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FRANTIŠEK FIALA:

ALKALICKÉ ČEDIČE (BASANITOIDY) OD TEKOVSKÉ BREZNICE A BREHŮ U NOVÉ BANĚ NA SLOVENSKU

ALKALI BASALTS (BASANITOIDS) FROM TEKOVSKÁ BREZNICA AND BREHY NEAR NOVÁ BAŇA IN SLOVAKIA

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NÁKLADEM NÁRODNÍHO MUSEA V PRAZE

V GENERÁLNÍ KOMISI MATICE ČESKÉ, PRAHA II - 1700, VÁCLAVSKÉ NÁM.

FRANTIŠEK FIALA:

Alkalické čediče (basanitoidy) od Tekovské Breznice a Brehů u Nové Baně na Slovensku.

(List spec. mapy č. 4661 Nová Baňa.)

Щелочные базальты (базанитоиды) из Тековской Брезницы и Брегов у гор. Нова Баня в Словакии

Лист специальной карты № 4661 — Нова Баня.

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Úložné poměry.

Novobanská kotlina při řece Hronu v jihových. okolí Nové Baně na Slovensku mezi vesnicemi Brehy a Tekovskou Breznicí, omezená částečně, zejména ve své východní polovině, zlomovými liniemi, patří spolu s oběma většími pánvemi svätokrížskou a zvolenskou k systému průtočných pánví hronských (sr. FIALA 1933, s. 122). Koncem třetihor, nejspíše v levantinu, v období závěrečné sopečné fáse karpatské, byla novobanská pánev jevištěm intensivního čedičového vulkanismu. Jeho středem byl sopečný kužel P ú t i k o v a v r š k u, c. 485, zvedající se ve vzdálenosti ca 2 km jihových. od Tekovské Breznice na svahu staršího andesitového pohoří nad průsečíkem dvou zlomových linií, jedné směru h 1, druhé směru s-j. Jak jsem uvedl v cit. práci (FIALA 1933, s. 121) představuje Pútikov vršek se svým okolím jednu z morfologicky nejkrásněji zachovaných třetihorních menších slovenských sopek.

Vlastní plochá vrcholová kupa Pútikova vršku je tvořena nahromaděním sopečných strusek a pum, většinou do červena silně oxydovaných. Je značně zahlíněna, po původním kráteru není na zarovnané vrcholové plošině už stopy. — Směrem k severozápadu ke vsi Brehům vycházejí

od úpatí Pútikova vršku 3 čedičové proudy, po případě skupiny menších dílčích proudů, z nichž spodní, největší a nejdelší, při svém konci mezi Tekovskou Breznicou a Brehy v šířce 3 km vějířovitě rozšířený, sahá až k řece Hronu. Úklon jeho vrcholové plošiny (Babin vršek j. Brehů), na povrchu zarovnané v terasové niveau 40 m nad Hronem, je velmi plochý, upadá 4° k sz. Východní omezení dolní části tohoto proudu představuje dolní tok Liesne doliny jz. Brehů. Za tuto dolinu přesahuje čedič jen na dvou místech: jednak při jejím vyústění do hronského údolí bezprostředně u Brehů, kde ve vých. svahu údolí byla v 20-tých a 30-tých letech otevřena řada menších lomů, jednak ca 2 km jihových. odtud v místech prudkého a náhlého ohybu Liesne doliny k severu. V obou případech opírají se tyto oddělené části spodního proudu o strmé svahy andesitového, ve vyšších úrovních rhyolitového svahu, o nějž se lávový čedičový proud s Pútikova vršku stékající, zde zarazil. — Druhý proud čedičový, jehož čelo je od Hronu vzdáleno ca ¾ km, 2 km dlouhý a při konci ca 1,4 km široký, se zvedá nad plošinu spodního proudu zřetelným stupněm. Úklon plošiny 2. proudu je 7°, místy i víc, mocnost láv je místy, zejména v údolíčku sz. Pútikova vršku velmi značná, přesahujíc i 50 m.

Před c. 305 v sv. okolí Tekovské Breznice se druhý proud dělí ve dva proudy, obtékající a částečně až přetékající zmíněné návrší c. 305, tvořené staršími andesity, andesitovými tufity a ve vrcholové části rhyolity. Na jižním svahu uvedeného návrší na sev. svahu Chválené doliny vjv. Tekovské Breznice je odkryt krásný profil, ukazující, že zdánlivě jednotný 2. proud se ve skutečnosti skládá z řady, t. j. minimálně ze 4 menších, tu 0,2 až 1,5 m mocných čedičových proudů, oddělených od sebe polohami *škvár a bomb*. V podloží čedičové stratovulkanické serie je vrstva jemnozrnného žlutavého *tufu* 0,2 m mocná a pod ní *slídnatý písek* a níže *pyroxenicko-amfibolický andesit s biotitem*.

Třetí proud, bezprostředně vycházející ze sz. úpatí vrcholové kupy Pútikova vršku, morfologicky dobře patrný nad plošinou 2. proudu, je ca 300 m dlouhý a 70 m široký; jeho úklon je ca 15° k sz.

Na jv. úpatí Pútikova vršku ve Chválené dolině nad potokem při sz. okraji t. zv. Chvalenských luk vystupují skalky doleritických čedičů (basanitoidů), představujících proniky čedičového magmatu v boku levantinské sopky. Basanitoidy jsou tu prostoupeny žilami šedozeleného nefelinického tefritu, charakterisovaného hojnými drobnými černými jehličkami *pigeonitu*.

Jihozáp. u Brehů na vých. boku Liesne doliny byla, jak výše vzpomenuto, v 20—30-tých letech řada menších lomů s drtičem, později zrušeným. Při stavbě drtiče byl v podloží čediče a též v korytu potoka zastižen vlhký, světle šedý plastický jíl neogenního, blíže neznámého stáří. Výchozy jsou zasuty a nepřístupny. Lomy v Liesne dolině jsou dnes opuštěny vzhledem k velké skrývce a malé zásobě kamene. V r. 1951 byl otevřen nový větší lom ve strmém severním svahu Babina vršku záp. od údolí Liesne doliny ca 200 m záp. Brehů. Další opuštěné lůmky jsou dále k sz. nad Hronem při silničce do Tekovské Breznice.

Sousedními horninami čedičů, jež tvořily současně úbočí a svahy novobanské pánve v době předlevantinské, jsou pyroxenické an-

desity, místy slabě propylitisované, pyroxenicko-amfibolické andesity, tu a tam s biotitem, rovněž dost často propyliticky přeměněné, tufy a tufity pyroxenicko-amfibolických andesitů, pyroxen-amfibol-biotitické trachyty, silně hydrothermálně přeměněné a místy velmi silně kaolinisované, a konečně rhyolity. Rhyolity tvoří především mohutný massiv hřebene c. 403 a 436 již. Brehů, s-j. směru, extrusivní povahy. V severním pokračování tohoto hřbetu za Hronem ve vých. okolí Nové Baně se táhne mohutná rhyolitová extruse hřbetu Himmelreichu. Ve spodní části rhyolitové massy hřebene c. 403 a 436 již. Brehů mezi niveau 300 a 360 m n. m. vystupuje typická a velmi dekorativní eruptivní rhyolitová brekcie pestré barvy, obsahující ostrohranné, jindy i zaoblené úlomky rhyolitů, trachytů a andesitů v drceném rhyolitovém, jindy limoniticko-křemitém tmelu. Na sev. svahu c. 403 obsahuje brekcie ve spodních polohách též dokonale oválené valouny andesitové, stržené z proražených andesitových tufitů.

Petrografie.

Čedičové horniny.

Čediče Pútikova vršku a tří proudů z něho vycházejících jsou vesměs tmavošedé až šedočerné, značně kompaktní horniny, většinou bez zřetelných makroskopických vrostlic; jen místy lze pozorovat drobné oliviny. Dosti časté je bobové navětrávání. Při povrchu a při podloží jednotlivých proudů se objevují typické porésní až struskovité formy. Petrograficky odpovídají převážně basanitoidům (nefelinitoidním basanitům), (sr. H. Rosenbusch 1908 s. 1395, H. Rosenbusch-O. Müggе I. 1927, s. 254, H. Rosenbusch-A. Osann 1923, s. 472 a 479, F. Fiala 1938, s. 40 a j.), t. j. alkalickým čedičovým horninám, v nichž individualisovaný nefelin je zastoupen hojnou isotropní nebo nízce dvojlomnou nefelinitoidní mesostasí, provázenou nezřídka phillipsitem. Některé partie proudu I. a II. obsahují též něco individualisovaného *nefelinu* a představují pak nefelinické basanity v užším slova smyslu. Z nich pochází i vzorek analysovaného basanitu z lomů jz. Brehů z Liesne doliny. — Prášek basanitoidů i nefelinických basanitů silně želatinuje s HCl a po odpaření krystaluje množství krychliček NaCl. Poměrně chudý nefelinitoidní mesostasí je čedič III. proudu, blížící se už normálnímu čediči.

Třebas makroskopicky pozorujeme v studovaných horninách jen zřídka drobné vrostlice *olivinu* a ještě vzácněji vrostlice *augitu*, jeví se při mikroskopickém studiu všechny basanitoidy i basanity typicky porfyrické. Obsahují vrostlice *olivinu* (větš. opt. + Mg-olivinu s velkým úhlem os optických, blížícím se 90°, řidčeji opt. negativního, s dispersí $\varrho > \upsilon$), čerstvého, ale často silně a velmi hluboce magmaticky korodovaného. Méně hojné jsou vrostlice *mkl. pyroxenu*, patřící většinou *pigeonitickému augitu*, jindy skoro jednoosému *pigeonitu*, (sr. H. Kuno 1950, s. 972 a d.), dost často i obecnému *augitu*. Často mívají pyroxeny přesýpátkovou strukturu, červeně zabarvený okraj je obohacen Ti. Hojně uzavírají drobné krystalky magnetitu,

kromě toho se místy objevuje *magnetit* i ve větších × ×, patřících generaci vrostlic. *Základní hmota* velmi jemnozrnná, drobně intersertální struktury, se skládá z lištiček *labrador-bytownitu* (sym. zhášení 32°), drobných sloupečků *mkl. pyroxenu* (typů jak výše uvedeny), hojných drobných krystalků *magnetitu*, ojediněle též *ilmenitu*. Velmi podřízeně se vyskytují drobná stébla *apatitu*, zarůstající v ostatních součástkách, místy též něco *biotitu*. Hojná je mezerní *nefelinitoidní mesostase*, čirá, nepatrně níže lomná proti kanadskému balsámu, isotropní nebo slabě dvojlomná, místy s vyvinutým *phillipsitem*. Jen ojediněle lze dokázat individualisovaný *nefelin*, hlavně ve vzorcích z lomů v Liesne dolině jz. Brehů, od studánky sev. Tekovské Breznice, ze spodních dvou dílčích proudů v profilu na již. svahu c. 304 vých. Tekovské Breznice, z údolíčka ssz. c. 485 a j. — V basanitoidu z plošiny sev. II. proudu sz. c. 485 byly dokázány i droboučké krystalky *hnědého amfibolu*.

Doleritické basanitoidy z jihových. úpatí Pútikova vršku ve Chválené dolině při sz. konci t. zv. Chvalenských luk, jsou značně zrnitější. Jejich struktura je doleritická, někdy až ofitická, připomínající diabasovou. Charakteristickým nerostem je tu *Ti-magnetit* a především *ilmenit*, tvořící velké tabulkovité kostrovité × ×. Vzácně se vyskytuje i *nefelin*. *Oliviny* jsou velmi silně nataveny. Pyroxen je bledě narůžověle zelenavý *pigeonitický augit*, obrůstaný na okraji růžovým lemem skoro jednoosého *pigeonitu*. *Základní hmota* zrnitě intersertální se skládá z lištiček *labradobytownitu*, něco málo *pigeonitu* a *nefelinitoidní* skoro isotropní *mesostase* s drobnými × × *magnetitu* a hojnými jehličkami čirého *apatitu*.

Nefelinický tefrit z jihových. úpatí Pútikova vršku tvoří žíly a proniky v právě popsaném doleritickém basanitoidu. Je to šedozelená jemnozrnná hornina s hojnými nápadnými černými jehličkami *pigeonitovými*. P. m. je struktura zrnitě intersertální, místy až ofitická. Olivin chybí, porfyričnost až na ojedinělé stéblovité vyrostlice klinoenstatitu není patrná. Hlavní součástkou je tlustě tabulovitý *basický labrador* (sym. zhášení 31°), slabě zonární, s andesinovými okraji, a dále zřetelně pleochroický červený *pigeonit* (α okrově žlutavý, β červenavě žlutavý, $\gamma = \beta$ až fialově červený. Na konci, místy i na okraji nasedá naň místy šedozelený *egirinaugit*. Nápadná jsou štíhlá dlouhá stébla *klinoenstatitu*, posit. délky, dvojlomu o něco vyššího proti pigeonitu, zhášení $c\gamma$ 9°. Hojný je *apatit* v štíhlých tenkých jehlicích, zarůstajících v ostatních součástkách, dále velké, poněkud kostrovité krystalky *magnetitu* a velké tabulkovité, typicky kostrovitě vyvinuté krystalky *ilmenitu*, podobné jako se hojně vyskytují v diabasech (sr. FIALA 1949, tab. 8). Intersertální *základní hmota*, tvořící ostrůvky mezi zrnitými partiemi, se skládá z *andesinu*, *egirinu*, *pigeonitu*, *nefelinu*, *apatitu*, něco *magnetitu*, *biotitu* a hojné *nefelinitoidní mesostase*, často provázené *phillipsitem*. Poměr vyrostlic k základní hmotě 3 : 1.

Chemická analysa nefelinického basanitu

ze starého lomu při vyústění Liesne doliny jz. Brehů byla lask. provedena v r. 1937 přítelem drem V. AMBROŽEM.

	Váhová % analysy	Molekulární
SiO_2	44,22	46,72
TiO_2	2,62	2,08
Al_2O_3	12,02	7,49
Cr_2O_3	0,05	9,92
Fe_2O_3	4,05	
FeO	7,54	
MnO	0,23	0,21
MgO	10,74	16,97
CaO	10,23	11,62
Na_2O	3,43	3,52
K_2O	1,69	1,14
P_2O_5	0,72	0,33
H_2O+	2,35	
H_2O-	0,09	
	99,98	100,00

Rozpočet podle OSANNA

A	4,66	a	3,2	n	7,6
C	2,83	c	2,0	k	0,70
F	35,89	f	24,8	s	48,80

Rozpočet podle NIGGLIHO

si	92	si'	134,4
al	14,8	qz	— 44,4
fm	53,3	c/fm	= 0,43
c	22,8	řez	III./IV.
alk	9,1		
k	,25		
mg	,62		

Podle rozpočtu analysy patří nefelinický basanit od Brehů typu theralitgabbroidních magmat NIGGLIHO. Velmi blízký je mu limburgitoidní basanit Kalvarie u B. Štiavnice (sr. F. FIALA 1938), lišící se poněkud vyšším al a nižším c a alk. Basanitoid od Podrečan u Lučence, i prostorově značně odlehlý, má už chemismus poněkud odlišný.

	si	al	fm	c	alk.	k	mg
Nefelinický basanit, Brehy	92	14,8	53,3	22,8	9,1	.25	.62
Limburgitoidní basanit, Kalvaria u Banské Štiavnice	90	17,5	56,5	19,0	7,0	.21	.69
Basanitoid, Podrečany	124	27,1	40,6	16,4	15,9	.24	.50

Srovnání se zahraničními a specielně maďarskými vulkanity sr. v anglickém textu. Proti maďarským čedičům představují čediče od Brehů i od Kalvarie typy značně basičtější, s nižším si, mírně nižším al a značně vyšším fm.

Andesity, trachyty a rhyolity ze sousedství basanitoidů od Tekovské Breznice a Brehů.

Pyroxenicko-amfibolické andesity, někdy s akcesorickým *biotitem*. Jsou to tmavošedé nebo růžově šedé horniny, u Brehů silně vybělené, někdy slabě propyliticky přeměněné. Obsahují vrostlice zonárního *labradoru* (labradorbytownit až kyselý labrador), *hypersthenu, augitu*, hnědozeleného *amfibolu*, většinou silně opacitisovaného, místy *biotitu*. Hojné jsou sloupečky pleochroického *apatitu*, s výrazně

silnější absorpcí ve směru délky (kouřově šedý, zatím co ve směru kolmém je světle hnědavý). Podobný pleochroický apatit jsem častěji zjistil hlavně v amfibolických andesitech Slovenského Středohoří (F. FIALA—R. KETTNER 1931 s. 201), hojně je citovaný i jinde. Sr. na př. H. KUNO 1950 s. 983 a 1936 s. 116.

Základní hmota mezi pilotaxitickou a hyalopilitickou, někdy silně sklovitá, obsahuje andesin, někdy kyselý labrador, magnetit, apatit, sklovitou výplň, místy něco křemene.

Pyroxenické andesity jsou tmavošedé, afanitické, drobně porfyrické. Obsahují vrostlice *labradoru, hypersthenu, diopsidického augitu* a *magnetitu. Základní hmota* obsahuje lištičky andesinové, zrnečka magnetitu, něco pyroxenu a mezerního skla. Ve vzdálenějším okolí popisovaných čedičových výskytů v sousedství Nové Baně a Pukance vystupují místy pyroxenické andesity *propylitisované.*

Pyroxenicko-amfibolicko-biotitické trachyty jsou vyvinuty v již. okolí Brehů na sev. a vých. úpatí c. 403, na hřebenu vých. c. 436, pak na c. 444 sv. Pútikova vršku a v již. okolí Nové Baně. Jsou to světle růžové až bělošedé horniny, drobně porfyrické, plosklovité, silně kaolinisované. P. m. vrostlice *sanidinu* a silně chloritisované vrostlice *amfibolu* a *pyroxenu* a někdy zachovaného *biotitu.* Hojný je pleochroický *apatit,* místy se objevují $\times\times$ *magnetitu. Základní hmota* silně *sklovitá* nebo *mikrofelsitická* ze sanidinu, křemene, chloritu, biotitu, magnetitu a skla s hojnými trichity a krystality. Větší množství *křemene* obsahuje základní hmota trachytu c. 444, tvořícího přechod k dacitům a rhyolitům.

Rhyolity a rhyolitové brekcie. Rhyolity tvoří jednak hřbet c. 403 a 436 již. Brehů, jednak vrchol c. 305 sv. Tekovské Breznice. Jsou felsitické nebo felsosférolitické a obsahují vrostlice velmi silně magmaticky korodovaného *křemene* a méně hojné vrostlice *sanidinu* a *biotitu* v základní felsitické, většinou typicky fluidální *základní hmotě* s proužky sanidinu a křemene a s hojnými *sferolity.*

Rhyolit hřebene c. 405 a 436 vystoupil jako mohutná extruse podél velké trhliny s-j směru, pokračující k severu za Hronem ve hřbetu Himmelreichu vých. a sv. Nové Baně. Východní omezení rhyolitu c. 403 a 436 je tektonické podle dislokační linie směru h 1, pokračující k jihu směrem na Pútikov vršek. Druhá poruchová linie směru s-j probíhá blízko pod záp. hranicí rhyolitu hřebene c. 403 a 436 ve vých. svahu Liesne doliny, podmiňuje náhlou změnu směru tohoto údolí v jeho poslední části a pokračuje k jihu přes sedélko záp. c. 444 k Pútikovu vršku. Čedičová sopka Pútikov vršek vznikla na průsečíku obou těchto poruch. Severní pokračování druhé z uvedených poruch k severu za Hronem je ve vých. okolí Nové Baně v terénu morfologicky dobře patrné.

Ve spodních polohách rhyolitové extruse c. 403 a 436 již. Brehů mezi isophysami 300 a 360 m n. m. jsou vyvinuty rhyolitové eruptivní brekcie bělavé, růžové i zelenohnědé s hranatými, někdy i zaoblenými úlomky rhyolitů, trachytů a andesitů čerstvých i propylitisovaných, event. kaolinisovaných. Ve spodních partiích na sev. svahu c. 403 obsahuje i dobře zaoblené velké *valouny andesitové,* stržené rhyolitem

z proražených andesitových tufitů. Tmel brekcie, zmíněné už E. BEUDANTEM 1822 a F. v. ANDRIANEM 1866 je drobně brekciovitý, drcený, bělavý nebo červenavý rhyolit, místy též drcená výplň železitokřemitá.

Geologicko-paleontologické oddělení
Národního musea v Praze.

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Описываемые здесь базальтовые породы были обнаружены у вышеприводимых общин у гор. Нова Баня в средней Словакии. Они относятся к заключительной фазе неогенового карпатского вулканизма и по возрасту являются правдоподобно левантинскими. Центром их извержений была возвышенность Путиков вршек, пункт 485, располагающаяся приблизительно в 2 км. к юго-востоку от Тековской Брезницы на краю андезитовых гор. Он находится на пересечении двух древних сбросов, простирающихся в направлении ССВ и С-Ю. Из него излились к СЗ в новобаньскую котловину 3 базальтовых потока. Наибольшими размерами отличается самый нижний из них. Он достигает реки Грон, где он веерообразно расширяется между общ. Бреги и Тековская Брезница. В своих краевых частях он состоит из найболее основных разновидностей базальта, соответствующих нефелиновым басанитам. Второй язык к СВ от Тековской Брезницы распадается в два крыла, окружающих с двух сторон возвышенность 305, образованную андезитами, андезитовыми туффитами и риолитами. На южном склоне этой возвышенности, над так наз. Хваленой долиной, находится обнажение, где видно, что данный лавовый поток состоит из нескольких самостоятельных потоков базанитов, чередующихся со шлаковыми горизонтами. Они залегают на слюдистых песках и на пироксен-амфиболовых андезитах. Третий поток гораздо меньше по своим размерам и близок по составу к нормальному базальту. Темя возвышенности Путиков вршек образовано, прежде всего, шлаком и вулканическими бомбами, окрашенными б. ч. вследствие окисления в красный цвет. На подножьях её юго-восточного склона в Хваленой долине были установлены зернистые доллеритовые базанитоиды, прорезанные жилами нефелинового тефрита.

Базальты отличаются ясно выраженным щелочным характером, соответствуя, таким образом, в значительной своей части базанитоидам (т. е. нефелинитоидным базанитам). В некоторых частях, главным образом на СЗ-ом краю нижнего излияния у Брегов и в известных местах второго потока, они стоят ближе к нефелиновым базанитам. Они отличаются серым цветом, не содержат макроскопически заметных вкрапленников и являются большей частью совсем плотными. При поверхности первого и в основании второго потока появляются типичные шлаковидные формы. Вкрапленники сильно корродированного оливина и появляющегося гораздо реже пироксена (авгит, иногда пижонитовый авгит, местами настоящий пижонит) заключены в интерсертальном основном веществе, состоящем из лабрадорбитовнита, мнкл. пироксена, магнетита и титано-магнетита, изредка

ильменита, акцессорического апатита и отдельных листочков биотита. Промежуточная масса образована б. ч. нефелититоидной изотропной или слегка двупреломляющей мезостазией (базанитоиды), заключающей в некоторых частях небольшие количества индивидуализированного нефелина (базаниты). Довольно часто появляется в ней и филлипсит. Доллеритовые базанитоиды с ЮВ-ой подошвы возвышенности Путиков вршек содержат большое количество ильменитов и пижонитов. По расчету химического анализа базанит из Брегов следует отнести к тералит-габброидной магме.

Нефелиновые тефриты из Хваленой долины не содержат оливина, не заключают большое количество лилово-красных пижонитов, а изредка и стеблевидные безцветные клиноэнстатиты, основ. лабрадоры, изобильный титано-магнетит и скелетные кристаллы ильменита, кроме того большое количество апатита, а в основном веществе андезин, эгирин, пижонит, нефелин, апатит, магнетит, биотит, филлипсит и обильную нефелинитоидную мезостазию.

Древние породы в соседстве базальта относятся к числу пироксеновых и пироксен-амфиболовых андезитов, андезитовых туфов и туффитов, риолитовых брекчий и фельзосферолитовых риолитов.

Геологическо-палеонтологическое отделение Национального музея в Праге.

Перевод Ю. В. Шуфа.

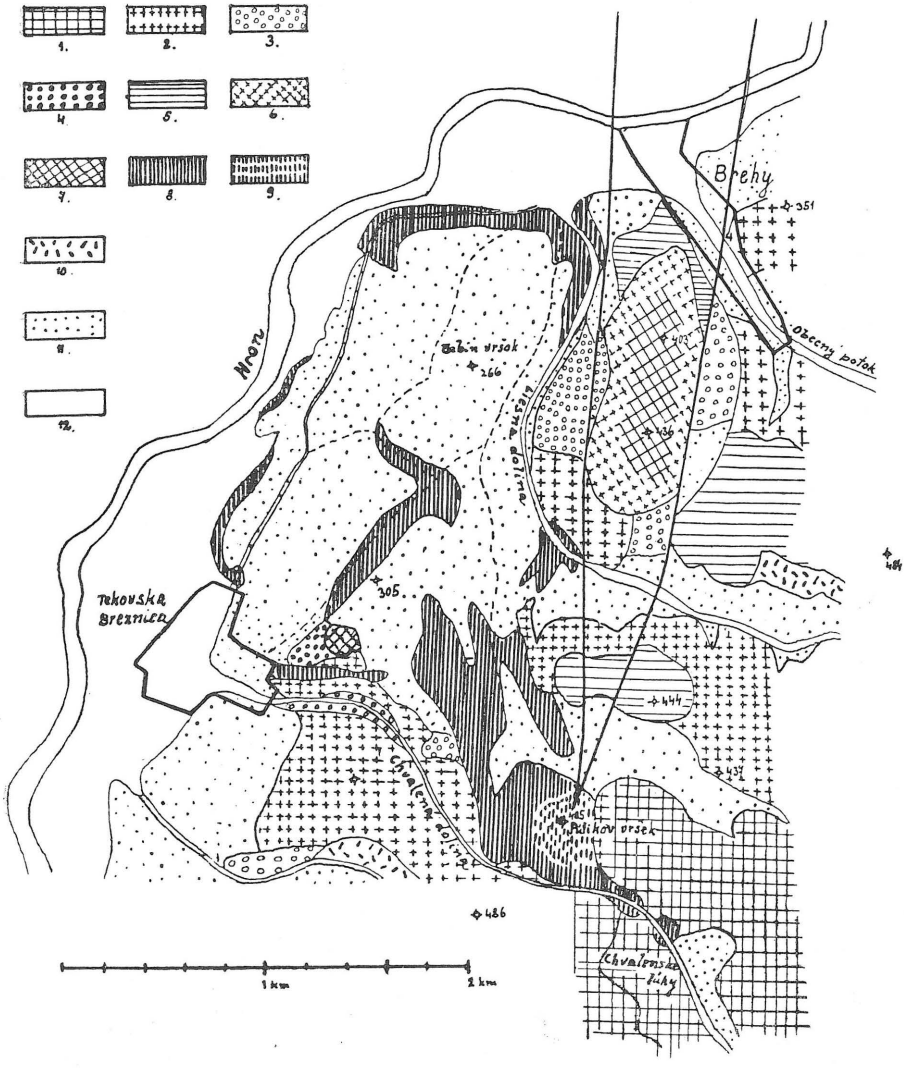
Alkali Basalts (Basanitoids) from Tekovská Breznica and Brehy near Nová Baňa in Slovakia

(Sheet of the Topographic Map 4661 — Nová Baňa)

A b s t r a c t: The masalts from Tekovská Breznica and Brehy in Slovakia, described in this paper, belong to the final phase of the Neogene vulcanism of the Carpathians. They are most likely of Levantine age. The centre of the eruptions was the height Pútikov Vršek southeast of Tekovská Breznica, formed of cinders in its summit part. At least three morpohologically very distinct lava streams flow in a northwesterly direction into the basin of Nová Baňa. Some of these streams are more complex and formed by a number of lesser streams flowing over each other. The basalts have a distinctly alkaline character; they correspond to basanitoids, in some cases even to nepheline basanites. Veins of nepheline tephrite were also ascertained at the SE foot of the Pútikov Vršek. The neighbouring mountains are formed by older andesites, andesitic tuffs and tuffites, trachytes, rhyolitic breccias and rhyolites.

I. INTRODUCTION AND LITERATURE

The present paper deals with a really restricted, but geologically important and with regard to type interesting occurrence of relatively young alkali basalts in the vicinity of the villages of Tekovská Breznica and Brehy in Central Slovakia, in the region of the volcanic mountains of the Slovenské Středohoří. The village of Tekovská Breznica lies about

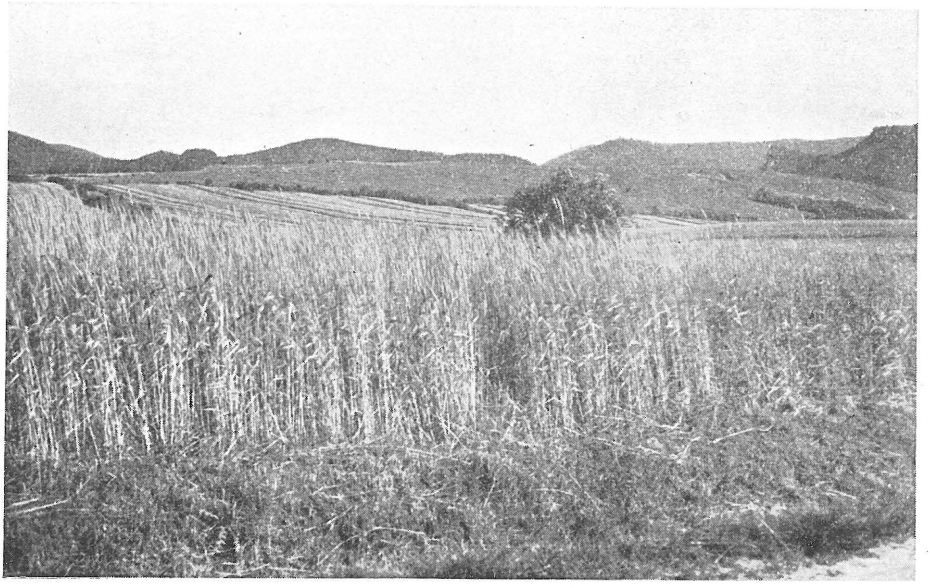


František Fiala: **Geologická mapa jihových. okolí Tekovské Breznice a Brehů na Slovensku.**

Vysvětlivky: 1. Pyroxenický andesit. — 2. Pyroxenicko-amfibolický andesit. — 3. Andesitové tufy. — 4. Andesitové slepencové tufity. — 5. Trachyt. — 6. Rhyolitová eruptivní brekcie. — 7. Rhyolit. — 8. Čediče. — 9. Čedičové strusky. — 10. Kamenitá ssuť. — 11. Hlíny ssuťové. — 12. Alluvium.

František Fiala: **Geological Map of the SE Vicinity of Tekovská Breznica and Brehy, in Slovakia.**

Explanations: 1. Pyroxene andesite. — 2. Pyroxene-amphibole-andesite. — 3. Andesite tuffs. — 4. Andesite conglomerate tuffites. — 5. Trachyte. — 6. Eruptive rhyolite breccia. — 7. Rhyolite. — 8. Basaltic rocks. — 9. Basalt cinders. — 10. Stony waste. — 11. Slope loams. — 12. Alluvium.



Obr. 1. Pohled s plošiny 1. čedičového proudu (Babin vršek) mezi Tekovskou Breznicí a Brehy k jihovýchodu na stupeň II. čedičového proudu. V pozadí Pútikov vršek.

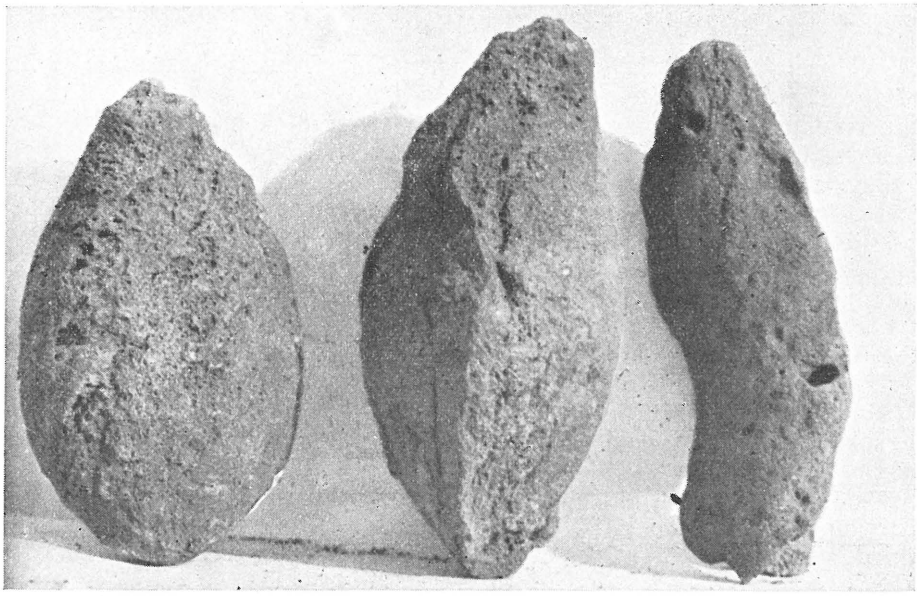
Fig. 1: View from the platform of the I. basalt flow (Babin Vršek) between Tekovská Breznica and Brehy to the SE to the step of the II. basalt flow. In the background the hill Pútikov Vršek.

4 km. SSW, that of Brehy about 2 km. SSE of Nová Baňa; both villages are on the left bank of the river Hron.

In the part between these two villages the valley of the Hron widens considerably, especially in its higher levels. In my report of 1933 (FIALA, p. 122) I placed this "Basin of Nová Baňa" together with the two other, larger basins of Zvolen and Svätý Kríž to the system of the river basins of the Hron formed in and after the Tortonian by the damming of the old pre-Tortonian terrain by volcanic, chiefly andesitic flows. Gradually the Hron had to force its way through these lava dams.

Towards the end of the Tertiary, probably in the Lower Levantian, several flows of alkali basalt lavas erupted in this basin, of which each younger one was smaller than the preceding one; they flowed from one eruption centre, the Pútikov Vršek, P. 485, about 2 km SE of Tekovská Breznica. On the map 1 : 25.000 the name of Pútikov Vršek is given to a hill farther north, composed of trachyte and andesite. The Pútikov vršek is one of the morphologically best preserved ancient volcanoes of Slovakia, as indeed I pointed out already in my paper mentioned above (FIALA 1933, p. 121).

It is not possible to date with certainty the time of the eruption of these alkali-basalts in the basin of Nová Baňa according to the geological finds. From the morphology we can only infer a relatively young age. The petrological analogy and the similar geological occurrence



Obr. 2. Bomby čedičové z již. svahu Pútikova vršku. — Ze sbírek Štátneho banského muzea Dion. Štúra v Banské Štiavnici. Ca $^2/_5$ skut. vel.

Fig. 2: Basalt bombs from the southern slope of the Pútikov Vršek. — From the collections of the State Mining Museum Dion. Štúr, at Banská Štiavnica. About $^2/_5$ nat. size.

connect, however, these basalts with the other eruptions of basaltic magmata of a slightly atlantic, more or less distinctly alkali character, which erupted in the Pannonian Basin and in the adjoining mountains (abundantly also in Styria) in the Pliocene, and which represent the last, final phase of the Neogene volcanism of the Carpathians. Their age is usually given as Upper Pontian (A. WINKLER, 1925, 1927; I. VITÁLIS 1904), or as post-Pontian (H. BÖCKH 1901) to Levantian (I. FERENCZI 1924, L. JUGOVICS 1916, A. HOFFER 1925, etc.). They have almost all a distinct alkali character, as determined systematically also by F. de QUERVAIN (1927, pp. 21—22) and B. MAURITZ. Cp. also FIALA's papers of 1938 on the basalt of the Kalvaria at Banská Štiavnice and on the basanitoid near Podrečany.

The basalts of Brehy and Tekovská Breznica have been mentioned several times. JOS. JONAS in "Ungarns Mineralreich" of 1820 (p. 328) reports from this region basalt from Brehy and Sv. Beňadik. The second of the two occurrences as well as a number of other "basalts" given by JONAS belongs to the andesites. — E. BEUDANT, 1822, gives specially detailed data and observations; he describes tuffs and tuffitic conglomerates (partly FIALA's rhyolitic breccia) underlying the basalt (Tome I, p. 243) as well as the different types of basalts (Tome III, pp. 610 and 615) and the volcanic bombs (T. III, p. 615). — FERD. V. ANDRIAN, 1866, describes the types of trachytic eruptions (p. 387) and treats in detail of the rhyolitic breccia at Brehy (p. 401), and briefly characterises the basalt plateau at Brehy (p. 415).

II. GEOLOGICAL AND MORPHOLOGICAL OBSERVATIONS

Three major valleys open from the SE, from the Pukanec group of the Banská Štiavnica Mts., into the basin which is situated east of the river Hron SE of Nová Baňa, between the villages of Brehy and Tekovská Breznica, or in their immediate vicinity. The northernmost valley is the Obecný Potok, of a NW direction, traversing the andesite and partly also trachyte area and the village of Brehy. About 1.4 km. south of it runs the Liesna Dolina, parallel with the preceeding valley, only with its final part, about 2 km long, sharply turning to the north; it follows here — apparently along an important fault line — the western side of the rhyolite body of the ridge P. 403 and P. 436. A small valley formed in its lower and highest parts by basalt, in the middle part by andesite opens at the bend into the Liesna Dolina from the SSE, i. e. in the direction from the Pútikov Vršek. In its upper part this small valley dissects the thick lava sheet of the 2. basalt flow. The lower part of the Liesna Dolina forms roughly the eastern limit of the basalt flows against the andesites and rhyolites; it is only in two places that the basalt extends to its eastern flank. The third, southernmost valley parallel to the two preceeding ones, i. e. with a NW direction, is the Chválená Dolina falling into the valley of the Hron at Tekovská Breznica. There are no further basalts south of the Chválená Dolina.

Basaltic rocks.

The eruptive centre of the Pliocene basalt eruptions was — as said in the introduction — the height "Pútikov Vršek", P. 485, rising above the northern slope of the Chválená Dolina about 2 km. SE of Tekovská Breznica at the southern margin of Sheet 4661/1 of the map at the scale of 1 : 25.000. It slopes very steeply to the south and southwest to the Chválená Dolina, more gradually to the NW, from where it appears as a flat, wooded dome with a levelled summit, rising above the platforms of the lava flows, which slope down slowly to the NW in the direction towards Brehy. On the summit of the Pútikov Vršek is a levelled platform, today without trace of a crater. The upper part of the elevation is composed predominantly of cinders and bombs, which alternate only here and there — as may be inferred from occasional preserved blocks of scoriaceous basalt — with minor basalt flows. The cinders are scoriaceous; on the summit platform they are mostly oxidized red, in the saddle east of the elevation they are fresher, black. It is not possible to distinguish any more accurately in the wooded terrain between cinders and lavas. Scoriaceous volcanic domes rising above the platforms of the basalt flows are a common phenomenon in the Pannonian Basin, as reported e. g. by K. HOFFMANN, 1879, for the basalts of the Bakony Forest.

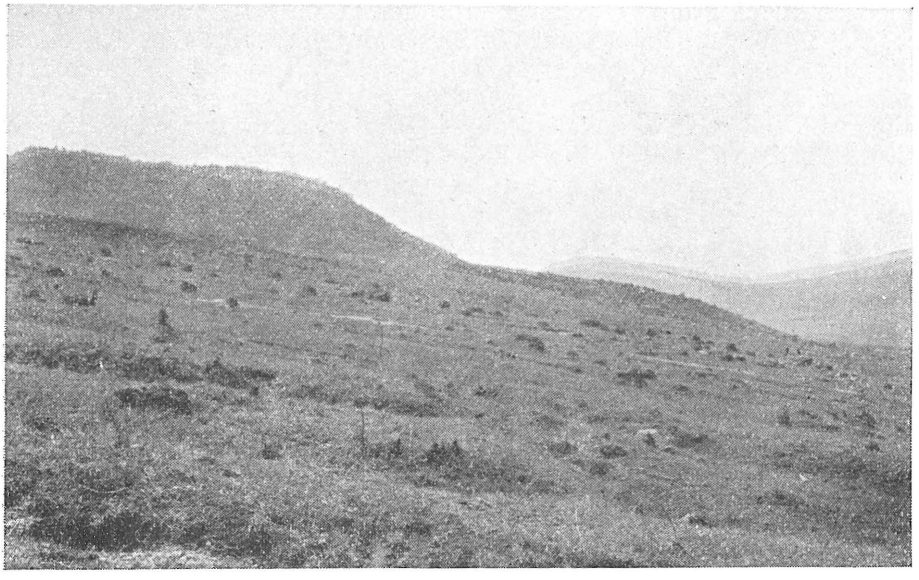
The volcano Pútikov Vršek is a typical unilateral volcano. Its cone sits on the steep slopes of older andesite mountains apparently above the intersection of two fault fissures. One

of them, striking in h 1, delimits in its forther NNE course the rhyolite body of P. 403 and P. 436 south of Brehy on the eastern side. The other, striking N-S, runs at the western side of the rhyolite mass in the eastern slope of the Liesna Dolina, and farther to the north beyond the Hron it can be followed morphologically in the terrain far to the eastern vicinity of Nová Baňa in the valley west of the ridge Himmelreich.

Flows of alkali basalts or basanitoids streamed from the Pútikov Vršek to the NNW in the direction towards Brehy. The lower, oldest flow characterized by the platform of the Babin Vršek, P. 266 (terrace level of 40 m. above the Hron), sloping very gently under an angle of about 4° to the NW, reached farthest and in its lowest part spread out in fan-shape between Brehy and Tekovská Breznica to a width of nearly 3 km. It reaches as far as to the present alluvial flood plain of the Hron forming a steep rocky slope towards this in the western vicinity of Brehy, on an average 30 m high. In the northern vicinity of Tekovská Breznica this lower flow was strongly denuded and covered with loam. About ¾ km. north of Tekovská Breznica some springs rise from below it.

The NE and E limit of this lower flow is formed roughly by the Liesna Dolina, which is crossed by the basalt only in two places. The first of these places is at Brehy, where the basalt was opened up in the past decades in several quarries in the eastern slope of the Liesna Dolina; these quarries are not worked any longer. Near the first quarry at the former crushingmill (see fig. 5) there was found at the foot of the slope as well as in the stream a moist, light gray, plastic Neogene clay of an age not more accurately known. Already in the thirties this occurrence was buried and inaccessible. The second occurrence of basanitoid lies about 2 km farther south in an upstream direction, opposite the mouth of the small valley NNW from the Pútikov Vršek, at the rim of the andesite slope. Both these occurrences on the eastern side of the Liesna Dolina represent most probably the eastern margin of the basalt flow of the Babin Vršek, which stopped at the steep fault margins of the basin of Nová Baňa, formed by older andesites and rhyolites; for the second of the two cited occurrences the possibility of an independent rise of the magma along the above-mentioned great N-S fault cannot be excluded. Nor can it be excluded that the lowest part of the basalts at Brehy, characterized by a very fine texture and strongly alkaline, corresponding to nepheline basanite, may to a certain extent represent — compared with the upper part of this flow complex — an independent partial flow. On the platform of the Babin Vršek SW of Brehy, strongly loamy, we find here and there typical outcrops of scoriaceous basalts corresponding to the highest layers of this flow or group of flows. The maximum length of the flow is 3.5 km.

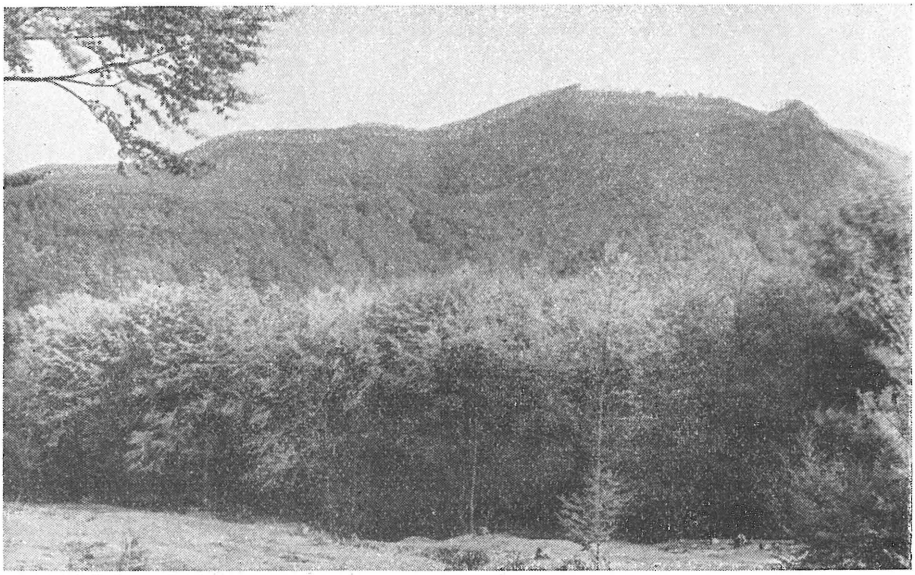
At a distance of ¾ km. east of the Hron in the eastern and NE vicinity of Tekovská Brezninca, a second flow is distinctly outlined morphologically above the platform of the lower basanitoid flow. This upper flow is 2 km long (measured from the Pútikov Vršek) and at its end 1.4 km wide. It does not form a connected sheet as the first flow



Obr. 3. Pútikov vršek a III. proud čedičový na jeho sz. svahu.
Fig. 3: Pútikov Vršek and III. basalt flow on its NW slope.

does, but divides before the dominating height P. 305 NE of Tekovská Breznica. This height composed of pyroxene-amphibole andesite, tuffitic andesite conglomerates and rhyolite was surrounded by the basanitoid flows. The second basalt flow has a stronger dip (7° and sometimes more) and here and there a considerable thickness, especially in the ravine NNW of the Pútikov Vršek, where it attains 50 m. Here platy, considerably massive, here and there weathered basanitoids are exposed; they can be followed upwards to the upper margin of the platform under the Pútikov Vršek, where they are covered by thick layers of loess loam. At the base and at the surface of flow II we find abundant black porous to typically scoriaceous basalts with dense, elongated cavities measuring up to 1 × 2 cm.

On the southern slope of P. 305, NE of Tekovská Breznice an interesting section is exposed in the northern slope of the Chválená Dolina; it shows that part of the basalt lavas corresponding to flow II described above flowed round the height P. 305 formed of andesite, andesitic tuffites and rhyolite, at its southern side in the direction towards Tekovská Breznica. This did not take place in one phase, but in a whole series of thin and strongly scoriaceous lava flows indicating the fluidity and considerable mobility of the lavas proved also by the whole morphology of flows I and II described above. In the northern slope of the Chválená Dolina there occur under the basanitoids grayish red, strongly weathered, pyroxene-amphibole *andesites* with biotite, piercing andesite tuffs. Above them, in one nowadays already rather decayed outcrop, *micaceous*



Obr. 4. Pútikov vršek (v pozadí) od východu.
Fig. 4: Pútikov Vršek (in the background) from the east.

sands occur and higher up a repeated *alternation of basalt scoria and cinders* with layers of porous basanitoid lavas. The thickness varies in different places. The profile recorded is:

14. IV. basalt (basanitoid), greenish black, partically disintegrated, 1.5 m.
13. cindery tuff 0.5 m.
12. cinders and pumice 0.5 m.
11. III. basalt (basanitoid), gray, finely porous, 0.5 m.
10. cinders and pumice, under them scoriaceous tuff, total 1.50 m.
9. II. basalt (basanitoid), gray, here and there disintegrated, cindery at the base and surface, more compact in the middle, 1.0 m.
8. basalt scoria and bombs, 0,25 cm.
7. I. basalt (basanitoid), porous, pinching out at the sides, 0.2 m.
6. basalt scoria and pumice with baked-in loam, 0.5 m.
5. basalt tuff, fine-grained, yellowish, 0.20 m.
4. micaceous sand, reddish, yellowish, 0.10 m.
3. micaceous sand, dark gray, 0.50 m.
2. micaceous sand, gray, 4—5 m.
1. pyroxene-amphibole andesite with biotite, reddish, strongly altered, with traces of secondary jasper, 15 m.

In the highest part of the slope above the basalt flows rises the summit P. 305 formed of rhyolitic breccias and rhyolites overlying the andesite tuffites and surrounded by the basalt flows described above.

The third basalt flow, inclined about 15° to the NW represents a narrow (70 m.) and only about 300 m. long ridge (fig. 3) starting from the lower part of the Pútikov Vršek above the upper rim of the Chválená Dolina and running along the surface of the flow II to the NW. Its relatively steep slopes indicate that at the time of the effusion it filled a through in accumulations of cinders and bombs since denuded. Of all the flows of the Pútikov Vršek the rock of this III. flow approaches most the type of the normal basalts.

Above the upper limit of the III flows rises the flat, wooded summit dome of the Pútikov Vršek (P. 485) levelled at the summit to a platform. It is mostly formed by cinders, bombs and lapilli, black in the saddle east of P. 485, oxidized to red on the summit of the height. The same cinders and bombs occur abundantly in the steep southern slope of the Pútikov Vršek in the northern slope of the Chválená Dolina. As far as it is possible to follow it in the wooded and loam-covered terrain there occur in them here and there thinner flows and intercalations of porous basanitoids. The bombs are here and there typically tear-shaped (fig. 2). The most beautiful specimens of them are in the State Mining Museum of Dionýz Štúr at Banská Štiavnica.

At the southern and south-eastern foot of the Pútikov Vršek in the Chválená Dolina, at the NW margin of the Chvalenské Meadows (northern margin of section 4661/3 of the map at the scale of 1 : 25.000) there are abundant outcrops of basanitoid rocks. In some portions the basanitoids are rather granular, doleritic, and their microscopic texture is even reminiscent of a doleritic diabase texture. This seems to be a cut lateral feeding channel. These doleritic basanitoids are penetrated by younger narrow veins of nepheline tephrites, fine-grained, greenish gray, characterized by the presence of black, sharply defined pigeonite needles.

In the village of Brehy the basalts have been quarried already for a fairly long time. The first quarries were established in the twenties in an occurrence of basalt (here nepheline basanite) in the northern slope of the Liesna Dolina at its junction with the Hron valley SW af Brehy. The quarries are today abandoned.

In the first quarry (formerly with the crushing-mill, fig. 5) 5 × 20 m., we find bedded, rather fresh, aphanitic, gray basanite, with the beds below 10 cm. above 30—50 cm. thick. Above this there are several beds of a disintegrated basalt, then a bed about 1 m. thick with indications of columnar jointing, above it again a disintegrated basalt. In the eastern part of the quarry there is typically columnar basanite. The more or less vertical columns, here and there irregularly bent, have a pentagonal or hexagonal cross section and a diameter of 50—80 cm. They are traversed by transverse fissures inclined under 8° h 4, running parallel with the surface of the flow, and by fissures inclined under 24° h 13. — Another (2.) quarry lying about 20 m. farther to the SE measures 5 × 17 m. In the lower part the basanite has here a characteristic columnar jointing extending to a height of 1 m.; higher up the rock is platy, above partially disintegrated. — A further (3.) quarry, 180 m. SE of the first quarry measures 6 × 40 m. The upper surface

of the basanite is here at about the same height as in the preceding quarries nearer the valley of the Hron. But the overburden of the basalt is here much thicker. This proves that the rock did not rise here in situ, but that it is the end of the main flow of the Babin Vršek (I. basalt flow) separated from this on the slope of the steeper older rhyolite and andesite heights by the erosion of the stream of the Liesna Dolina.

In the 30'ies the quarry was abandoned and the cable railway from it to the station of Nová Baňa was dismantled, because it was found that the thick overburden steadily increased in thickness the farther one got into the slope. At the same time it was improbable that the basanite continued into the depth in view of the fact that it forms the end of a flow coming from the SE from Pútikov Vršek and Babin Vršek. Recently a new quarry, mainly for ceramic purposes, has been opened about 150 m. to the west in the northern slope of the Babin Vršek, i. e. already in the main body of the lower flow.

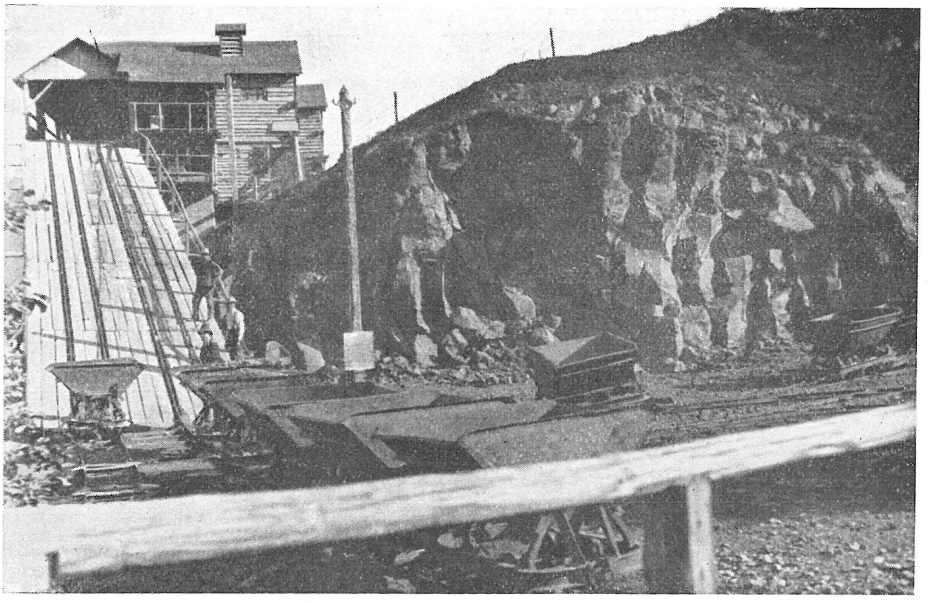
Farther to the west, where the slope of the Babin Vršek, here in E-W direction, approaches the Hron, some small basalt quarries were opened. In one of these the basanitoid has a platy jointing with a gentle dip of the beds to the north in the upper part of the quarry, and with almost horizontal beds in the lower part; the rock above is strongly disintegrated. In the quarries farther to the west the dip of the beds varies from 60° to the south to quite irregular (fig. 6), while here and there a non-typical columnar jointing is developed.

The basalt does not continue on the western side of the Hron in the direction towards Nová Baňa. The occurrence of a black rock on the southern slope of the Kalvarie at Nová Baňa recorded by F. v. ANDRIAN, 1866 (p. 415) belongs to propylitized pyroxene andesite of a considerably greater age (Tortonian).

Rocks Underlying the Basalts.

The borders of the basin of Nová Baňa at Brehy and Tekovská Brezninca are formed by pyroxene andesites and pyroxene-amphibole andesites with biotite, further by their tuffs and tuffites, biotite-amphibole-pyroxene trachytes, propylitized and partly strongly kaolinized rhyolite breccia and rhyolites. All these rocks, enumerated here in their succesion in time from the older to the younger members, are older than the basalts.

The principal rock consists here as in the whole Slovenské Středohoří of andesites, which form the greater part of the slopes in the eastern vicinity of the basin. Part of them belongs to the pyroxene andesites, here and there slightly propylitized. These occur together with tuffs in the southern slope of the Kalvaria at Nová Baňa above the western bank of the Hron, and in the eastern vicinity of the basin especially in the eastern and southeastern neighbourhood of the Pútikov Vršek. They form here the ridge P. 627 (Rakové), where they are slightly propylitized. In the group of the Priesil (P. 736) and in the spurs to the NW towards Tekovská Breznica pyroxene andesites, mostly



Obr. 5. Dnes opuštěný basanitový lom u Brehů s drtičem z let 30-tých. Sloupovitá odlučnost.

Fig. 5: Basanite quarry, today abandoned, at Brehy, with crushing-mill of the 30'ies. Columnar jointing.

reddish gray, are developed, with layers of agglomerated tuffs. More pyroxene andesites occur in the ridge P. 437 east of the Pútikov Vršek and in the N and NW slope of P. 444.

The pyroxene-amphibole andesites with biotite, sometimes also pyroxene andesites with biotite, occur in the western parts of the spurs of the Priesil towards Tekovská Breznica, in the Chválená Dolina, in P. 305 at Tekovská Breznica, on the platform E of the Pútikov Vršek (here they seem to underlie pyroxene andesites), in the valley of the Obecný Potok, at the foot of the ridge P. 484, here and there at the foot of P. 403 and P. 436, in the Liesna and Obecná Dolina, and at the southern foot of the Kobližný Vrch, at Brehy, in the northern slope of the valley of the Obecný Potok.

In the valley of the Obecný Potok, in the Liesna Dolina, at the foot of the ridge P. 403 and 436, on the slopes of P. 305 NE of Tekovská Breznica andesite tuffs underlyeing the rhyolite occur above the andesite; here and there (Tekovská Breznica) tuffites of pyroxene amphibole andesite also underlie the rhyolite above the andesite.

Pyroxene-amphibole-biotite trachytes, to a great extent strongly kaolinized, younger than the andesites but older than the rhyolites, underlie the rhyolites in the slopes and at the northern foot of the ridge P. 403 and P. 436 south of Brehy, and form the upper part of the continuation of this ridge to the east from P. 436 towards

Obr. 6. Deskovitá odlučnost basanitoidu v menším lomu na sev. úpatí Babina vršku nad Hronem zjz. Brehů (Brehy).

Fig. 6: Platy jointing of the basanitoid in a smaller quarry at the northern foot of the Babin Vršek above the Hron, WSW of Brehy.

P. 484, the ridge P. 444, and finally the height farther west between the preceding ridge and the Pútikov Vršek. They are gray, pinkish gray and whitish, markedly porphyritic, rather strongly kaolinized. In some samples (chiefly from P. 444) they contain a large amount of quartz in the matrix, thus forming a transition to the rhyolites. Their fragments and pebbles occur abundantly in the rhyolite breccia mentioned below.

The r h y o l i t e s form the summit of the height P. 305 NE of Tekovská Breznica, surrounded by the basanitoid flows. Their main occurrence is the ridge P. 403 and P. 436 of N-S direction south of Brehy between the valley of the Obecný Potok and the Liesna Dolina, whose upper part is formed by a great rhyolite extrusion. The foot of this ridge is formed by pyroxene amphibole andesites, here and there also by their tufs, on the northern slope also by trachytes, reaching here to 300 m. above sea level, 60 m above the level of the Hron. The lower part of the rhyolite body is formed by an e r u p t i v e b r e c c i a, very variegated, containing fragments of rhyolites, trachytes and decomposed andesites, sometimes also perfectly rounded andesite and trachyte pebbles, derived from the pierced tuffites, in a matrix of crushed rhyolite, or in a ferruginous-siliceous cement. The pebbles have a diameter ranging from a few cm. to several dm., and the breccias formed by them are very compact (pl. VIII, figs. 19 and 20). Above the level of 360 m. a. s. l. rhyolite breccias are overlain by felsospherulitic rhyolites.

The rhyolite breccias were reported by F. v. ANDRIAN (1866, p. 401), who regarded them as sediments of siliceous springs rising through a fissure of the rhyolite: „Sie dürften wohl auch als Absatz aus einer durch eine Rhyolithspalte ausgetretenen kieselerdehaltigen Quellen angesehen sein. Ich sah nur große Bruchstücke davon. Die Hauptmase, in der sie eingebettet sind, sind die früher beschriebenen blauen Tuffe und der blaue Trachyt. Es ist eine theils grobkörnige, theils feinkörnige Verunreinigung von einem weißen und rothen Rhyolith in scharf begrenzten eckigen Stückchen, durch eine Bindemasse verkittet, welche rother Hornstein zu sein scheint. Der feine Quarz in den Bruchstücken ist sehr gut zu beobachten. Die Mächtigkeit dieser Gangbildung erhellt aus der Masse und der Größe der Bruchstücke. Das Hauptauftreten derselben fällt so ziemlich in die Verlängerungslinie des Himmelreicher Rhyolithstockes."

E. BEUDANT, 1822, also stated that the basalts lie on a mass of rounded pebbles cemented by a mass which seems to have been formed by the destruction of tuff conglomerates. These conglomerates lie according to BEUDANT on compact "trachyte", i. e. mostly andesite.

The rhyolite of the ridge P. 403 and 436 rose evidently as a big extrusion along a great fissure of N-S direction, whose northern continuation above the right bank of the Hron is represented by the rhyolite of the ridge Himmelreich E and NE of Nová Baňa. The eastern delimitation of the rhyolite of the ridge P. 403 and 436 is evidently tectonic. Andesites, trachytes and tuffs are here strongly crushed along a line striking approximately h 1 (15° E); the secretions of red jasper occur here abundantly. In the southern continuation of this line lies the Pútikov Vršek, whose eruption seems to have taken place at the intersection of this fault with another fault of N-S direction running from the Pútikov Vršek to the north via the saddle west of P. 444 and along the western limit of the rhyolite of P. 403 and 436 (or a little lower in the eastern slope of the Liesna Dolina) through the western vicinity of Brehy and to the north across the river Hron into the valley of Nová Baňa. Here the northern continuation of the fault is very marked in the relief. It cannot be excluded that the isolated occurrence of basalt (basanite) in the Liesna Dolina at its bend to the north may represent an independent eruption which took place along this line.

III. PETROLOGY.

1. Basaltic rocks.

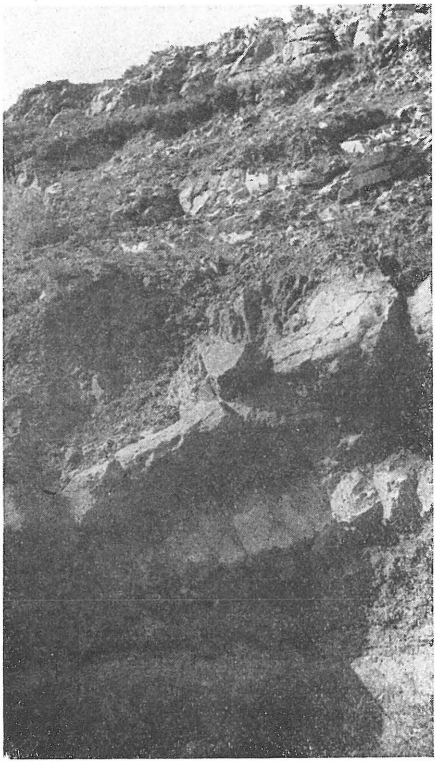
Basanitoids.

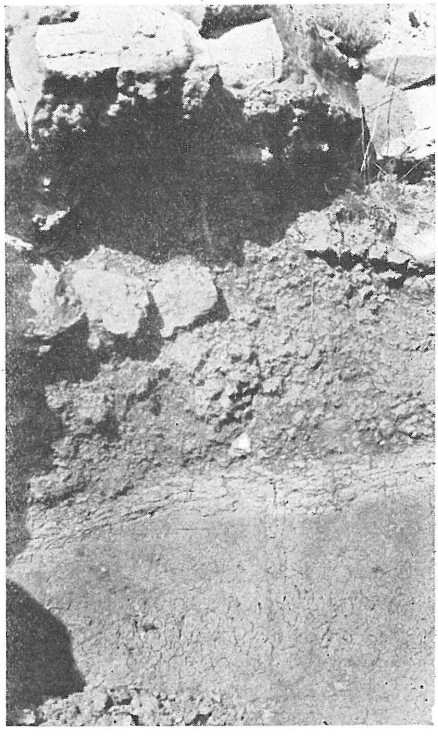
The alkaline character of the basalts of Tekovská Breznica and Brehy is clear. Most of them belong to the type of basanitoids, i. e. of basanite rocks in which individualized nepheline is replaced by non-crystallized *nephelinitoid,* sometimes also zeolitic *mesostasis,* often completely isotropic, in other cases with a slight double refraction. Cf. H. ROSENBUSCH 1908, p. 1395; H. ROSENBUSCH—O. MÜGGE I, 1927, p. 254; H. ROSENBUSCH—A. OSANN 1923, pp. 472 and 479; further the papers by REICHERT, ROZLOZSNIK-EMSZT, VITÁLIS, and F. FIALA 1938, p. 40, etc.

The studied basanitoids are gray, mostly very fine-grained to massive rocks, minutely and scantily (macroscopically mostly hardly discernibly) porphyritic. They contain minute, mostly sharply idiomorphic phenocrysts of *olivine* (up to 2 mm. ∅), well visible in a slide, mostly quite fresh, only here and there strongly corroded. Rather less abundant and smaller are the phenocrysts of monoclinic *augite*, here and there also those of *pigeonite-augite* and *pigeonite*. On the surface and at the base of the flows there occur typical porous to scoriaceous forms. The rocks from the quarries at Brehy are still more compact and massive.

Giving a general petrological characterization we may say that the texture of most of the samples is microscopically distinctly porphyritic, mostly granularly intersertal, in the samples from Brehy approaching a limburgitoid to hyalopilitic one. Most phenocrysts belong to the *olivine* (∅ 0.05 × 0.1 to 0.2 × 0.9 mm.), which almost always exhibits enhedral forms. It is mostly optically positive; the angle of the optical axes is very large, approaching 90°. It is almost always completely fresh, but often deeply corroded (Pl. I, fig. 2, pl. II, figs. 5 and 6). A number of authors reports similar corrosions from Carpathian basalts, especially B. MAURITZ for the olivines of the basalts of Tátika in the Balaton area (1936, p. 375) and for those of the basalts of the height Sághegy (1938, p. 241). It was only exceptionally that I found in the olivines of the investigated basanitoids limonitized margins, thus in the sample of porous basalt from the cinders of the platform of the Pútikov Vršek.

A less abundant mineral among the phenocrysts is *monoclinic pyroxene* in short columns mostly moderately flattened according to 010, light brownish green, at the margin often reddish through an admixture of Ti. Sometimes it has an hour-glass structure. It belongs mostly to *pigeonite augite* ($\sphericalangle$ $c\gamma$ between 48—53°), with a smaller angle of the optical axes, here and there, especially in the quarries at Brehy, also to *pigeonite*, almost uniaxial (cp. H. KUNO, 1936, and 1950, pp. 972—7) with a larger extinction angle, and fairly often also to *common augite* with an angle $c\gamma$ between 40—48°, and an angle of the optical axes exceeding 45°. It encloses abundantly minute magnetite grains. Here and there *magnetite* occurs in large (100), belonging to the generation of phenocrysts. — The *matrix*, most frequently of a granularly intersertal texture, is composed of minute columns (0.02 × 0.1 to 0.04 × 0.3 mm.) of *mcl. pyroxenes*, lath-shaped *labradorite-bytownite* (symmetrical extinction 32°), and abundant minute crystals of *magnetite*. *Ilmenite* occurs only sporadically. Very subordinate are minute crystals of *apatite* grown into the other components. In some samples, especially from the vicinity of Brehy, some *biotite* appears in tiny crystals and lamellae. It is reported quite often from the Carpathian basalts (cp. e. g. B. MAURITZ 1930 (St. György), 1936 (Tátika), and 1938 (Ságberg). — Fairly abundant is an interstitial *nephelinitoid substance*, slightly less refracting than the Canada balsam, sometimes isotropic, in other cases with a very slighht birefringence. Here and there *phillipsite* (— length, positive low birefringence) is developed in it (cp. B. MAURITZ, 1936, pp. 383 and 387). Only sporadic



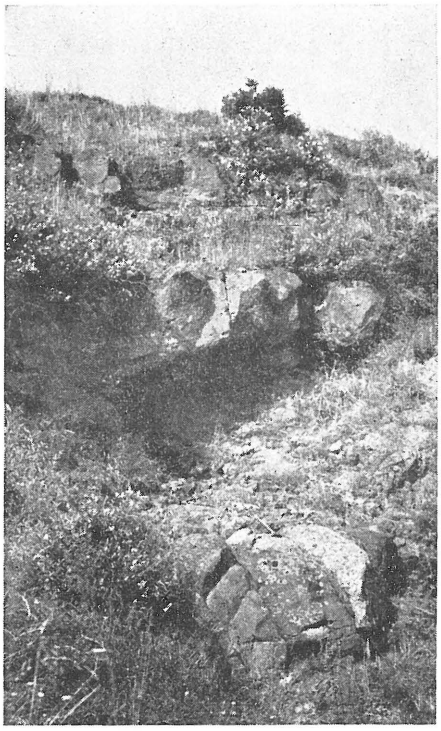


Obr. 7. Profil uložením basanitoidových proudů a strusek na již. svahu c. 305 vých. Tekovské Breznice. V podloží písky.
Obr. 8. Detail ze spodní části téhož profilu.

Fig. 7: Section through the complex of basanitoid flows and cinders on the southern slope of P. 305 east of Tekovská Breznica. Underlain by sands.
Fig. 8: Detail from the lower part of the same section.

ally, e. g. in the basanite from Brehy, also *nepheline* can be demonstrated, individualized in // extinguishing columns of — length. The chemical analysis of the basanites from Brehy is given on p. 19. It indicates that these rocks belong to the theralite-gabbroid magmas. The alkaline character is proved also by the microchemical test. — The powder of the basalts from almost all points of the flows of the Pútikov Vršek strongly gelatinises with HCl and after evaporation yields a larger or smaller amounts of crystals of NaCl, in greatest quantity when using samples of the basanites from Brehy, of which also the chemical analysis has been made. The basalt of the III flow proved to be relatively poor in alkalis according to the microchemical tests.

The doleritic basanitoids from the SE foot of the Pútikov Vršek in the Chválená Dolina, at the NW margin of the Chvalenské Meadows, are considerably more granular. Their texture is doleritic,



Obr. 9. Horní basanitoidové proudy v profilu na již. svahu c. 305 vých. Tek. Breznice.
Obr. 10. Basanitoidový proud v témže profilu. Basanitoid silně porésní.
Fig. 9: Upper basanitoid flows in the section on the southern slope of P. 305 east of Tek. Breznica.
Fig. 10: Basanitoid flow in the same section. Basanitoid trongly porous.

approaching a diabasic one, sometimes even ophitic. A characteristic mineral is here the *ilmenite*, forming large, ornamentally skeletic, tabular crystals, younger than the augite and the feldspars (cp. the similar observations of B. MURITZ in the basalt of Tátika, MUHITZ 1936, p. 387). Rarely also *nepheline* occurs here.

The Basanitoids and Nepheline Basanites of the Lower Flow

A rather large number of samples was studied, derived from the quarries of the Liesna Dolina at Brehy and from the NW foot of the Babin Vršek above the Hron west of Brehy, from the locality at the northward bend of the Liesna Dolina, and from the northern vicinity of Tekovská Breznice. From the upper part of the flow, i. e. from the platform of the Babin Vršek, strongly vesicular basanitoids were studied, taken from the northern vicinity of P. 305 at the road from Brehy to Tekovská Breznica.

The sample of the 3. quarry at the junction of the Liesna Dolina at Brehy is characterized by a very fine grain and considerable compactness. The *olivine* attains a maximum of 0.3 × 0.6 mm. The pyroxene of the scarce phenocrysts and of the matrix is almost uniaxial *pigeonite,* sometimes zonal, with extinction $c\gamma$ in the middle up to 56°, at the margin 46°. In the corrosive cavities of the pigeonite clusters of minute crystals of *brown amphibole* appear with minute lamellae of *biotite. Ti-magnetite* abounds in skeletal (100) and crystal clusters. The very finely intersertal *matrix* is composed of tiny ledges of *basic labradorite* (0.004 × 0.02 mm) and many minute columns of *pigeonite* (0.01 × 0.02 × 0.03 × 0.1 mm.). Rather abundant is minute *biotite.* Here and there columns of // extinguishing *nepheline* occur. The large amout of *nephelinitoid mesostasis* encloses many minute needles of *apatite.* The sample gelatinises strongly with HCl, after evaporation very many NaCl cubes crystallise. For the chemical analysis see p. 34.

Planimetrical measuring:

Phenocrysts:			
olivine	10.7	11.5%	
pigeonite	0.8		
Matrix:			
pigeonite	59.9		67.7
Ti-magnetite	4.7		5.3
biotite	0.4	88.5%	0.5
plagioclase	15.5		17.5
mesostasis	8.0		9.0
	100.0%	100.0%	100.0%

The basanite from the northern slope of the Liesna Dolina at the bend of the valley to the NNW, 2 km. SE from Brehy corresponds on the whole to the usual type of larger grain. The slightly zonal pyroxene belongs to *pigeonite augite,* $\sphericalangle c\gamma$ 53°. The *magnetite* belongs mostly to the generation of the phenocrysts. A small amount of individualized *nepheline* occur in the *mesostasis.*

Planimetrical measuring:

Phenocrysts:		
pigeonite-augite	3.6	16.9
olivine	3.3	
Matrix:		
pigeonite-augite	39.9	
magnetite	3.6	83.1
plagioclase	30.7	
mesostasis	8.9	
	100.0%	100.0%

The basanitoid from the new quarry at the northern foot of the Babin Vršek west of Brehy has a finely porous structure; under the microscope it shows fluidal structure slightly indicated by the arrange-

ment of abundant oval or irregular cavities, ⌀ 0.2 × 0.2 to 0.6 × 1 mm. The *olivine* is optically negative, the pyroxene belongs to *mcl. augite*. A *nephelinitoid mesostasis* is here very abundant.

In the basanitoids of the small quarries farther to the west at the foot of the Babin Vršek the pyroxene belongs to *pigeonite-augite* ($\sphericalangle$ $c\gamma$ 48°). The amount of nephelinitoid mesostasis is here smaller, the amount of NaCl crystallising from the powdered samples with HCl also. — In contradistinction to this, nephelinitoid mesostasis is again abundant in the basanitoid from the well in the NNE vicinity of Brehy; also individualized *nepheline* is here developed; the microchemical test with HCl gives many × × Na Cl. The *olivine* is here distinctly negative, the pyroxene belongs to *common augite*.

The porous to scoriaceous basanitoids from the platform of the Babin Vršek south of Brehy are blackish gray, slightly vesicular, with beginning disintegration. In the cavities we find here and there *opal* linings. The *olivines* are usually slightly limonitized at the margin; the pyroxene belongs to *mcl. augite* ($\sphericalangle$ $c\gamma$ 48°). *Magnetite* is abundantly included in the olivine and augite. The amount of *mesostasis* is small. Succession: olivine, augite I, plagioclase, magnetite I, augite II, magnetite II, mesostasis.

The Basanitoids of the Second Flow

This starts from the slopes of the Pútikov Vršek, flows down the surface of the I flow to the NW, and forms a platform inclined under 7° to the W and NW. In the NE vicinity of Tekovská Breznica before reaching the summit P. 305 it divides into two flows, a wider northern one and a narrower southern one, flowing round the height P. 305. The southern basannitoid flow, fairly well exposed on the southern slope of P. 305 above the Chválená Dolina, is not homogeneous; it is composed of several alternating smaller flows of porous basanitoids and layers of volcanic cinders and scoria (cp. figs. 7—10). The northern portion of the II flows is well exposed in the valley leading from the Pútikov Vršek to the NNW towards the bend of the Liesna Dolina; in it a thick basaltic "coulée", about 50 m thick, composed of tabular, compact, partially weathered basanitoid is exposed.

The samples studied microscopically were taken from the individualized small flows occurring on the southern slope of P. 305 east of Tek. Breznica, from the western slope of P. 305, from the northern part of the flow near the upper rim of the platform north of P. 305, from the crossroads NE of P. 305, from the platform north of the III flow NW of the Pútikov Vršek, and from the valley NW of the Pútikov Vršek.

The basalts of the II flow belong almost all to the basanitoids, only in some places (e. g. the two lower flows of the exposures in the southern slope of P. 305 east of Tek. Breznica, the northern vicinity of P. 305, further the valley NW of the Pútikov Vršek) the scanty occurrence of individualized *nepheline* indicates transitions to true basanites. The texture is porphyritic, analogous to the texture of the lower flow; the matrix is minutely granularly intersertal.

The *olivine* of the phenocrysts (0. × 0.2 to 0.24 × 1.6 mm) is almost exclusively opt. + Mg-olivine with a large angle of the optical axes approaching 90° and with dispersion $v > \varrho$. Here and there it is strongly corroded (cp. phot. pl. II, fig. 6). It is mostly completely fresh, only in the sample from the upper end of the valley NW of the Pútikov Vršek a more marked change into Fe-chlorite has been observed. Opt.—olivine was found only sporadically, with dispersion $\varrho > v$ (valley NW of the Pútikov Vršek and the two lowest flows on the southern slope of P. 305 east of Tek. Breznice). The pyroxene is mostly *common augite;* uniaxial *pigeonite* was found only in the two lower flows on the southern slope of P. 305. As in the lower flow so also here its occurrence is bound to relatively more alkaline types of basanitoids in which — even if only in a minute quantity — also individualized *nepheline* occurs. The *matrix* is granularly intersertal and is composed of ledges of *labradorite-bytownite* (symmetr. extinction 32°), predominating minute granules and columns of *mcl. augite,* rarely also of *pigeonite-augite,* abundant minute *magnetite* and *nephelinitoid mesostasis.* Individualized *nepheline* was found in a small quantity in the mesostasis in the two lower flows in the southern slope of P. 305, in the occurrence north of P. 305, and in the valley NW of the Pútikov Vršek. Here and there *phillipsite* is developed. Accessorily not too abundant *apatite* in minute needles mostly embedded in the mesostasis. *Brown amphibole* in a small quantity occur in the form of minute crystals in the basanitoid of the platform north of the III flow. Here also some *hyalite* was ascertained in the cavities.

In the cinders and scoriaceous basalts and in the bombs on the southern slope of P. 305 the pyroxene belongs partly to pinkish green *augite,* partly to pink *pigeonite.* Pigeonite forms in addition to independent crystals sometimes narrow rims round the augite. The bombs have a somewhat more compact, densely fine-porous rim and a more coarsely porous centre where the pores often occupy more than a half of the surface of the slide.

In the section on the southern slope of P. 305, on the northern slope of the Chválená Dolina the basanitoids are, especially at the base, rather strongly alkaline, here and there with individualized *nepheline.* In the microreaction with HCl they give many minute × × NaCl. They are strongly porous. The pyroxene belongs mostly to greenish *pigeonite,* pink at the rim, with traces of hour-glass texture. In the second flow *mcl. augite,* slightly pinkish green, occurs together with it and not rarely grows round the pigeonite at the margin. In the matrix *pigeonite-augite* with basic *labradorite* occur. The red rim of the pyroxenes indicates a rather large admixture of Ti. The matrix of the scoriaceous basalts contains abundant clusters of limonite.

In the basanitoid from the western slope of P. 305 the olivines are slightly limonitized at the margin. In contradistinction to the almost everywhere strikingly occurring predominance of the olivine among the phenocrysts *olivine* and *pyroxene* (here *mcl. augite)* are about equally represented among the phenocrysts. There is little *mesostasis,*

and in the microchemical test few $\times\times$ NaCl crystallise. The rock approaches normal basalts.

The samples from the upper margin of the platform north of P. 305 contain *mcl. augite* with extinction at 39° in the centre and at 46° in the pink marginal zone richer in Ti. The very abundant, almost isotropic *mesostasis* fills the triangular areas between the feldspar ledges and augite columns. It contains aggregates and skeletal forms of minute, partly limonitized crystallites, perhaps of *ilmenite,* abundant *apatite* in long-columns, rarely columns of *nepheline*. The microchemical test yields many $\times\times$ NaCl.

Planimetrical Measuring:

Phenocrysts:		
olivine	14.0	20%
augite	6.0	
Matrix:		
augite	56.9	80%
magnetite	2.4	
plagioclase	13.2	
mesostasis	7.5	
	100.0	100%

At the crossroad north of P. 305 between Brehy and Tekovská Breznica dark gray, coarsely porous, distinctly porphyric basanitoid was found. The phenocrysts of opt. + *olivine,* strongly and deeply corroded (pl. I, fig. 2), are at the rim here and there slightly limonitized. Nephelinitoid mesostasis enclosing many *apatite* needles is abundant.

The basanitoid of the platform of the northern II flow is dark gray, coarsely vesicular, with rounded to elliptic cavities ∅ 0.5—3 cm. The *augites* of the phenocrysts are often not clearly differentiated in size from the augites of the matrix. The matrix is overcrowded with disseminated hematite. It includes sporadic minute columns of *basaltic amphibole.* In the cavities minute hyaline clustered aggregates of *hyalite* occur, isotropic, with r. i. approaching 1.46.

The basanite from the valley NW of the Pútikov Vršek shows coarsely pisolitic disintegration. The *olivines,* very strongly corroded, are optically negative, dispersion $\varrho > v$. The feldspar is *labradorite-bytownite,* sym. extinction 34°. In the matrix columns of *nepheline* and abundant long, transversally fissured, long-columnar *apatite* occur. The abundant mesostasis is mostly devitrified into *phillipsite.*

The basanitoid from the upper end of the same valley is much more strongly altered. The *olivines* are replaced by a brown substance of Fe-chlorite. Larger crystals of *Ti-magnetite,* reflecting whitishly, are abundant. Matrix without nepheline, but with very abundant *phillipsite* is pigmented by abundant flakes of *hematite.*

Basanitoid of the III Flow

The third flow is restricted in extent. It is represented by a relative narrow (70 m), but fairly high and about 300 m long ridge on the sloping platform NW below the summit dome of the Pútikov Vršek. Dip of the flow 15° to the NW. Under the microscope it is a finely porphyritic rock with phenocrysts of opt. + *olivine* and *pigeonite-augite* in a fine-grained matrix formed of ledges of *basic labradorite* (symmetr. extinction: 32°), short columns of *pigeonite-augite*, a lesser amount of *magnetite* and a lower refracting, grayish, strongly vitreous *mesostasis* with sporadic crystals of *apatite*. Only little NaCl crystallise with HCl. The rock approaches the type of normal basalts.

Planimetrical Measuring:

Phenocrysts:			
olivine	12.7	15.6	
pigeonite-augite	2.9		
Matrix:			
pigeonite-augite	46.3	84.4	54.8
Ti-magnetite	7.9		9.4
plagioclase	20.2		23.9
mesostasis	10.0		11.9
	100.0%	100.0%	100.0%

Summit Dome of the Pútikov Vršek

The summit height is forested and without outcrops. As far as one can judge from the finds of individual fragments it is formed mostly of volcanic cinders, bombs and lapilli, among which smaller flows and lava penetrations occur here and there, especially on the southern slope. The cinders are sometimes black, e. g. on the eastern slope and in the saddle east of the Pútikov Vršek, but mostly oxidized to red. The sharply delimited cavities have a diameter up to 1 cm, here and there they predominate considerably over the mass of the rock forming thin partitions between the cavities.

The microscope reveals nothing special. The phenocrysts belong to opt. + *olivine*, 0.2 × 0.4 mm, strongly corroded, fresh, with differentiated reticular ore forms, and to *mcl. augite* ($\sphericalangle c\gamma$ up to 50°), reddish at the rim because of the admixture of Ti. The intersertal matrix of predominating *augite*, a lesser amount of *bas. labradorite-bytownite* (32°), very many granules of *magnetite*, some *apatite*, sporadic granules of serpentinized *olivine*, and a rather considerable amount of *glass*.

The reddish oxidized cinders have an analogous composition, except that their olivine is more or less completely altered to *iddingsite*. The augites are darkened at the rim, the matrix is poppered with limonite, here and there also with opal. On the walls of the cavities there are abundant linings of *opal*.

The porous lavas of the southern slope of the Pútikov Vršek above the Chválená Dolina are on the whole analogous. The phenocrysts of *olivine* opt. ± disp. $\varrho > v$, strongly corroded, are here considerably large. The phenocryst of *mcl. augite* are less abundant. At the margin they are bordered by saturated red *Ti-augite,* which also forms a number of smaller individuals. It shows a slight pleochroism and a more distinct violet reddish tinge in the direction γ, while in a transverse direction it is yellowish green. Angle $c\gamma$ 52°. It encloses also abundant minute crystals of magnetite. There is a gradual transition from the phenocrysts to the matrix; the size of the components decreases from the olivines of the phenocrysts via the augites to the plagioclases. Very abundant are magnetite and apatite. The *mesostasis* includes a considerable amount of *phillipsite* (low double refraction, opt. +, character of the length —, extinction //, medium angle of the optical axes, texture here and there up to radiating).

Doleritic Basanitoid and Nepheline Tephrite in the Chválená Dolina

The basaltic rocks occurring at the NW end of the Chvalenské Meadows (northern margin of section 4661/4 of the map at the scale of 1 : 25.000), above the stream of the Chválená Dolina at the SE foot of the Pútikov Vršek are of a more granular type than the basanitoids described above and correspond in texture to dolerites. They represent a lateral feeding channel exposed by the erosion of the stream. The doleritic basanitoid is here further pierced by veins of grayish green nepheline tephrite, fine-grained, characterized by the presence of very abundant black pigeonite needles, which are macroscopically well visible and very striking.

Doleritic Basanitoid

This is a gray, fine-grained rock with non-abundant minute pores and with sporadic phenocrysts of pale green olivine, ∅ 2—4 mm. Under the microscope the texture is doleritic, granularly intersertal, here and there to ophitic, strikingly reminiscent of the texture of intrusive diabases (pl. III, figs. 7, 8). The phenocrysts of *olivine* (opt. —) are here and there strongly corroded. Not rarely a wreath of minute granules of *pigeonite* has grown on them at the margin, and pigeonite forms also the main part of the matrix. The pyroxene of the phenocrysts is pale greenish *pigeonite augite,* at the margin much overgrown by a pinkish rim of almost uniaxial, slightly pleochroic *pigeonite.* Very abundant are skeletal × × of *magnetite,* and very typical, skeletal, platy × × of *ilmenite,* also agreeing with the occurrence in intrusive diabases. *Matrix* not too abundant, restricted to a kind of "islands", of granularly intersertal texture; it is composed of ledges of *labradorite-bytownite* (0.02 × 0.15 to 0.04 × 0.5 mm), a litle *pigeonite,* and a nephelinitoid, almost isotropic mesostasis with minute × × of magnetite and abundant included needles of hyaline apatite.

Planimetrical Measurings:

Olivine	6.5
pigeonite-augite	31.2
ore (magnetite and ilmenite)	6.3
plagioclase	28.1
apatite	1.6
matrix	26.3
	100.0%

Doleritic Nepheline Tephrite, ibid.

It is a greenish gray, fine-grained rock with abundant black, lustrous needles of pyroxenes. It is younger than the doleritic basanitoid, into which it intruded in the form of veins and veinlets. The macroscopically well discernible acicular black pyroxenes belong predominantly to *pigeonite,* to a lesser extent also to *clinoenstatite.*

Texture under the microscope granularly intersertal, here and there ophitic. Olivine is lacking, porphyric texture not perceptible except for the above mentioned long-columnar phenocrysts of *clinoenstatite.* The principal constituent is a thickly platy *basic labradorite* (31°), 0.2 × 0.1 to 0.1 × 0.4 mm, sometimes slightly zonal, with an up to *andesinic* margin. Often it encloses abundant × × of *apatite.* The ends of the platy labradorites penetrate not rarely the margin of the larger granules of pigeonite, so that the structure approaches an ophitic one (pl. VI, fig. 13). The pyroxenes belong mostly to almost uniaxial *pigeonite.* They form octogonal columns enclosing here and there *apatite* needles. They are often of an hour-glass structure and slightly zonal. The centre is usually yellowish; the margin, fairly distinctly separated from the centre, is formed by a variety of pigeonite of a somewhat higher refraction and slightly lower double refraction, of a more distinctly reddish tone, and of distinct pleochroism.

α ochre yellowish
β reddish yellowish
$\gamma = \beta$ to violet red.

Angle of extinction $c\gamma$ 54°. It is almost uniaxial with a slight divergence of the optical axes. At the end, sometimes also at the margin, a grayish green *egirine augite* is developed ($\sphericalangle$ $c\gamma$ 56°, — character of the length), forming sometimes also independent small crystals. The pigeonite is often overgrown by *ilmenite.*

Independetly non-abundant slim long-columns of colorless to slightly greenish pyroxene (0.15 × 2 mm) occur, ending in a pointed pyramid. Extinction //, only in some cross-sections there appears a deviation from the vertical edge up to 9°; the length is +, double refraction somewhat higher than in pigeonite. The cross-section is usually octogonal; prismatic faces predominate by far over the narrow faces of the pinacoids. In transversal cross-sections the bisectrice γ emerges. Angle of the optical axes is very large. This pyroxene belongs to *clinoenstatite,* very near to the rhombic type.

In the slide there are abundant long thin needles of *apatite,* of a dark gray colour and with a low double refraction, — character of the length, extinction //, enclosed in the other constituents. Further, crystals of *magnetite,* cubic, somewhat skeletally developed, and abundant, typically skeletally developed platy crystals of *ilmenite* (pl. VI, figs. 13 and 14), very similar to the forms we find e. g. in the intrusive diabases of Central Bohemia (FIALA 1949, pl. 8).

The *matrix,* forming islands between the more granular parts, has an intersertal texture. It is composed of minute ledges of *basic andesine* (0.004 × 0.04 mm), abundant short columns of green *egirine,* a lesser amount of *pigeonite,* colourless columns of a mineral with // extinction and negat. character of the length, belonging very probably to *nepheline,* abundant *apatite,* some *magnetite,* sporadic, very tiny crystals of *biotite,* and abundant *nephelinitoid mesostasis* of a low double refraction and often altered into *phillipsite.* In one case flakes of minute biotite crystals were ascertained, with still younger needles of egirine-augite both minerals being perched on an clinoenstatite phenocryst.

The microchemical test with HCl confirms he microscopic diagnosis and indicates the strongly alkaline character of the rock. With HCl some gelatine is formed, in evaporation many large (100) NaCl crystallise.

Planimetrical Measuring:

Phenocrysts:		
Pigeonite	26.4	74.9
Clinoenstatite	2.6	
Ilmenite & magnetite	5.7	
Plagioclase	40.2	
Matrix:		
pigeonite	1.8	25.1
egirine	0.7	
biotite	1.2	
magnetite	0.4	
apatite	3.2	
plagioclase	4.3	
nephelinitoid mesostasis, nepheline included	13.5	
	100.0%	100.0%

Chemism of the Nepheline Basanite at Brehy

A sample from the anterior quarry, today abandoned, in the Liesná Dolina at Brehy was analysed by my friend Dr. A. AMBROŽ in 1937.

	Weight % of the analysis	Molecular %
SiO_2	44.22	46.72
TiO_2	2.62	2.08
Al_2O_3	12.02	7.49
Cr_2O_3	0.05	
Fe_2O_3	4.05	9.92
FeO	7.54	
MnO	0.23	0.21
MgO	10.74	16.97
CaO	10.23	11.62
Na_2O	3.43	3.52
K_2O	1.69	1.14
P_2O_5	0.72	0.33
H_2O +	2.35	
H_2O —	0.09	
	99.98%	100.00%

Calculation according to OSANN

A	4.66	a	3.2	n	7.6
C	2.83	c	2.0	k	0.70
Fe	35.89	f	24.8	s	48.80

Calculation afer NIGGLI

si	92	si	134.4
al	14.8	qz —	44.4
fm	53.3	c/fm =	0,43
c	22.8	section	III/IV
alk	9.1		
k	.25		
mg	.62		

According to the calculation the basanite of Brehy belongs to the type of theralite-gabbroid magmata of NIGGLI. The following rocks are close to the above rock according to NIGGLI's calculations:

Rock:	si	al	fm	c	alk	k	mg	Section
Bekinkinite, Bekinkina, Madagascar	89	16.5	49	26.5	8	.10	.64	IV
Fasinite, Ambaliha, Madagascar	80	18	47	26.5	8.5	.25	.54	IV
NIGGLI's average of 38 analyses of nepheline basalts	73	13	54	25	8	.21	.63	IV
Of theralitic magmata can be mentioned:								
Monchiquite, Reservoir, Montreal, Canada	78	15	50.5	23.5	11	.26	.50	IV
Of normal gabbroid ones:								
Olivine norite, Gang, Gersten, Lusatia	111	18	56	17.5	8.5	.05?	.60	III
Nepheline basanite, Brehy	92	14.6	53.3	22.8	9.1	.25	.62	III/IV
Slovak basalts for comparison:								
Limburgitoid basanite, Kalvaria at B. Štiavnice, FIALA 1938	90	17.5	56.5	19	7	.21	.69	III
Basanitoid, Podrečany FIALA 1938	124	27.1	40.6	16.4	15.9	.24	.50	III

Indubitable relations to the basanite of Brehy shows the basalt (limburgitoid basanite) of Kalvaria at Banská Štiavnice (FIALA, 1938), differing from the former by somewhat higher al and lower c and alk as is in accord with its limburgitoid character. The basanitoid from Podrečany (NW of Lučenec) situated at a rather great distance belongs already to another group of magmata.

For the purpose of a comparison of the chemical properties of the Slovak basalts studied so far I give below a selection of analyses of Hungarian basalts, taken from the papers of B. MAURITZ of 1930 (pp. 8—22), 1936 (p. 396), and 1938 (p. 254), arranged according to decreasing si:

	si	al	fm	c	alk	k	mg
St. Győrgy, vein, 1930, p. 10	119	25.5	41.5	22.5	10.5	.14	.63
Ibid., lower sheet, 1930, p 8	116	22	44	23	11	.14	.58
Pécskő, ibid., p. 22	115	22.5	41.5	24.5	11.5	.21	.62
St. Győrgy, upper sheet, ibid. p. 9	114	22	45	22	11	.30	.61
Kővár, ibid. p. 21	112	21.5	40	27	11.5	.29	.55
Kővár, ibid. p. 21	112	22	40.5	27.5	10	.37	.54
Nagylas, 1936, p. 396	112	21	47	22	10	.23	.60
Ságberg, east, 1938, p. 254	112	19	48	23	10	.27	.62
Ságberg, summit, Ibid. p. 254	110	19	48	23	10	.27	.63
Ságberg, lower level, ibid. p. 254	110	19	49	22	10	.26	.63
Tótihegy, 1930 p. 8	109	21.5	47	24	7.5	.09	.51
Kis Salgó, 1930 p. 18—19	108	22	41.5	23.5	11	.25	.50
Tátika west, 1936 p. 396	107	21	45	23	11	.30	.60
Meneshegy (limburgitoid), 1930, p. 14	106	19.5	47.5	20.5	12.5	.15	.52
Sághegy, anal. HORVATH	103	19	47	24	10	.30	.63
Rekettyés, limburgitoid, 1930, p. 15	102	19.5	48.5	25	7	.12	.60
Fertős, 1936, p. 396	101	21	45	24	10	.35	.60
Tátika, south, 1936, p. 396	101	22	45	22	11	.33	.62

Tátika, summit, 1936, p. 396	101	21	46	23	10	.35	.61
Tátika, south, 1936, p. 396	99	20	46	23	11	.29	.61
Eresztvény, neph. basanite, 1930, p. 17	95	20	46.5	22.5	11	.21	.53

The comparison of this selection of Pannonian basalts from the publications of B. MAURITZ with the three analyses of basalts from Central Slovakia given above shows a certain affinity of the Pannonian basalts with the basanitoid from Podrečany which is, however, relatively more acidic and considerably more alkaline. The basalts from Kalvaria at B. Štiavnice and from Brehy represent much more basic types, partly approaching limburgites, with a lower si, moderately lower al, and considerably higher fm. — The nepheline basalt of Moldova in the Banat given in the paper of V. ROZLOZSNIK—K. EMSZT, 1923, p. 497, shows some relations to the basanite of Brehy.

Of the Balaton basalts B. MAURITZ states that they have no modal nepheline, but represent — according to the chemical examination — a transition between the Pacific and Atlantic magmata. This applies also fully to the basalts of Slovakia which erupted at the end of the Neogene in the depressions of the volcanic mountain chain with the modification that in the Slovak basalts, especially of some localities, the alkaline character manifests itself considerably more distinctly and that here also considerably basic types occur.

2. Andesitic, Trachytic and Rhyolitic Volcanic Rocks from the Vicinity of the Basanitoids of Tekovská Breznice and Brehy

Andesites

Pyroxene-amphibole andesites with biotite represent in the nearer vicinity of Tekovská Breznice and Brehy the principal type of andesitic rocks. They are at least in part older than the pyroxene andesites.

Their colour is dark gray, here and there pinkish gray; at Brehy in consequence of stronger hydrothermal alteration they are considerably bleached. The texture is minutely porphyric. Sometimes they are slightly propylitized, the hypersthenes being replaced by chlorite.

They contain phenocrysts of *labradorite,* sometimes of *acid labradorite,* here and there (Brehy) also of *labradorite-bytownite,* further phenocrysts of *hypersthene* almost always considerably chloritized, and non-abundant monoclinic, completely fresh *augite.* A regular component among the phenocysts is brownish green *amphibole,* mostly very strongly opacitized, replaced by magnetite often secondarily limonitized. Brown, mostly corroded *biotite,* occurs accessorily here and there (e. g. at Te-

kovská Breznica, SE of Brehy at the NW foot of P. 484 on the southern slope of the valley of the Obecný Potok), besides there are here and there minute, intensively pleochroic biotites disseminated in the matrix. Sporadically occur larger phenocrysts of *magnetite*. To the generation of the phenocrysts belongs also the *apatite;* it is very abundant, disseminated in the matrix as well as included in the pyroxenes and feldspars. It is columnar, smokily clouded by fine occluded particles, mostly typically pleochroic, smoke gray lengthwise, light brownish perpendicularly. This pleochroic apatite is abundant in the amphibole of andesites of the Slovenské Středohoří (cp. FIALA—R. KETTNER, 1931, p. 201). Pleochroic apatites are also quite often recorded in the literature, e. g. from the Japanese andesites by H. KUNO (1936, pp. 116 and 131, 1950, p. 983).

The *matrix* has a texture intermediate between pilotaxitic and hyalopilitic, sometimes also strongly glassy (NW foot of P. 484 SE of Brehy). It contains fine ledges of *andesine,* sometimes of *acid labradorite,* sporadic minute × × of *magnetite,* and a strongly glassy interstitial filling with abundant ore trichites. In some samples there is also some *quartz,* the texture then becomes microgranitic. The andesites from the southern slope of P. 304 NE of Tekovská Breznica are hypocrystalline, with a strongly glassy matrix. In the quarry in the southern slope of the Kobližný Vršek at Brehy the andesite are hydrothermally metamorphozed, the feldspars (labradore-bytownite) are kaolinized, the pyroxenes chloritized, the amphiboles strongly limonitized. In the strongly kaolinized, originally considerably glassy matrix there are smokily pleochroic *apatites.*

The andesite pebbles in the tuffites at P. 304 NE of Tekovská Breznica have a similar composition. The rock contains a greater amount of biotite. The matrix is brownish, strongly glassy, fluidal.

Pyroxene andesites are little represented in the immediate vicinity of Tekovská Breznica and Brehy. The rock from the height east of the Pútikov Vršek is dark gray, aphanitic, minutely porphyritic. The phenocrysts belong to *labradorite,* fresh, strongly pleochroic and corroded *hypersthene,* and mcl. *diopsidic augite* ($\sphericalangle$ $c\gamma$ 37°). *Magnetite* is abundant, often included in pyroxenes. Matrix pilotaxitic with minute ledges of andesine (symmetr. extinction 20°), fine granules of magnetite, sporadic granules of decomposed pyroxene, and a small quantity of interstitial glass.

The pyroxene andesite from the northern foot of P. 444 from the southern flank of the Liesna Dolina SSE of Brehy is compact, grayish black, with abundant phenocrysts of *bas. labradorite* and *hypersthene* and large × × of *magnetite.* The texture of the matrix approaches the hyalopilitic one.

Propylitized pyroxene andesites are developed mostly in the farther vicinity of the surveyed area, especially in the neighbourhood of the old mining towns of Pukanec and Nová Baňa.

Biotite-Amphibole-Pyroxene Trachytes

These geologically and petrologically interesting rocks are considerably restricted in occurrence. They occur in the southern vicinity of Brehy, forming the northern and eastern foot of P. 403 under the rhyolites; further they occur in the ridge east of P. 436. Less typical and with a larger quartz content forming a transition to the rhyolites and dacites are the rocks of P. 444 and of its vicinity NE of the Pútikov Vršek. On the western bank of the Hron trachytes occur on both sides of the valley of Nová Baňa, forming especially the height Kalvaria. Here and there, especially around Brehy, they are strongly hydrothermally metamorphozed and kaolinized.

They are light pinkish gray to whitish gray rocks, considerably massive, sometimes finely porous, minutely porphyritic. In addition to whitish, strongly kaolinized feldspar phenocrysts (∅ 1—2 mm) they contain abundant, strongly limonitized phenocrysts of dark constituents. Under the microscope the texture is closely porphyritic, semivitreous. The thick platy phenocrysts of hyaline, low refracting *sanidine* (0.06 × 0.2 to 1 × 1.5 mm), sometimes in the form of Carlsbad twins, enclose here and there some inclusious of the matrix. Often they are strongly kaolinized, here and there also replaced by chlorite. The phenocrysts of the primary dark constituents, i. e. of *amphibole, biotite* and *hypersthene* are mostly completely replaced by chlorite (propylization). According to the hexagonal cross-sections amphibole predominates among them. Only the *biotite* has been preserved sometimes in fresh, blackish brown plates. Sporadically large (100) of *magnetite* and columns of smoky pleochroic *apatite*. The *matrix* is strongly vitreous, in other cases microfelsitic, brownish, of low refraction, typically fluidal, ropy. It includes minute individuals of *sanidine* and here and there a certain amount of *quartz* and abundantly disseminated, saturated green *chlorite* and abundant minute *magnetite*, fine flakes of reddish brown *biotite*, black *ore trichites*, and indeterminable crystallites.

The trachytes show a strong propylitic alteration, besides here and there as its further stage also kaolinization. The kaolinization is especially strong at the N and NW foot of P. 403 south of Brehy in the neighbourhood of the eruption of the rhyolitic body of the ridge P. 403 and 436. — The strong crushing in these places, caused by large dislocations, resulted here sometimes in a brecciated structure.

The trachyte from the eastern slope of P. 444 east of Tekovská Breznica NE of the Pútikov Vršek is pinkish gray, strongly porphyric. It contains kaolinized phenocrysts of *sanidine*, ∅ 3—6 mm, and strongly limonitized phenocrysts of dark constituents, mostly *pyroxene*, subordinately also *amphibole* and *biotite*. Under the microscope the strong opacitization of the dark constituents is visible; as far as between the limonitized magnetite the interior of the pseudomorphosis shines through, it is composed of a mixture of quartz, talc, apatite, cimolite and magnetite. The feldspars (sanidines) are strongly kaolinized. *Apatite*, smokily pleochroic, with greater absorp-

tion in the direction of the length, is fairly abundant, in columns 0.3 mm long. *Quartz* is in the matrix fairly abundant, *zircon* forms groups of small crystals between the feldspars. The finely textured *matrix* is formed approximately by $^1/_3$ of quartz (transitions to rhyolites and dacites) and $^2/_3$ of sanidine; accessorily it contains limonitic flakes, limonitized granules of magnetite, and abundant crystals of apatite.

Rhyolites and Rhyolitic Breccias

Rhyolitic rocks occur especially in the large extrusive body of the ridge P. 403 and 436 south of Brehy, where they are associated with eruptive breccias at the margin. A smaller occurrence exist NE of Tekovská Breznica, where they form the summit P. 305, surrounded on both sides by basanitoid flows. On the western side of the Hron north of Brehy the rhyolites continue in the big ridge Himmelreich east of Nová Baňa.

The rhyolite of P. 305 north of Tekovská Breznica is felsitic, pinkish gray, sometimes finely, sometimes more coarsely porous. The fluidity is mostly fairly distinctly marked, especially in the more finely porous varieties, by the elongation and parallel arrangement of the cavities. Under the microscope the texture is typically porphyric. The phenocrysts of bipyramidal quartz (⌀ 0.1—1 mm) are strongly corroded; of several quartz sections only negligible, lobatedly ramified forms have remained. Sometimes a quartz phenocryst became the core of a *sanidine* crystal growing up on it. We find rarely also skeletal *sanidines* composed of minute plates, which fill incompletely the space of an individuum of a higher type. Not abundant are plates of brown, intensively pleochroic *biotite*. The *matrix* is *felsitic*, brownish, mostly typically fluidal, with secreted portions of sanidine and with quartz zones. Abundant are in it globulitic shapes, ⌀ 0.25 mm, forming the rudiments of small spherulites, elsewhere filiform black trichites. Here and there are cavities filled with aggregate quartz.

The rhyolite of the ridge P. 403 and 436 south of Brehy is in its highest part felsospherulitic, minutely porphyric, here and there minutely porous, little distinctly fluidal. Under the microscope strongly corroded phenocrysts of *quartz* (pl. VI, figs. 15 and 16) and sporadic phenocrysts of *sanidine*. *Felsospherulitic matrix* is fluidal, composed of felsospherulitic and transversally fibrous *quartzine* zones. In the spherulites are thin, filiform trichites; here and there, especially near the margins, clusters of fine limonitic pigment have been secreted.

Eruptive rhyolitic breccias are developed in the lower layers of the rhyolite extrusion of the ridge P. 403 and 436. They are mostly considerably coarse (pl. VIII, fig. 19). The colour is whitish, pinkish and greenish brown, the general aspect is very decorative. They enclose angular as well as rounded fragments of fresh and also of propylitized or hydrothermally altered pyroxene and amphibole-pyroxene andesites, further abundant fragments of trachytes and rhyolites. Here and there, especially at the base, they pass into conglomerates in which the angular material of the breccia is replaced

by well rounded andesite pebbles, up to several dm in diameter and derived from the pierced andesitic tuffs (pl. VIII, fig. 20) as we can observe today e. g. at P. 304 NE of Tekovská Breznica. The andesites of the inclusions in the rhyolitic breccia are mostly hyalopilitic, somewhat fluidal, with ledge-shaped feldspars, in other places pilotaxitic and then mostly propylitized, rarely also intersertal. — The trachytes of the inclusions are microgranitic or semivitreous with a matrix reminiscent of the matrix of the rhyolites, composed predominantly of *alkali feldspar* with a small amount of *quartz* and disseminated fine limonitic pigment. They contain phenocrysts of strongly corroded *sanidine,* opacitized *dark constituents,* and here and there granules of *magnetite.* In one fragment remains of hypersthene have been ascertained. Some feldspar phenocrysts have inclusions of columnar crystals of *apatite.* — The rhyolite of the inclusions is of the common type. It contains strongly corroded phenocrysts of quartz and abundant crystals of sanidine. The matrix is felsitic, with spherocrystals of *sanidine,* in other cases felsospherulitic or microgranitic. It contains a disseminated ore pigment with abundant dark trichites.

The cement of the breccia is formed by a minutely breccious, brownish red rhyolite, strongly ferruginous and rich in limonite, with fragments of *sanidine* and *quartz,* here and there by a crushed ferriferoussiliceous filling.

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CITOVANÁ LITERATURA. — REFERENCES CITED.

ANDRIAN, FERD. v. (1866): Das südwestliche Ende des Schemnitz-Kremnitzer Trachytstockes. — Jahrbuch der k. k. geolog. Reichsanstalt, Wien, XVI. 1866.

BEUDANT, E. (1822): Voyage minéralogique et géologique en Hongrie en 1818. Tome I.—IV. Paris 1822.

BÖCKH HUGO (1901): Előzetes jelentés a Selmeczbánya vidékén előforduló eruptivkőzetek korviszonyairől. — Földtani közlöny, XXXI, 1901, s. 289—328. — Vorläufiger Bericht über das Altersverhältniss der in der Umgebung von Selmeczbánya vorkommenden Eruptivgesteine. Ibidem, s. 365—408.

FERENCZI ISTVÁN (1925): Geomorfologiai tanulmányok a kismagyar Alföld D-i öblében. Földtani közlöny, 54, 1925, s. 17—38. — Geomorphologische Studien in der südlichen Bucht des kleinen ungarischen Alföld. — Ibidem, s. 137—158.

FIALA, FRANT.—KETTNER, RAD. (1931): Les montagnes de Kremnica dans les environs de Stará Kremnička et de Bartošova Lehotka. — Guide des excursions dans les Carpathes occidentales organisées à l'occasion de la IIIème réunion de l'association pour l'avancement de la géologie des Carpathes. Knihovna Státního geologického ústavu, sv. 13. A. Praha 1931, s. 199—212.

FIALA, FRANT. (1933): O současném stavu geologického výzkumu Slovenského Středohoří. Sborník II. sjezdu čs. geografů v Bratislavě 1933, s. 121.

— (1938) — 1.: Nefelinický basanitoid od Podrečian (sz. Lučenca). — Basanitoïde néphélinique de Podrečany (au NW de Lučenec). Sborník štátneho banského muzea Dion. Štúra v Banskej Štiavnici, II, 1938, s. 36—52. — Banská Štiavnica 1939.

— (1938) — 2.: Niekoľko petrochemických poznámok k čadiču Kalvárie u Banskej Štiavnice. — Quelques remarques relatives à la pétrochimie du basalte du mont Kalvaria près Banská Štiavnica. — Ibidem, str. 53—66.

HOFMANN KÁROLY (1879): A déli Bakony bazalt kőzetei. — Die Basaltgesteine des südlichen Bakony. — A magy. kir. földtani intézet évkönyve, III. 4. 1879.

HORVÁTH BÉLA (1916): Jelentés a m. kir. földtani intézet Kémiai laboratoriumából 1916 ról. — A magy. kir. földtani intézet évi jelentése 1917 ról.

JONAS, JOS. (1820): Phisico-technographisches Magazin über die anorganische Natur des Österreichischen Kaiserstaates (Ungarns Mineralreich), Pest, s. 137.

JUGOVICS L. (1915 et 1916): Az Alpok keleti végződése alján és a Vasvármegyei Kis Magyar Alföldön felbukkanó bazaltok s bazalttufák. — A magy. kir. földtani intézet évi jelentése 1915-ról (s. 49—73, Budapest 1916), Dtto 1916-ról (Budapest 1917) s. 63—76.

KUNO, HISASHI (1936): Petrological notes on some pyroxene-andesites from Hakone Volcano, with special reference to some types with pigeonite phenocrysts. — Japanese Journal of Geology and Geography. XIII, s. 107—140.

— (1950): Petrology of Hakone Volcano and the adjacent areas, Japan. — Bulletin of the Geol. Soc. of America, Vol. 61, s. 957—1020.

MAURITZ BÉLA (1930): Der Basalt des Szent-György-Berges in der Balatongegend (Plattenseegebiet). — Mathem. u. naturwiss. Berichte aus Ungarn, XXXVII. Budapest 1930.

— (1948): A Dunántúli bazaltok kőzetkémiai viszonyai. Földtani közlony, 1948, s. 134—169.

MAURITZ BÉLA—HARWOOD (1936): Die basaltischen Gesteine der Tátikagruppe im Plattenseegebiet (Ungarn). — Miner. petrogr. Mitt., 48, 1936, s. 373—401.

— — (1938): A Sághegyi Bazalt. — Das basaltische Gestein des Ságberges (Sághegy) bei Gelldömölk in Ungarn. — Földtani közlöny, 47, 1938, s. 241 až 256.

NIGGLI, P. (1903): Gesteins- u. Mineralprovinzen, I. Berlin.

QUERVAIN, F. de (1927): Die jungen Eruptivgesteine der pannonnischen Senke und ihrer Umrandung. — Schweizerische mineralog. u. petrogr. Mitt. VII, 1927, s. 1—27.

REICHERT, R. (1925): Petrochemische Untersuchungen aus den Basaltgesteinen der Umgebung von Salgótarján. — Földtani közlöny, 1925, s. 344.

— (1927): Petrografiai megfigyelések nógrádmegyei bazaltokon. I. Földtani közlöny, 57, 1927, s. 201—208. — Petrographische Untersuchungen an basaltischen Gesteinen aus dem Kom. Nógrád in Ungarn. Ibidem, s. 240—247.

ROSENBUSCH, H. (1908): Mikroskopische Physiographie der massigen Gesteine. 2. Hälfte. Ergußgesteine. — IV. Aufl. Stuttgart 1908, s. 1395.

ROSENBUSCH, H.—MÜGGE, O. (1927): Mikroskopische Physiographie petrographisch wichtiger Mineralien. Bd. I. 2. Hälfte. V. Aufl. Stuttgart 1927, s. 254.

ROSENBUSCH, H.—OSANN, A. (1923): Elemente der Gesteinslehre. IV. Aufl.

ROZLOZSNIK P.—EMSZT K. (1911): A Medveshegység bazaltos kőzetei. Földtani közlöny 41, 1911, s. 257—272. — Beiträge zur Kenntniss der Basaltgesteine des Medvesgebirges. Ibidem, s. 354 (343—361).

— — (1913): Az újmoldovai bazalt. — Földtani közlöny, 43, 1913, s. 416—420. — Der Basalt von Újmoldova. — Ibidem, s. 494—499.

SIGMUND, AL.: Die Basalte d. Steiermark. Tschermak's mineral. u. petrogr. Mitteilungen. XV, 1895, s. 360—387 a XVI, 1896, s. 336—359.

VITÁLIS, I. (1904): Beiträge zur Kenntniss der Basaltgesteine des Balatonbergbaugebietes. — Földtani közlöny, 1904.

WINKLER, A. (1913): Das Eruptivgebiet von Gleichenberg in Oststeiermark. Jahrbuch der k. k. geolog. Reichsanstalt.

— (1925): A K. Magyar Alföld szegélyén a Kelet-Stajér medencében fellépö bazaltkitörések kora és kelezkezése. — Földtani közlöny, 55, 1925, s. 227—235. — Über Entstehung u. Alter der Basaltaufbrüche im östlichen Steirischen Becken am Rande der kleinen ungarischen Ebene. — Ibidem, s. 379—384.

— (1927): Der jungtertiäre Vulkanismus im steirischen Becken. Zeitschrift f. Vulkanologie 1927 (ref. N. Jb.).

VYSVĚTLIVKY MIKROFOTOGRAFIÍ.

Tab. I.

Obr. 1. Basanit nefelinický velmi kompaktní z III. lomu v Liesné dolině jv. Brehů. Vrostlice olivinu, jedna augitová. Nikoly //, zvětš. ca 62×.

Obr. 2. Basanitoid s vrostlicí silně korodovaného olivinu. — II. proud sev. c. 305 sv. Tekovské Breznice. Nikoly //, zvětš. ca 62×.

Tab. II.

Obr. 3. Basanitoid I. proudu od studánky ssv. Tekovské Breznice. Nikoly //, zvětš. ca 47,5×.

Obr. 4. Basanit nefelinický z ohybu Liesne doliny, 2 km jv. Brehů. Vrostlice olivinu. Nikoly //, zvětš. ca 47,5×.

Obr. 5. Basanitoid z nového lomu na sev. úpatí Babina vršku zjz. Brehů s význačně korodovanými vrostlicemi olivinu. Nikoly //, zvětš. ca 47,5×.

Obr. 6. Basanitoid s význačně korodovanou vrostlicí olivinu. Jižní svah c. 305 vých. Tekovské Breznice. Nikoly //, zvětš. ca 47,5×.

Tab. III.

Obr. 7. Doleritický basanitoid z jv. úpatí Pútikova vršku v Chválené dolině jv. Tekovské Breznice. Vrostlice olivinu, hojný pigeonitický augit. Nikoly //, zvětš. ca 62×.

Obr. 8. Žilka nefelinického tefritu (pigeonit a jehlicovitý klinoenstatit) v doleritickém basanitoidu z jihových. úpatí Pútikova vršku ve Chválené dolině jv. Tekovské Breznice. Nikoly ××, zvětš. ca 17,5×.

Tab. IV.

Obr. 9. Nefelinický tefrit ze žil v doleritickém basanitoidu na jihových. úpatí Pútikova vršku ve Chválené doline. Jehlice klinoenstatitu, sytě zbarvené pigeonity s ofiticky zarůstajícími živci. Nikoly //, zvětš. ca 17,5×.

Obr. 10. Dtto. — Nikoly ××.

Tab. V.

Obr. 11. Táž hornina, nikoly //, zvětš. ca 67,5×. — Pigeonit, obrůstaný ilmenitem, dlouze sloupcovitý klinoenstatit, živce, hojné tenké šedé jehličky apatitu.

Obr. 12. Dtto, nikoly ××.

Tab. VI.

Obr. 13. Kostrovité ilmenity s pigeonitem v nefelinickém tefritu z jihových. úpatí Pútikova vršku ve Spálené dolině. Nikoly //, zvětš. ca 43×.

Obr. 14. Dtto, jiná část výbrusu.

Obr. 15. Korodovaná vrostlice křemene ve felsosférolitickém rhyolitu. C. 436 již. Brehů. Nikoly ××, zvětš. ca 47,5×.

Obr. 16. Velmi silně korodovaná vrostlice křemenná v rhyolitu z c. 436 již. Brehů. Nikoly ××, zvětš. ca 47,5×.

Tab. VII.

Obr. 17. Rhyolitová brekcie ze západního svahu c. 436 již. Brehů. Nikoly //, zvětš. ca 19×.

Obr. 18. Rhyolitová brekcie z vých. svahu c. 436 již. Brehů. — Nikoly //, zvětš. ca 19×.

Tab. VIII.

Obr. 19. Rhyolitová brekcie ze záp. svahu c. 403 již. Brehů s úlomky andesitů, trachytů a rhyolitů. Ca ⅔ skut. vel.

Obr. 20. Andesitové valouny v rhyolitové brekcii na sev. svahu c. 403 již. Brehů.

EXPLANATION OF THE MICROPHOTOGRAPHS

Pl. I

Fig. 1: Very compact nepheline basanite from the 3. quarry in the Liesna Dolina SE of Brehy. Phenocrysts of olivine, one of augite. Nicols //, about 62× nat. size.

Fig. 2: Basanitoid with a phenocryst of strongly corroded olivine — II. flow north of P. 305 NE of Tekovská Breznica. Nicols //, about 62× nat. size.

Pl. II

Fig. 3: Basanitoid of the I. flow from the well NNE of Tekovská Breznica. Nicols //, about 47.5× nat. size.

Fig. 4: Nepheline basanite from the bend of the Liesna Dolina, 2 km. SE of Brehy. Phenocrysts of olivine. Nicols //, about 47.5× nat. size.

Fig. 5: Basanitoid from the new quarry at the northern foot of the Babin Vršek WSW of Brehy with characteristically corroded phenocrysts of olivine. Nicols //, about 47.5× nat. size.

Fig. 6: Basanitoid with characteristically corroded phenocryst of olivine. Southern slope of P. 305 east of Tekovská Breznica. Nicols //, about 47.5× nat. size.

Pl. III

Fig. 7: Doleritic basanitoid from the SE foot of the Pútikov Vršek in the Chválená dolina SE of Tekovská Breznice. Phenocrysts of olivine, abundant pigeonitic augite. Nicols //, 62× nat. size.

Fig. 8: Veinlet of nepheline tephrite (pigeonite with needles of clinoenstatite) in doleritic basanitoid from the SE foot of the Pútikov Vršek in the Chválená dolina SE of Tekovská Breznica. Nicols ××, about 17.5× nat. size.

Pl. IV

Fig. 9: Nepheline tephrite from veins in doleritic basanitoid at the SE foot of the Pútikov Vršek in the Chválená dolina. Needles of clinoenstatite, deeply coloured pigeonites with included ophitic feldspars. Nicols //, about 17.5× nat. size.

Fig. 10: Dtto. — Nicols ××.

Pl. V

Fig. 11: The same rock, nicols //, about 67.5× nat. size. — Pigeonite overgrown by ilmenite, long-columnar clinoenstatite, feldspars, abundant thin gray needles of apatite.

Fig. 12: Dtto, nicols ××.

Pl. VI

Fig. 13: Skeletal ilmenite with pigeonite in nepheline tephrite from the SE foot of the Pútikov Vršek in the Chválená dolina. Nicols //, about 43× nat. size.

Fig. 14: Ditto. — another part of the thin section.

Fig. 15: Corroded phenocryst of quartz in felsospherulitic rhyolite. P. 436 south of Brehy. Nicols ××, about 47.5× nat. size.

Fig. 16: Very strongly corroded phenocryst of quartz in rhyolite from P. 436 south of Brehy. Nicols ××, about 47.5× nat. size.

Pl. VII

Fig. 17: Rhyolitic breccia from the western slope of P. 436 south of Brehy. — Nicols //, about 19× nat. size.

Fig. 18: Rhyolitic breccia from the eastern slope of P. 436 south of Brehy. — Nicols //, about 19× nat. size.

Pl. VIII

Fig. 19: Rhyolitic breccia from the western slope of P. 403 south of Brehy with fragments of andesites, trachytes and rhyolites. Approximately ⅔ nat. size.

Fig. 20: Andesite pebbles in the rhyolitic breccia of the northern slope of P. 403 south of Brehy.

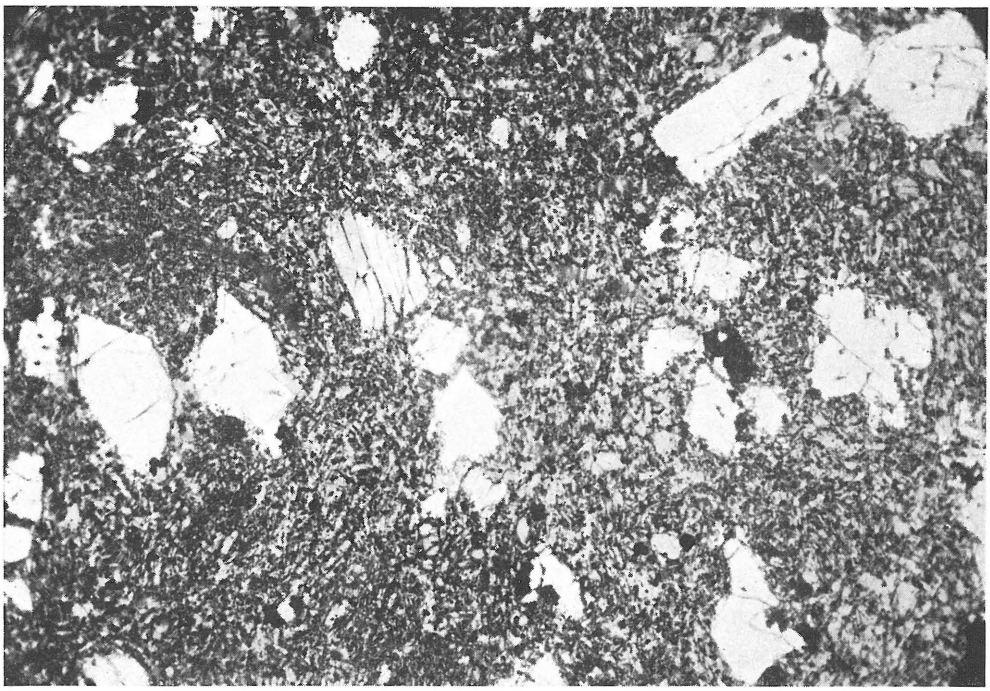
SBORNÍK NÁRODNÍHO MUSEA V PRAZE - ACTA MUSEI NATIONALIS PRAGAE

VIII. (1952) - B (PŘÍRODOVĚDNÝ) No. 5. - GEOLOGIA ET PALAEONT. No. 2.

REDAKTOR IVAN KLÁŠTERSKÝ

FRANTIŠEK FIALA: ALKALICKÉ ČEDIČE (BASANITOIDY) OD TEKOVSKÉ BREZNICE A BREHŮ U NOVÉ BANĚ NA SLOVENSKU. ALKALI BASALTS (BASANITOIDS) FROM TEKOVSKÁ BREZNICA AND BREHY NEAR NOVÁ BAŇA IN SLOVAKIA

V KVĚTNU 1952 VYDALO SVÝM NÁKLADEM V POČTU 1100 VÝTISKŮ NÁRODNÍ MUSEUM V PRAZE - VYTISKLA STÁTNÍ TISKÁRNA, N. P. 01. - CENA BROŽOV. VÝTISKU 61·- Kčs



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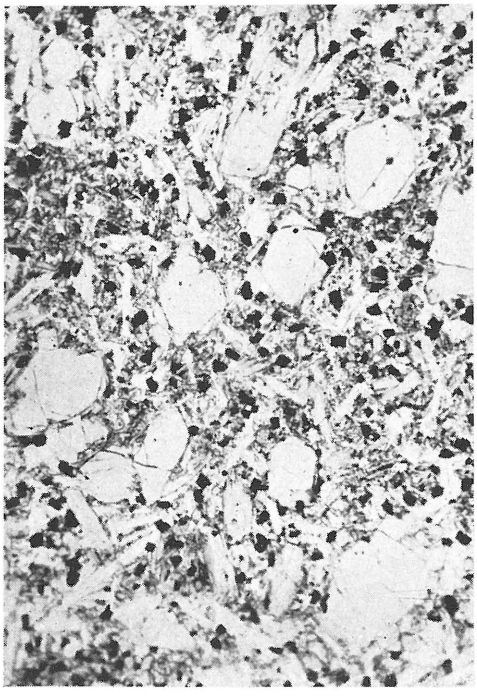

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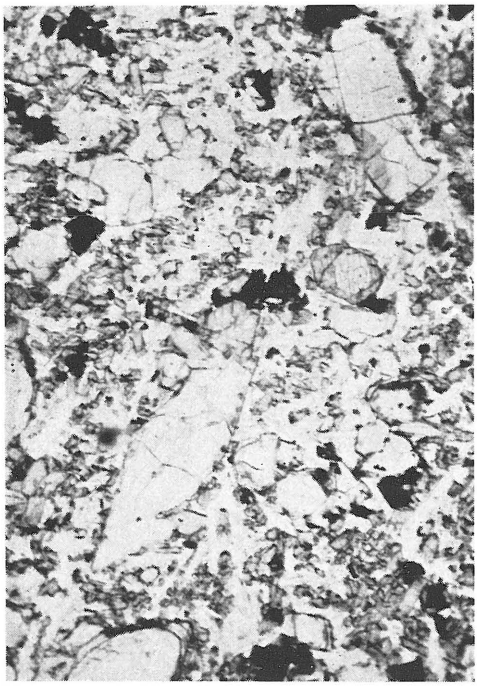

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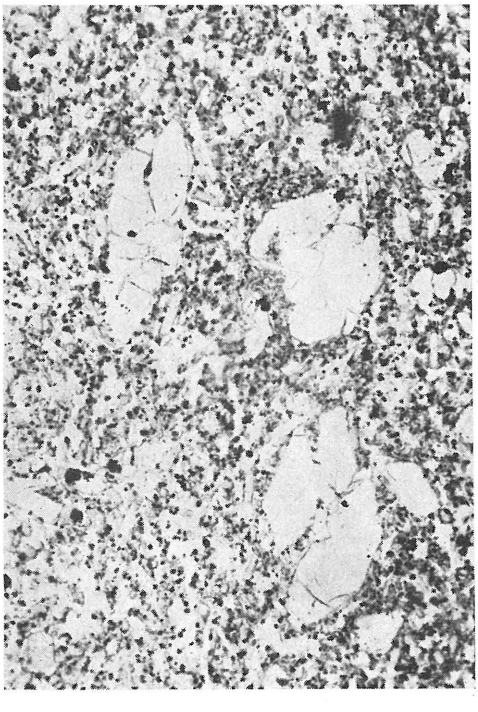

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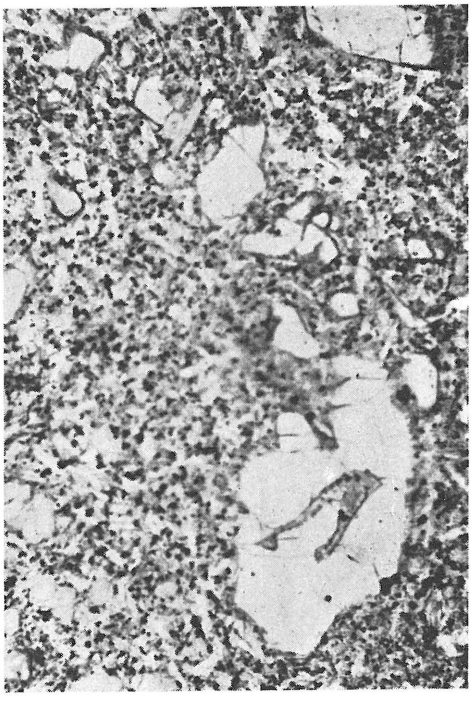

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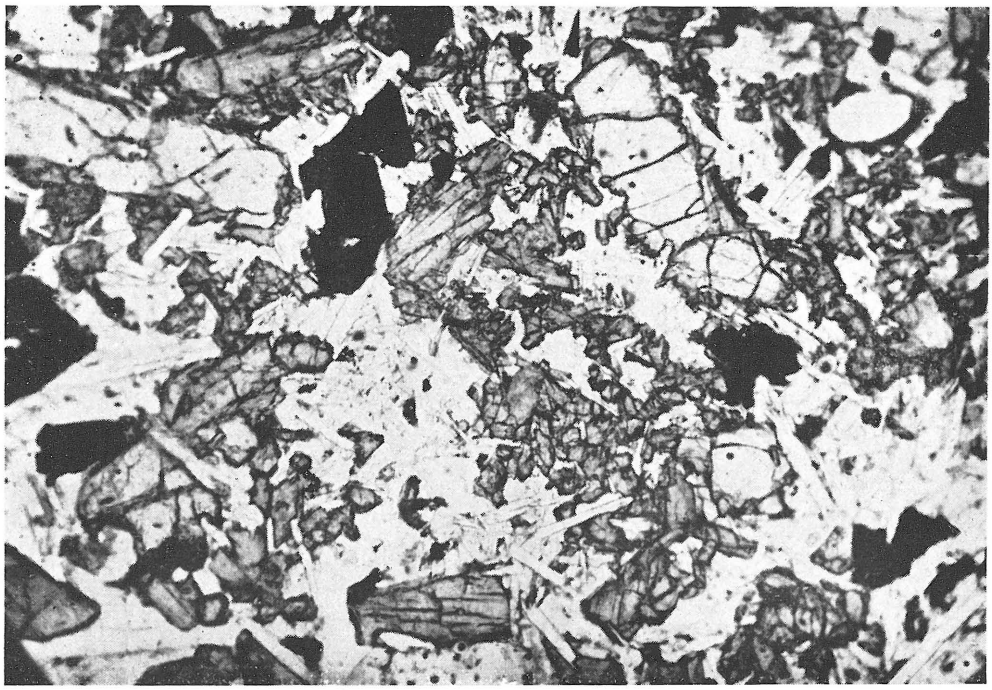

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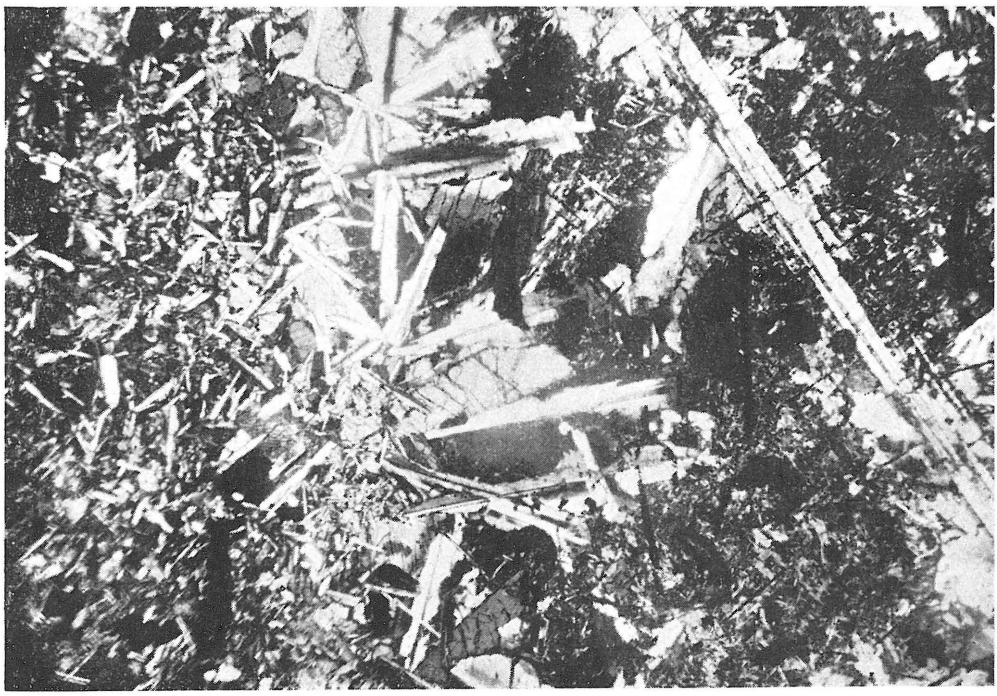

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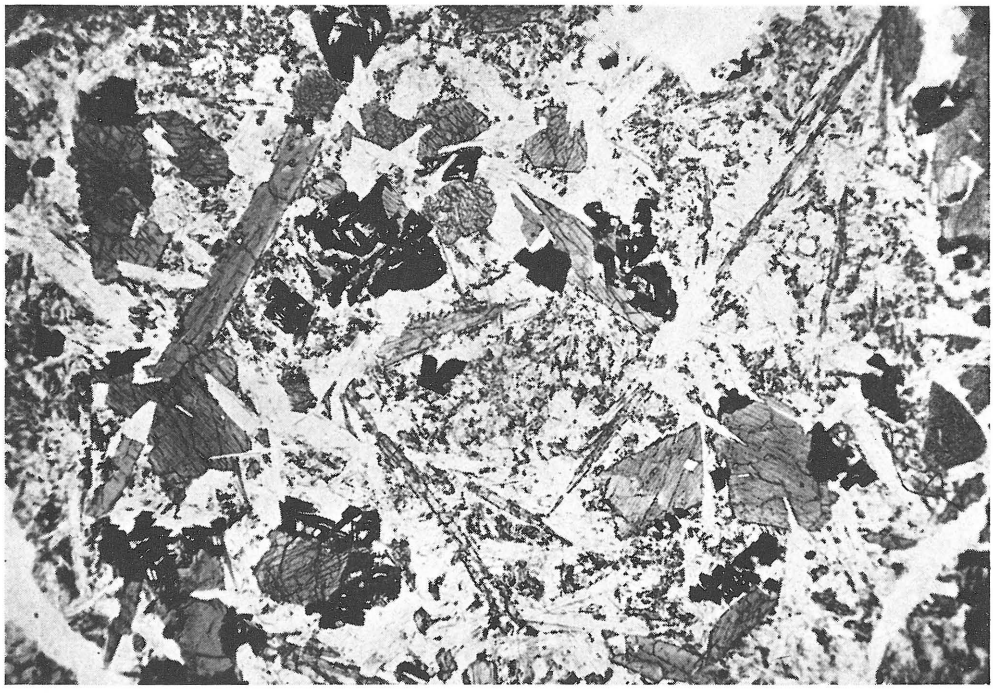

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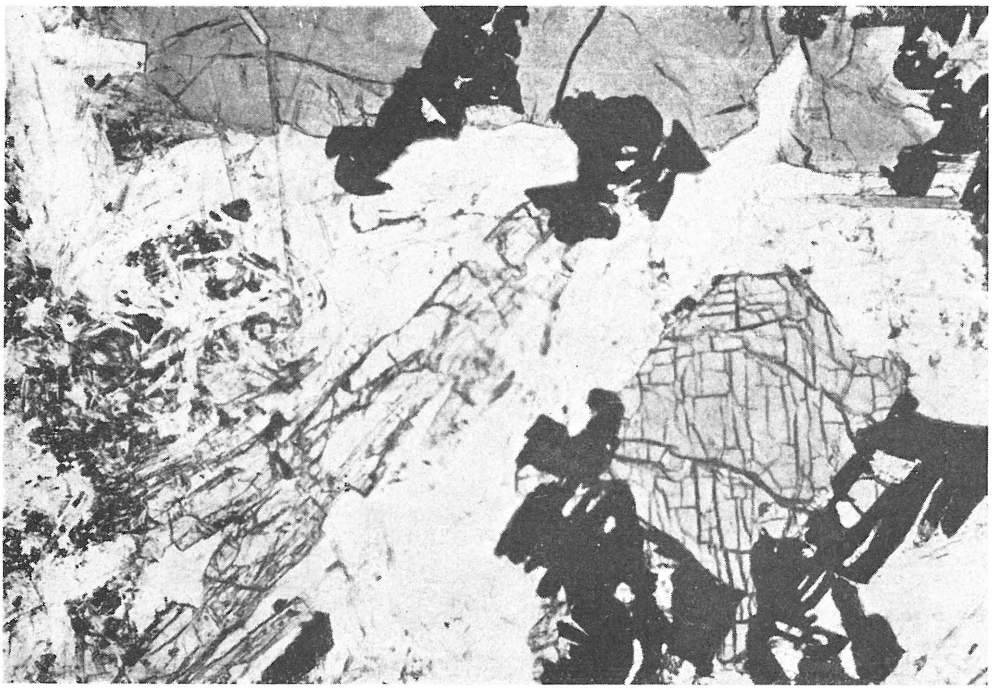

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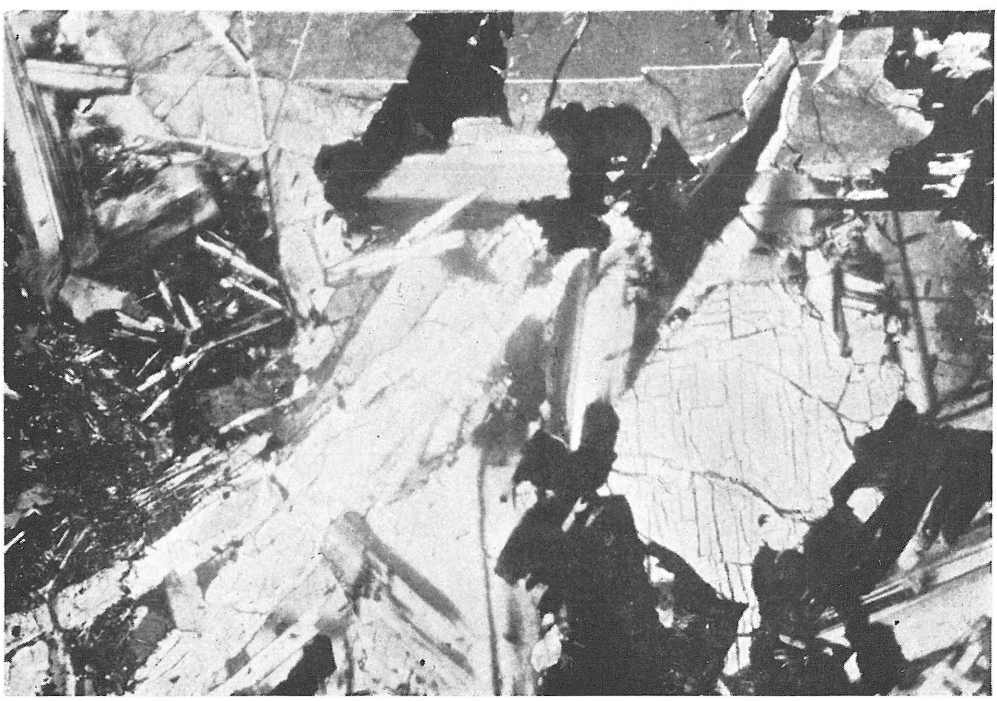

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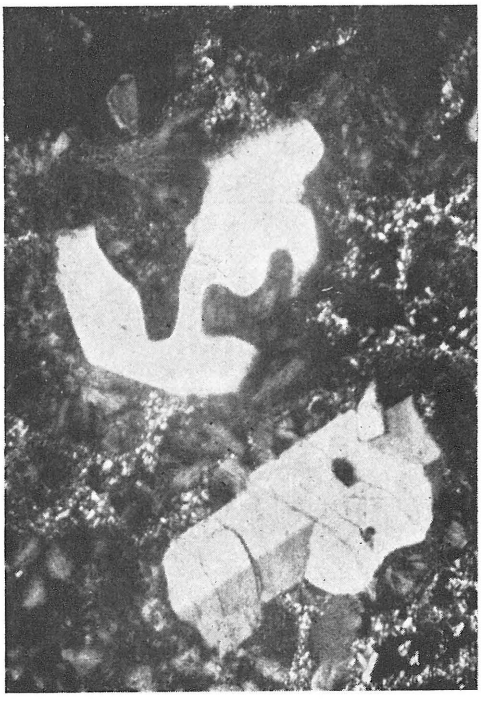

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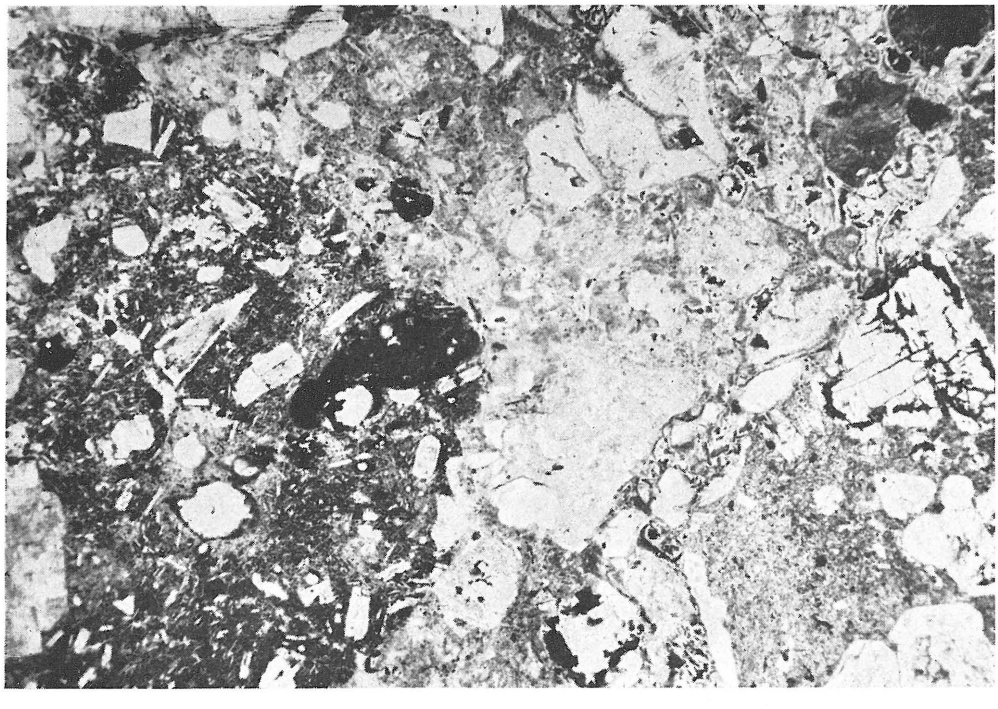

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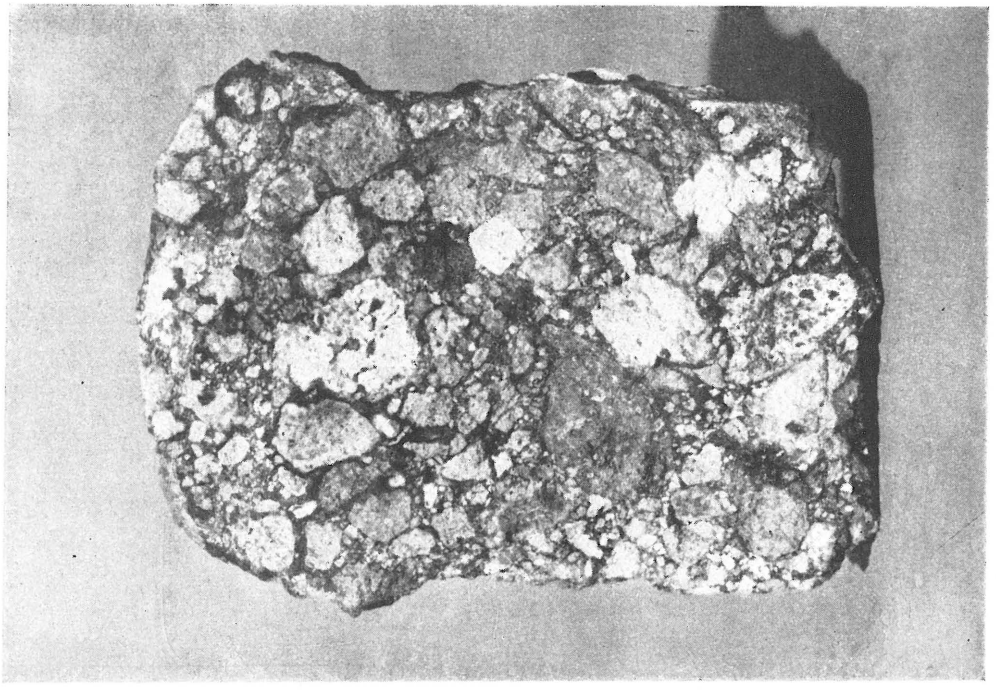

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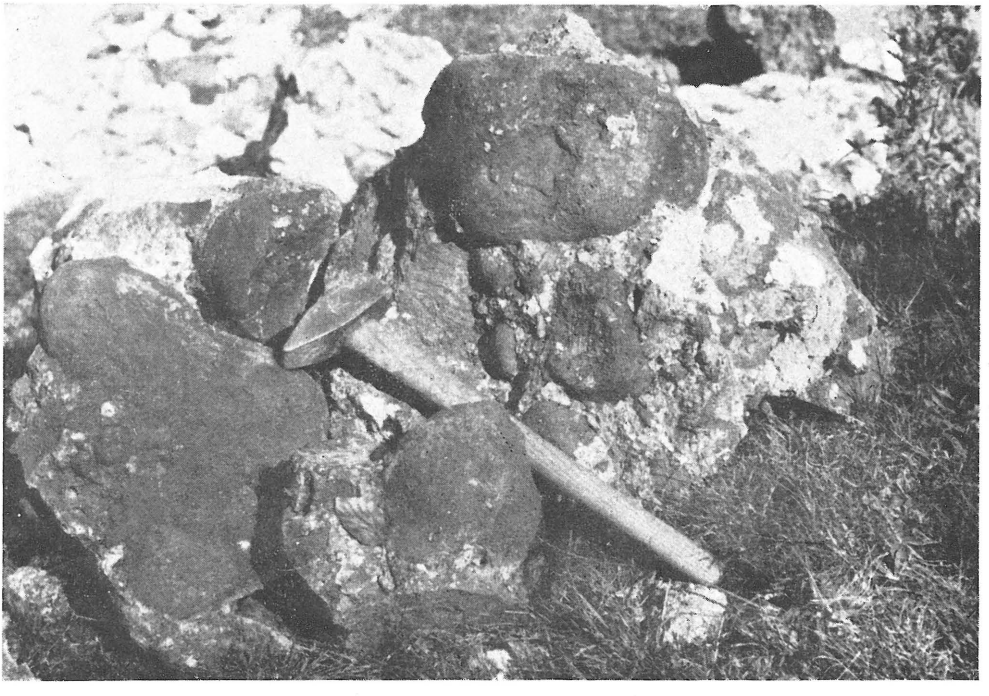

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