈シ扁桃狀ヲ爲シテ頁岩中ニ介在セリ、佛像ニ於ケルモノハ *Solenopora rotundata* (Yabe) 其他珊瑚ノ破片ヲ埋藏シ鳥ノ巢層ノ石灰岩ニ酷似セリ、厚サ一米乃至三米ニシテ延長五十米ニ及フモノ稀ナリ

放散蟲頁岩 赤色ヲ呈シ赤鐵質ヲ含メル粘土質物ヨリ成リ中ニ放散蟲ヲ包藏スルモノニシテ厚サ三米内外アリ、本層中ニハ寧ろ稀レニ存スルモノナリトス

構造 本層ハ高岡郡高岡町ヨリ戸波村、半山村及東津野村ニ向ヒ東西ニ互リテ發達ス、而シテ本層ハ斷層及褶曲多キ爲メ地層擾亂セルモ厚サハ半山村ニ於テ千五百米、戸波村ニ於テ三千米ニ達スルモノ、如シ、走向ハ東西或ハ東北東―西南西ニシテ北方或ハ南方四十度乃至八十度ニ傾斜シ褶曲層ヲ形成ス、即チ高岡町横瀬山ヨリ戸波村浦ノ内ニ互リ一向斜層ヲ形成ス、半山村ノ上部層ノ地帯中ニモ亦東西ニ走レル一斷層アリテ其北方ノ地塊ニ於テハ兩翼四十度乃至八十度ニ傾斜セル向斜層ヲ形成ス、而シテ上部層ノ地帯ノ北側ハ斷層ヲ以テ虚空藏山層ニ接ス、此斷層ノ兩側ノ地層ハ時ニ傾斜方向ヲ異ニスルコトアルモ概シテ何レモ共ニ北方

ニ急斜セル處多ク露頭ニ即シテ斷層ノ性質ヲ究ムルコト能ハサリシモ其境界竝ニ地形上ヨリ之ヲ推考スルニ該斷層ハ逆斷層或ハ衝上斷層ナラント疑ハル

(二) 四萬十統

本統ハ砂岩及頁岩ヲ主トセル岩層ヨリ成レルモ處々ニ放散蟲頁岩及疊岩ヲ挾有セリ、而シテ砂岩ハ良ク發達シ厚層ヲ成セルコトアリ

砂岩 灰色或ハ暗灰色ヲ呈シ石英及ヒ長石ノ細粒或ハ粗粒ヨリ成リ、灰色粘土質物ニテ膠結セラル、普通厚サ〇三米内外若クハ厚サ一米乃至五米ニテ頁岩ト互層セルモ時ニ厚サ二十米ニ達スルモノアリ

頁岩 灰色、暗灰色時ニ綠色或ハ黑色ヲ呈ス、暗灰色ノモノ普通ニシテ灰色ノモノ之ニ次ク、綠色ノモノハ稍軟脆ニシテ小片ニ破碎シ易ク黑色ノモノハ硅質ニシテ堅硬ナリ、概ネ〇三米乃至五米ノ厚サヲ以テ砂岩ト互層ス

放散蟲頁岩 赤色ヲ呈シ凝灰質ノモノ、緻密ニシテ稍軟キモノ、板狀ニ剝離スルモノ又塊狀ニシテ堅硬ノモノアリ、放散蟲ノ形骸及赤鐵礦ノ細粒ヲ含ミ粘土質物或ハ硅質物ニテ膠結セラレ、厚サ一米乃至五米ナリ

疊岩 暗灰色ヲ呈シ小豆大乃至胡桃實大ノ硅岩砂岩粘板岩等ノ圓礫ヲ砂粒ニテ膠結セルモノナリ、厚サ一米乃至三米ナリ

構造 本統ノ分布區域ハ斷層ヲ以テ數區ニ分タレ各區域ニ於テ地質構造ヲ異ニセリ、即チ高岡郡上ノ加江村附近ニアリテハ海岸ニ於テ走向東西ナルモノヨリ西方山地ニ於テハ次第ニ彎曲シ南西方ノ東又村ニ於テハ北東―南西ニ變シ、傾斜ハ北方若クハ北西方ニ四十度乃至八十度ナリ、而シテ斷層或ハ褶曲ノ爲メニ南方ニ傾斜スルトコロアリ、仁井田村地方ニアリテハ走向北二十度乃至四十度東ニ走リ北西方ニ四十度乃至八十度傾斜シ松葉川村ニ於テハ南北ニ走レル斷層、北西―南東ニ走レル斷層及北東―南西ニ走レル大斷層ニ因リテ數區ノ小地塊ニ分タル、同村ヨリ大野見村ニ互レル地域ニ於テハ走向東西ニシテ北方ニ五十度乃至八十度傾斜シ單斜層ヲ成セリ

本統ハ久禮町ヨリ大正村ニ互レル一大斷層ヲ以テ安藝川統下部層ニ接シ其層位關係不明ナリ、岩質、層序等ヨリ見ル時ハ安藝川統及鳥ノ巢層ヲ含ムモノナルヘキモ地質構造ノ複雜セルト岩層ハ到ル處稍一樣ノ岩質及累重狀態ヲ持シ之ヲ各層ニ區別スルコト困難ナル爲メ本圖幅ニ於テハ四萬十統トシテ之ヲ一括スルコト、セリ、岩層ノ厚サハ斷層、褶曲等多キ爲メ之ヲ詳ニスルコト能ハサルモ松葉川沿岸ニ於テハ四千米ニ達スルモノ、如シ

五 鳥ノ巢領石統

鳥ノ巢層ハ佐川町ノ南方鳥ノ巢附近ニ最モ良好ニ發達スルヲ以テ此名有リ、本層ハ灰色ノ石灰岩ヲ挾メル砂岩頁岩層ニシテ鑿岩ヲ挾有セリ、本圖幅ニ於テ茲ニ鳥ノ巢領石統トシテ區別シタルモノハ此巢層ノ連續ニシテ其大部分ハ鳥ノ巢層ナルモノ一部ニ領石植物化石其他ノ下部白堊紀化石ヲ産シ珠羅紀ヨリ白堊紀ニ互レルモノナルヘシ、然レトモ全區域ニ互リテ此兩者ヲ區別シテ塗色スルコト能ハサリシヲ以テ之ヲ一括シタリ、鳥ノ巢、長者村白石川、及古味口ノ各地ニ於テ測定スルニ岩層ノ厚サ一千米ニ達スルモノ、如シ

頁岩 灰色、暗灰色或ハ綠色ニシテ稍脆ク小片ニ破碎シ易シ、時ニ板狀ニ剝離スルモノアリ、白石川及佐川町吉田屋敷ニ於テハ領石植物化石ヲ包藏ス、又鳥ノ巢附近ニ於テハ之ヨリ三角介ノ *Trigonia koyanai* Yehara 「アムモン」介ノ *Perisphinctes murimatoi* Yehara ノ採取セラレタルコトアリ、本岩ハ厚サ一米乃至五米ヲ以テ砂岩ト互層セリ

砂岩 灰色、暗灰色或ハ黃灰色ヲ呈シ石英及長石ノ細粒乃至粗粒ヨリ成リ厚サ一米乃至十米ヲ以テ頁岩ト互層ス、香ヶ瀧、谷地及白石川ニ於ケル灰色砂岩中ニハ *Trigonia sennuwayi* Yehara,

Trigonia pacilliformis Yok. 等ノ化石ヲ埋藏ス

石灰岩 暗灰色又ハ黑色ヲ呈シ緻密堅硬ナルモノ、餅狀ヲ呈スルモノ及形狀種々ナル化石ヲ多量ニ包藏スルモノ等アリテ結晶質ノモノハ稀ナリ、本岩ハ何レモ頁岩中ニ介在シ厚サ一米以内ノ扁桃狀ヲ呈スルモノ又厚サ二十米ニ達シ二百米以上連續スル大ナル扁桃狀ヲ成スモノアリ、概シテ化石ニ富ミ海膽ノ棘、珊瑚ヲ多量ニ埋藏シ、特ニ鳥ノ巢地方ノモノニハ澀青質物ノ小塊ヲ含有シ之ヲ打テハ石油臭ヲ發散ス

鑿岩 灰色、暗灰色ヲ呈シ時ニ赤色或ハ綠色ノ硅岩或ハ硅板岩礫ヲ含ミ雜色ノモノアリ、小豆大乃至胡桃實大ノ硅岩、角岩、砂岩及粘板岩ノ礫ヲ硅質粘土質物及砂粒ニテ膠結セルモノナリ、厚サハ一米乃至五米ヲ普通トスルモ時ニ三十米ニ達スルモノアリ、東津野村上郷ニ露出セルハ其最モ厚キ層ナリトス

化石 鳥ノ巢ニ於ケル鳥ノ巢石灰岩ノ化石ハ古クヨリ多數ノ地質學者ニヨリ研究セラレ *Neumann, Keunayr*, 横山博士等ニヨリテ有孔蟲、珊瑚類、二枚介、海膽類等ノ記載セラレタルヲ初メトシ其後矢部及早坂兩博士ハ珊瑚類「ハイドロゾア」類ヲ、徳永博士ハ海膽類ヲ、矢部博士及外山氏ハ石灰藻類ヲ、矢部博士及杉山氏ハ層孔蟲類ヲ記載セリ、其他附近ノ花畑、野口、岩佐、金比羅、八ヶ森、殖生川、西山、奥瀧、小瀧等ニハ鳥ノ巢石灰岩斷續シテ露出シ其中ヨリ前記ノ諸氏ニヨリ

ヲ記載セヨレタル化石多數アリ、化石中主ナルキノノ一類ニテ列森スレハ左ノ如シ

| | |
|-----------------------------------------------------------------------------------|-------------------|
| <i>Mitropophyes vivax</i> Yabe & Toyama | 八ヶ森、鳥ノ巢 |
| <i>Solenopora volkeltzi</i> (Yabe) | 花畑、岩佐、野口 |
| <i>Girardinia torensii</i> Yabe & Toyama | 八ヶ森 |
| <i>Cyclonema lituae</i> Yok. | 岩佐、鳥ノ巢 |
| <i>Tectularia cf. cordiformis</i> Sch. | 鳥ノ巢 |
| <i>Pulvinulina</i> sp. | 鳥ノ巢 |
| <i>Chaetopsis cristata</i> Neum. | 鳥ノ巢、岩佐 |
| <i>Isostrea</i> sp. | 岩佐、小瀧 |
| <i>Mamudrina</i> sp. | 鳥ノ巢 |
| <i>Actinostromaria asiatica</i> Yabe & Sugiyama | 小瀧 |
| <i>Stromatopora</i> (<i>Protastromatopora</i>) <i>subjaponica</i> Yabe & Sugiy. | 岩佐 |
| S. (♀) <i>japonica</i> Yabe | 岩佐、花畑、尾川 |
| S. (♀) <i>miyada</i> Yabe & Sugiy. | 鳥ノ巢、小瀧 |
| S. (♀) <i>memoria-nanumai</i> Yabe & Sugiy. | 岩佐、鳥ノ巢、花畑、八ヶ森、殖生川 |

| | |
|-----------------------------------------------------------------------------------|------------------|
| S. (♀) <i>memoria-nanumai</i> var. <i>kausa</i> Yabe & Sugiy. | 小瀧 |
| S. (♀) <i>kaui</i> var. <i>tanacensis</i> Yabe & Sugiy. | 花畑 |
| <i>Stromatopora</i> (<i>Epistromatopora</i>) <i>horizantensis</i> Yabe & Sugiy. | 鳥ノ巢、奥ノ瀧 |
| S. (♀) <i>delicta</i> Yabe & Sugiy. | 谷地 |
| <i>Stromatoporellina</i> ? <i>unulada</i> Yabe & Sugiy. | 小瀧 |
| <i>Milopellera fasciculata</i> Yabe & Sugiy. | 岩佐 |
| <i>Tonastroma tokanagai</i> Yabe & Sugiy. | 花畑 |
| <i>Mileporidiana lamellata</i> Yabe & Sugiy. | 殖生川 |
| M. <i>kanakataense</i> Yabe & Sugiy. | 花畑、西山 |
| M. <i>somocense</i> Yabe & Sugiy. | 花畑 |
| M. <i>fasciculata</i> Yabe & Sugiy. | 野口、西山、岩佐、鳥ノ巢、奥ノ瀧 |
| <i>Spongiomorpha globosa</i> Yabe & Sugiy. | 奥ノ瀧 |
| S. <i>asitica</i> Yabe & Sugiy. | 西山、花畑、鳥ノ巢 |
| <i>Stromatomorpha yokoyamai</i> Yabe & Sugiy. | 野口 |
| <i>Mitopora pyriformis</i> Yabe & Hayasaka | 鳥ノ巢(?) |

| | |
|----------------------------------------------|----------|
| <i>Pentacrinus</i> sp. | 西山 |
| <i>Orthis</i> cf. <i>glauclifera</i> Gold. | 鳥ノ巢、岩佐 |
| <i>Hemichelonic</i> cf. <i>oreularis</i> Ag. | 西山 |
| <i>Pygurus asiaticus</i> Tokunaga | 鳥ノ巢 |
| <i>Terebratulida bisseffensis</i> Zeit. | 小瀬、西山 |
| <i>Rhynchonella karadai</i> Neum. | 岩佐、花畑 |
| <i>Alcyonaria</i> cf. <i>amor</i> d'Orb. | 尾川 |
| <i>Nerinea</i> cf. <i>visseryi</i> Kömmer | 鳥ノ巢 |
| <i>Cerithium</i> sp. | 岩佐、小瀬 |
| <i>Belonitica</i> sp. | 岩佐、西山、花畑 |
| 長者村白石川地方ノ石灰岩中ニハ次ノ化石ヲ含ム二十萬分之一須崎圖幅説明書所載 | |
| <i>Chonetopsis cristata</i> Neumayr | |
| <i>Laridraea</i> | |
| <i>Thaumatocraea</i> | |
| <i>Cidaris</i> cf. <i>glauclifera</i> Gold. | |

以上列挙セシ動物化石ハ鳥ノ巢石灰岩ノモノニシテ上部珠羅紀ニ屬ス
白石川地方ノ頁岩中ニハ又次記ノ植物化石發見セラレタリ二十萬分之一須崎圖幅説明書
所載)

Cladophlebis browniana (Dunker)

Podozamites pusillus Vel.

Zamiophyllum buckianum (Ett.)

Psilophyllum cf. *caelense* Morris

Nitsonia schwanbergensis Dunker

吉田屋敷ノ頁岩中ヨリハ次記ノ植物化石發見セラレタルコトアリ (*Cladophlebis browniana*
(Dunker) (二十萬分之一須崎圖幅説明書)

是等植物化石ハ普通領石植物化石ト稱スルモノニシテ下部白垩紀ウキルデン階ニ屬ス此外
白石川ニ於ケル砂岩中ヨリ三角介及 *Seymouria* ヲ二十萬分之一須崎圖幅説明書、山神ニ
於ケル砂岩中ヨリ *Trigonia rotundata* Yok., *Trigonia poeciliformis* Yok., *Alcyonaria* cf. *conruda* Lam. 等ノ二枚
貝ヲ産セル記録アリ(江原博士記事)是等ハ下部白垩紀ニ屬スルモノナリ

構造 本層ハ上部古生層ト虚空藏山層トノ間若クハ上部古生層中ニ斷層ヲ以テ圍繞セラ

レテ介在シ鳥ノ巢地方ノ外、白石川、古味口、小日浦、小奥等ニ賦存ス。走向ハ略東西或ハ東北東—西南西ニシテ北方ニ五十度乃至八十度傾斜セルモノ、白石川ニ於ケルモノハ直立ス。

鳥ノ巢地方ニアリテハ下部ニ疊岩ヲ挟メル頁岩層、中部ニ三石灰岩層ヲ挟メル砂岩頁岩層、上部ニ砂岩頁岩層アリテ北方ニ斜下セル單斜層ヲナス、然ルニ白石川地方ニ於テハ岩層直立シ北部ヨリ石灰岩層、含植物化石頁岩層、石灰岩、三角介ヲ含メル砂岩及疊岩層アリテ此間ニ斷層ノ存在及岩層ノ轉倒ヲ想像セラル、モノアリ、古味口ニ於テハ其北及南ニ疊岩層露出シ其間ノ中央ニ數層ノ石灰岩ヲ挟メル頁岩砂岩層アリテ向斜構造ヲ爲シ其北翼ハ略直立シ其南翼ハ北方ニ傾斜セルモノ、如シ。

六 現世統

本統ハ砂礫及粘土ヨリ成レル沖積層ニシテ、河流ノ沿岸ニテハ粘土、砂礫層ヨリ成リ、高岡町及戸波村ノ平地ニテハ粘土層廣ク發達シ、宇佐須崎ノ海岸、仁淀川沿岸及川尻ニ於テハ砂礫層發達セリ。

七 閃綠岩

綠色或ハ灰綠色ヲ呈シ粗粒ナリ

主成分—灰曹長石、角閃石

副成分—綠簾石、綠泥石、透輝石、方解石、磁鐵礦

灰曹長石ハ大サ一耗内外半、自形或ハ他形ヲ爲シ、アルバイト式双晶ヲナス、分解シテ綠泥石及綠簾石ニ變セリ、角閃石ハ大サ〇五耗内外ノ柱狀結晶ヲ成シ多クハ綠泥石化スルモ僅ニ中央部ニ遺レル殘骸ハ多色性ヲ示ス、綠泥石ハ不規則形或ハ東線狀ヲ成シ綠簾石ハ小柱狀ヲ成シ長石間ヲ充填シ、透輝石ハ小柱狀ヲナス、磁鐵礦ハ小粒狀ヲ呈シ、方解石ハ長石及其他礦物ノ間ヲ充セリ。

本岩ハ古生層中ニ岩床或ハ岩脈ヲ成シテ長者村ノ長者及黑瀧川ニ露出ス、黑瀧川ニ於ケルモノハ一大崖壁ヲ成シ約東西ニ亘リ其長サ約六千米ニ達スル大岩脈ナリ、本岩ハ黑瀧川附近ニ於テハ稍粗粒ナルモ其尖端ナル上郷、都越ニ於テハ細粒ナリ、又長者村長者ニ於ケルモノハ露出僅カニシテ岩石モ稍基性ニ屬スルモノ、如ク黑瀧川ノモノヨリハ透輝石ニ富メリ。

八 蛇紋岩

本岩ハ長者村織合地方ノ小區域ヲ占メ古生層中ニ貫入シ岩床或ハ岩脈ヲ成シ閃綠岩ヨリ分化變質セルモノ、如シ

綠色ヲ呈シ主成分ハ蛇紋石、副成分ハ斜長石、透輝石、角閃石、格魯謨鐵礦ナリ、蛇紋石ハ線狀或ハ網狀ヲ呈シ斜長石ハ僅ニ「アルバイト」式双晶ヲ示スモ大部分ハ分解セリ、輝石ハ透輝石ニ屬シ蛇紋石中ニ包裹セラレ柱狀結晶ヲナス、角閃石ハ陽起石ニ屬シ柱狀結晶ヲ成ス

第二章 應用地質

一 滿俺鑛

高岡郡尾川村西山附近、斗賀野村及北原村等ニ發達セル上部古生三疊系中ノ角岩ヲ採メル砂岩頁岩層中ノ角岩ニ伴ヒテ黑色滿俺鑛アリテ約十年前ノ頃採掘セラレタルコトアリ

二 石灰岩

烏ノ巢層、安藝川統、三疊系及古生界中ニ發達セル石灰岩ハ各地ニ於テ必要ニ應シテ採掘セシ主トシテ生石灰製造原料ニ利用セラル

三 硅石

高岡郡宇佐村龍地方ノ赤色硅板岩及同郡長者村附近ノ赤色ノ角岩ハ硅石ト稱シ製鐵用トシテ採掘セラレタルコトアルモ巡回當時ハ全ク採掘スルモノナシ

四 建築石材

安藝川統ノ砂岩及四萬十統ノ砂岩ハ土臺石、捨石、墓石、石垣石等トシテ利用セラレ地方ノ需用ヲ充タスニ足リ、石灰岩ハ石垣石、道路敷石、散石等ニ利用セラル、モ一部ノ地方ニテ使用セラル、ノミナリ

五 瓶土

沖積層ノ粘土ハ諸處ニ於テ瓦用粘土トシテ利用セラル、殊ニ高岡平地、佐川盆地ニ於テ之ヲ採掘セル處多シ

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EXPLANATORY TEXT
OF THE
GEOLOGICAL MAP OF JAPAN

Scale 1:75,000



SUSAKI
Zone 33 Col. XVIII
Sheet 248

By
TATSUO SUZUKI

GEOLOGY

Upper Palaeozoic (Chichibu System) consists of sandstone, slate, hornstone and limestone. The slate is gray, dark gray, black or green in colour, and is traversed by platy joints. The sandstone is fine-grained in texture and dark grayish in colour and is alternated with the slate. The hornstone is gray, black, white, red, green, or variegated in colour, being thinly bedded, and mostly compact, and frequently microcrystalline. The red variety contains radiolarian remains. The limestone occurs as thin intercalations in the upper part of the alternation of sandstone and slate, and is white to gray in colour, being compact or crystalline. *Neoschwagerina craticulifera* SCHWAGER and other fusulinid fossils of the age of from the Permian to

upper Carboniferous were detected in the limestone from Mine, Sanokuni, Kurotakigawa, Shiraishigawa and Kamigō. The formation bears a dominant strike of east-west or north 60° east and northward dips varying from 50° to 80°. The strata are heavily faulted and broken into many blocks. From the Triassic rocks to the north and the Jura-Cretaceous Torinosu-Ryōseki Series to the south, the Chichibu rocks are separated by two prominent faults, of which the southern one seems to be a thrust or reverse fault, the Chichibu limestone having been thrust up over the Torinosu rocks as observed at Hanyūgawa in Togano-mura.

Upper Palaeozoic—Triassic (Kokuzōsan Series) is a continuation of the Sambōsan Series in the Kōchi sheet-map area, where it yielded Triassic fossils from its upper portion, while in the present area the limestone imbedded in the lower portion afforded some fossil *Fusulina*. Owing to the similarity of the constituting rocks throughout the series, no demarkation line could be drawn between the Palaeozoic and Triassic portions. The series may be divided into two parts; namely, Lower and Upper Beds.

Lower Beds consist of gray to dark gray shale and sandstone with subordinate amount of reddish or grayish chert and dense or crystalline limestone, being rarely accompanied by a fine greenish chloritic schalstein.

Upper Beds are also composed of shale and sandstone, characterised by frequent intercalations of variegated chert and absence of limestone. The chert from Togano

contains radiolarian remains belonging to *Cenosphaera*, *Sphaenozoum* and *Porodiscus*. It is reported that a Triassic fossil, *Pecten suzuki* KOBAYASHI which was originally described from the *Daonella* Beds at Shimoyama in the Sakawa Basin, was obtained from the Upper Beds at the Togano Tunnel. The general strike of the Kokuzōsan Series is from east to west or from east-north-east to west-south-west, and the dip is mostly toward north at angles from 40° to 80°, not without exception toward south.

Triassic System occurs in the vicinity of Sakawa in the northern part of the mapped area, forming a belt trending west-south-west. It is bounded and separated from the Chichibu rocks on the north and south sides by two subparallel faults. The System is made up of sandstone and shale, about 300 metres in total thickness, intercalated with thin conglomerate. The System is noted by the fact that it yielded *Daonella sakawana* and *Daonella kotoi* described by E. v. Mojsisovics some thirty years ago. Later Prof. H. Yabe and Dr. S. Shimizu, reported besides the above, three species and subspecies of *Daonella*; *D. kotoi* Moj. var. *alta*, *D. densisulcata* and *D. densisulcata* var. *subquadrata*. Mr. T. Kobayashi added to the above the followings: *Daonella indica* BITTNER, *D. indica* var. *zohoensis*, *D. densisulcata* var. *salinariformis* and *D. densisulcata* var. *shimizui*. S. Shimizu also described two Ammonites associated with *Daonella densisulcata* from Zōhōin: *Protrachyceras* aff. *archelaus* (LAUBE) and *Thisbites orientalis* SHIMIZU. By these shell remains the Triassic of Sakawa

is compared with the *Daonella* Beds of Rifu in Rikuzen and correlated to the Carnic or to the Ladinic of Europe.

Jurassic is divided into two series: the Akigawa and the Shimanto series.

Akigawa Series consists of shale and sandstone of enormous thickness, with interstratified radiolarian cherty shale. It is again subdivided into the Lower and Upper beds. In the Lower beds, layers of radiolarian shale are more frequently found, while the limestone and conglomerate are rare and thin. In the Upper, limestone lenses are rather common insertions in the shale. The sandstone is gray to dark gray in colour, being mostly fine grained. The shale is gray to black or greenish in colour, and platy or fissile in structure. The radiolarian shale is commonly reddish, but rarely greenish, being argillaceous or cherty. The limestone is light to dark grayish, and that found at Butsuzo contains *Solenopora rothpletzi* (YABE) and other fragmental coralline fossils, which commonly occur in the Torinosu Limestone. The Akigawa series strikes in the most cases from east to west or from east-north-east to west-south-west and dips to north at 30° to 80°. It is traversed by numerous faults and broken into several blocks, in which synclinal foldings are locally observed. The Upper and Lower beds are disconnected from each other by a dislocation running from east to west. The northern side of the Upper beds is also bounded by a heavy fault, the Kokuzōsan series being thrust up over the Akigawa series.

Shimanto Series is composed of grayish sandstone and black or green shale with local interbeddings of red radiolarian shale and thin conglomerate, the sandstone predominating over the others. It occupies the southern part of the mapped area, being separated from the Akigawa series by a conspicuous fault running from east to west. The series might include certain portions of the Akigawa series and the Torinosu-Ryōseki series. Whole area of this complex is severely faulted and divided into many blocks with different strikes, from east to west or from north-east to south-west, the prevailing dips being toward north or northwest. The total thickness attains 4,000 metres.

Jura-Cretaceous (Torinosu-Ryōseki Series) is a complex which includes both the Torinosu and the Ryōseki Series. The Torinosu Series consists of an alternation of sandstone and shale, intercalating dark gray, bituminous limestone lenses, rich in fossils of Hydrozoa, Bryozoa, Corals, Crinoids, etc. of Jurassic age, and is typically exposed at Torinosu, south of Sakawa. The western extension of this series is intimately associated with another rock series maintaining the so-called Ryōseki flora and other mollusca of the Wealden or Lower Cretaceous age. But as their rocks are quite similar to each other it is very difficult to draw a boundary line between them, and so they are here grouped altogether under the name of the Torinosu-Ryōseki Series.

The series forms a belt extending from east-north-east

to west-south-west and is steeply monoclinial toward north. On both sides, north and south, it is limited by faults from the neighbouring Chichibu System and Kokuzōsan Series.

Fossils of Foraminifera, Corals, Crinoids and Mollusca from Torinosu, south of Sakawa were early described by Naumann, Neumayr and Prof. Yokoyama. Later, Prof. S. Tokunaga described Crinoids and Echinoids. Prof. H. Yabe, I. Hayasaka and al. also described Diatoms, Hydrozoa, Stromatopora and Corals from the same locality and several others in the neighbourhood. These fossils are listed on pages 18-20 of the Japanese text. From the limestone at Shiraishigawa in Chōja-mura, the following fossils are recorded: *Chaetopsis crinita* NEUMAYR, *Isastrea*, *Thamnastraea*, *Cidaris* cfr. *glandifera* GOLD. The above fauna is generally accepted to be of the Upper Jurassic in age.

From the shale exposed in the Shiraishigawa district and also at Yoshidayashiki, the following Ryōseki plants are recorded to have been collected:

Cladophleis browniana (DUNKER)

Podozamites pusillus VEL.

Zamiophyllum buchianum (ETT.)

Ptilophyllum cfr. *cutchense* MORRIS

Nilssonia schauburgensis DUNKER

The sandstone at Shiraishigawa yielded, besides these, *Trigonia* and *Stephanoceras* and that at Yamanokami, *Trigonia pocilliformis* YOK., *T. rotundata* YOK. and *Alectryonia* cfr. *cornata* LAM., which belong to the Lower Cretaceous.

Recent is composed of clay, sand and gravel, forming alluvial plains along the rivers and dunes on the sea coast.

Diorite occurs as dikes or sheets intruded into the Palaeozoic rocks. The dike of the Kurotakigawa at Chōja-mura has an extension of six kilometres from east to west, forming precipitous cliffs along it. It is coarse-grained and greenish gray, being chiefly composed of labradolite and hornblende. Its marginal facies seen at Kamigō and Miyakogoshi, and a small dike at Chōja show fine grained texture and afford a more basic aspect, containing a little amount of diopside.

Serpentine is found at Oriai, as a dike intruded into the Palaeozoic. It may be a rock differentiated from the diorite magma.

ECONOMIC GEOLOGY

Manganese Ore was mined about ten years ago at Ogawa-mura, Togano-mura and Kitalara-mura. The ore is kept in a hornstone which is interstratified in the Upper Palaeozoic-Triassic beds.

Limestone embedded in the Akigawa, Kokuzōsan and Upper Palaeozoic beds is burnt for lime at many places.

Siliceous Stone which is nothing but a red chert found at Ryū in Usa-mura and at Chōja in Chōja-mura was mined and used for iron furnace.

Building Stone is got from some sandstones of the Akigawa and Shimanto Series and some limestones, for

foundation of building, tombs, and pavement of road, but only for local demand.

Tile-clay is dug from the Recent deposits for making roof-tile, particularly in the Takaoka plain and Sakawa basin.